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Estimating the Constraints to Agricultural Trade of Developing Countries

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Abstract

Estimating the Constraints to Agricultural Trade of Developing Countries

Agricultural trade is widely considered as an important contributor to developing countries' economic growth, poverty alleviation and food security. This report identifies and analyses some of the most important supply-side constraints to developing countries' exports of agricultural products, in order to inform prioritisation and sequencing of domestic policy reforms as well as targeting of donor interventions. The analysis is supplemented by case studies of Aid for Trade programmes supporting agricultural trade expansion in Indonesia, Zambia and Mozambique. The report confirms that developing countries' agricultural exports are highly responsive to the quality of transport and trade-related infrastructure, while tariffs still have a significant negative impact. The analysis also highlights the importance of complementary policies such as education and political stability on developing countries' agricultural trade performance. In the poorest countries of the sample, significant trade expansion could be achieved by easing constraints related to governance and infrastructure quality, as well as by lifting constraints related to the efficient use of existing freshwater resources. The case studies illustrate the impact on agricultural exports of constraints related to standards and conformity assessment or access to credit, in particular as regards small and medium agricultural producers, processors and traders. They also show the contribution of donor supported programmes promoting private sector initiatives to poverty reduction through increased employment and the promotion of production adapted to local endowments.

Keywords: binding constraints; trade expansion; developing countries agricultural trade; aid for trade; poverty reduction; food security.

JEL classification: F13, O13, O19, Q17

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Executive Summary

Trade can be a powerful engine for economic growth, poverty reduction, and development. However, harnessing that power is often difficult for developing countries, particularly the least developed ones, notably because of domestic supply-side constraints such as lack of trade-related infrastructure and obstacles restraining their productive capacity. As trade-related needs of developing countries are numerous, while political impetus and financial resources are scarce, prioritisation is crucial to sequence trade reforms and to guide aid-for-trade interventions.

This report identifies and analyses some of the most important supply-side factors constraining developing countries' agricultural exports in order to inform prioritisation and sequencing of domestic policy reforms as well as targeting of donor interventions. It follows past OECD work under the Aid for Trade Initiative to understand, identify and quantify constraints to trade expansion in developing countries.

The paper reviews potential constraints to agricultural trade as highlighted in economic literature. Next it presents a quantitative analysis of the impact of potential supply-side constraints to developing countries' exports of agricultural products. Using a cross-sectional gravity model, trade is regressed on the various trade impediments typically introduced in such models, augmented with a set of possible supply-side constraints to agricultural trade identified in literature. The latter include productive capacity constraints related to access to agricultural inputs and electricity, and trade-specific constraints, such as tariffs or transport and logistics quality. The model also controls for elements of comparative advantage – arable land and water resources – as well as complementary policies, including institutional and governance issues. The insights of this econometric exercise are supplemented by three case studies of Aid for Trade programmes supporting agricultural trade expansion in Indonesia, Zambia and Mozambique. The case studies aim to add to the quantitative evidence by highlighting the importance of some variables that could not be captured in the quantitative exercise because of data limitations.

The report confirms that some of the insights of previous work on constraints to overall trade performance (Hallaert et al., 2011, *Estimating the Constraints to Trade of Developing Countries)* are equally valid in the case of agricultural trade, but also identifies a number of specific obstacles to this sector.

- According to the quantitative analysis, developing countries' agricultural exports are highly responsive to the quality of transport and trade-related infrastructure. A 10% improvement in the transport and trade-related infrastructure quality has the potential of increasing developing countries agricultural exports by 30%. This finding confirms a large body of literature which highlights the impact of efficient and accessible transport on countries' capacity to explore market access opportunities for their agricultural products.
- Tariffs are found to have a significant negative impact on agricultural trade. On average, a reduction of tariffs by 10% would increase trade value by about 3.7%.
- In line with evidence from the literature, the analysis also highlights the importance of complementary policies such as education and political stability. A 10% improvement in the secondary education enrolment rate would generate a 7.2%

increase in agricultural trade value. Aid interventions aiming at upgrading skills could contribute to agricultural modernisation and improve the market participation of smallholders.

- Focusing on the poorest countries in the sample, it appears that significant trade expansion could be achieved by easing constraints related to governance and infrastructure quality. Agricultural exports of these countries could more than double if political stability or the quality of infrastructure were brought to the level observed in the richest developing countries.
- In addition, important gains in these countries can also be obtained from lifting constraints related to freshwater availability. This is because poor countries lag far behind better off developing countries in this respect. While not much can be done with respect to water availability, nor is it desirable to distort resource allocation by subsidising water consumption, this suggests an important role for aid for trade in terms of helping address the regulatory and infrastructure burdens that prevent a more efficient use of existing water resources. Such efficiency gains could in addition enable greater participation of the private sector in irrigation systems. Thus, while infrastructure often attracts the largest amounts of aid for trade, this finding emphasises the importance of alleviating bottlenecks in other areas.
- Although data limitations have not allowed for assessing the impact of all trade cost-related constraints, such as standards and conformity assessment or access to credit, case studies illustrate how strongly these constraints affect the agricultural trade performance of developing countries, in particular as regards small and medium agricultural producers, processors and traders. In the case of standards and conformity assessment, the wide range of actions necessary to upgrade efficiently implementation, monitoring and certification capacities is difficult to bring to fruition without long-term commitment and extensive planning. Satisfactory access to finance appears as a prerequisite not only for undertaking export activities but also for addressing a number of productive capacity constraints that limit agricultural growth.
- Finally, case studies have illustrated how donor supported programmes promoting private sector initiatives can make a significant contribution to poverty reduction through increased employment and the promotion of production adapted to local endowments.
- The exercise conducted in this report is of course not sufficient in itself to direct aid flows or prioritise domestic reforms. Policy conclusions for aid for trade investments should be drawn by comparing these outcomes with the cost and feasibility of lifting the different constraints identified. Serious preparatory field work to identify the most relevant, country-specific approach to building supply, production and marketing capacities is thus paramount to the success of such endeavours.

I. Introduction

Trade can be a powerful engine for economic growth, poverty reduction, and development. However, harnessing that power is often difficult for developing countries, particularly the least developed ones, mainly because of domestic supply-side constraints such as lack of trade-related infrastructure and obstacles restraining their productive capacity. The Trade Committee (TC) and Development Assistance Committee (DAC) work under the Aid-for-Trade Initiative has been successful in drawing attention to the importance of addressing supply-side constraints to trade and development. Over the last three years, a series of reports have highlighted the importance of prioritising trade-related needs, which compete for political momentum and scarce financial resources, in accordance with country specificities. These reports sought to better understand, identify and quantify the constraints to trade expansion in partner countries; emphasised the importance of complementary policies in maximising the impact of trade policy reforms on trade and economic growth; and discussed how Aid for Trade, together with pro-active policy reform and government action, can help relax the constraints that prevent developing countries from improving trade performance and benefitting from the global marketplace.[1]

More specifically, the report "Binding Constraints to Trade Expansion" shows that trade-related needs of developing countries are numerous, while political impetus and financial resources are scarce and may not be available consistently over time. Furthermore, proper sequencing is needed to ensure front-loading of some prerequisite actions without which other reforms are bound to fail. Prioritisation is therefore crucial to sequence trade reforms[2] and to guide aid-for-trade interventions. In order to identify which needs should be tackled first, so as to match concerned countries' specific circumstances in accordance with the call by WTO DG Lamy[3], the report proposed to adapt the growth diagnostics procedure developed by Haussmann et al. (2005) to trade expansion. The report "Increasing the Impact of Trade Expansion on Growth" argues that Aid for Trade should go beyond support to trade expansion, but also help developing countries address the constraints that prevent trade opportunities from translating into economic growth. It shows that most but not all trade reforms had a positive impact on economic growth, often for lack of compatible policies that would make trade reform sustainable, or of complementary policies that would increase the growth impact of trade expansion. Finally, the report "Estimating the Constraints to Trade of Developing Countries" sought to identify the most important supply-side constraints to trade expansion and estimate their relative severity for trade and economic growth.

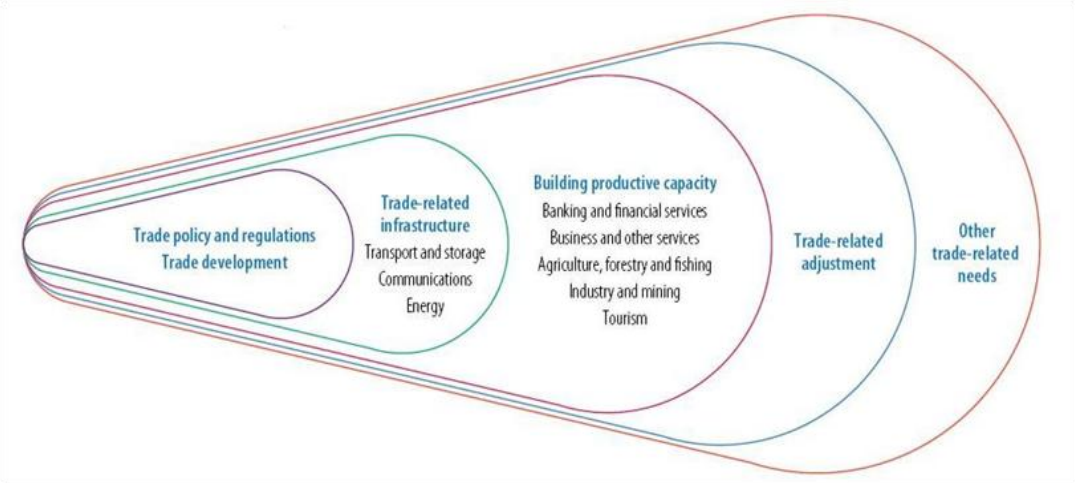
1. "Binding Constraints to Trade Expansion: Aid for Trade Objectives and Diagnostics", *OECD Trade Policy Working Paper* No. 94; "Increasing the Impact of Trade Expansion on Growth: Lessons from Trade Reforms for the Design of Aid for Trade", *OECD Trade Policy Working Paper* No. 100; and "Estimating the Constraints to Trade of Developing Countries", *OECD Trade Policy Working Paper* No. 116.

2. In this report, "trade reform" is defined as encompassing all reforms and measures that affect the tradable sector. This approach is consistent with the recommendations of the Task Force on Aid for Trade (WTO, 2006): "the scope of Aid for Trade should be defined in a way that is […] broad enough to reflect the diverse trade needs identified by countries".

3. As highlighted by the Second Global Review of Aid for Trade held in 2009. WTO Director General Lamy (2009) stressed: "We also learnt that Aid for Trade needs to factor in specificities; for example, those of middle-income countries and the types of financing available to them; or those of landlocked countries, small economies, remote islands or countries emerging out of conflict."

The present report seeks to deepen the analysis of constraints to trade expansion by introducing a sectoral focus: the question here is to identify and analyse the most important supply-side constraints inhibiting developing countries' performance in agricultural exports in order to inform the potential contribution of aid for trade in supporting agricultural trade. The report uses the term "supply-side" constraints by contrast to "market access" constraints and applies it to the categories of economic infrastructure[4] and building productive capacity used in the OECD Creditor Reporting System (Figure 1).

Figure 1. The Aid for Trade Agenda



Source: Aid for Trade at a Glance 2011: Showing Results, OECD, WTO 2011.

The choice to focus on agricultural trade is motivated by the importance of agriculture in the trade of developing countries and by the interest of the international community in the development dimension of trade in agriculture, which is reflected in increasing Aid for Trade interventions –approximately 18.5% of Aid for Trade was disbursed for agriculture over the period 2006-09. The recent food crisis has elicited increased interest. The policy challenge confronting policymakers is to find an effective mix of policies that: (1) promote food production, in particular through productivity growth; (2) foster trade and the proper functioning of markets; and (3) address the wider development dimensions of food insecurity. Aid for trade programmes have a critical role to play along all of these policies.

Agriculture remains the largest source of employment, GDP, exports and foreign exchange earnings in many developing countries. However, the importance of agriculture varies considerably among developing countries even within one region: for example, agriculture accounts for 71% of the national GDP in Liberia, 57% in Guinea-Bissau, and 52% in the Democratic Republic of the Congo but less than 8% in oil-rich, middle-income countries like Gabon, the Republic of Congo, and Equatorial Guinea (USAID, 2011). A declining share for agriculture in national employment and GDP is an inevitable consequence of economic progress (Byerlee et al., 2009; Brooks, 2012). This is largely due to higher income elasticities of demand for non-agricultural goods and services. As their incomes grow, consumers increase their consumption of manufactured goods and services faster than their consumption of food. Byerlee et al. (2009) note the significant role played by agriculture in the early stages of development, linked to the prevalence of unskilled

4. Aid commitments for trade-related infrastructure are proxied in the OECD Creditor Reporting System (CRS) by data under the heading "Economic infrastructure".

labour and the fact that the weak business climate in terms of infrastructure (roads, electricity, communications) and institutions (legal, financial, regulatory) constrains private investments in the formal manufacturing and services industries. Brooks (2012) highlights the importance of choosing the appropriate mix of agricultural and non-agricultural policy instruments, in order to achieve satisfactory rural development. On the other hand, business climate and institutional constraints may not only influence the capacity of developing countries to evolve into a more balanced mix of agricultural, manufacturing and services activities, but also restrain the trade expansion of the agricultural sector, and this will be the focus of this paper.

While agriculture declines relative to other sectors as incomes per capita improve in a growing economy, growth in agriculture has a disproportionate effect on poverty. According to the World Bank's World Development Report 2008 on *Agriculture for Development*, 70% of poor people live in rural areas and are dependent on agriculture for their living. An estimated 2.5 billion persons depend on this activity worldwide. Cervantes-Godoy and Dewbre (2010), seeking to identify shared characteristics among developing countries that had been particularly successful in reducing extreme poverty over the last twenty to twenty-five years, find that, while economic growth in general was a necessary pre-condition and an important contributor to poverty reduction, agricultural growth had played the most important role in the majority of the reviewed countries. Brooks (2012) highlights the contribution of agricultural growth in reducing poverty in particular through smallholder development.

The primary objective of the present report is to identify the most important supply-side constraints to agricultural export expansion in developing countries. The core of the analysis rests on a cross-sectional gravity model, in which trade is regressed on various trade impediments identified in the literature, such as different measures of physical, cultural and administrative distance, augmented with a set of possible supply-side constraints to agricultural trade, as reviewed in the following Section II. In addition, the model controls for the impact of market-access constraints, a number of comparative advantage elements, and complementary policies.

The insights of the econometric work are supplemented by three case studies aiming at supplementing the econometric evidence and highlighting the importance of some variables that the quantitative work could not capture because of data limitations.

The remainder of the paper is organised as follows. Section II reviews potential constraints to agricultural trade as they appear in the economic literature. Section III reviews the links between agricultural trade and poverty reduction and food security. Section IV presents the econometric strategy, discusses data issues and analyses the results highlighting the most important supply-side constraints to agricultural exports. Sections V to VII present country case studies illustrating the mechanisms highlighted by the econometric work and the importance of some variables that the econometric work could not capture because of data limitations. Section VIII concludes.

II. Estimating the impact of the various supply-side constraints to agricultural trade: What kind of constraints restrict agricultural trade and why?

The potential contribution of aid in supporting trade in agriculture and fostering food security goes well beyond direct support to the agricultural sector and to agricultural policies. It can also help by supporting trade policy and regulation, and trade development (GTZ, 2010). Support to trade policy and regulation can be channeled to developing the capacity of public and private stakeholders at national and regional levels; supporting the adoption, where appropriate, of international standards as a basis of domestic regulation, as well as the regional harmonisation of standards and quality assurance systems which best reflect the specific climatic, geographical and technological circumstances in the concerned countries; and reducing trade barriers that affect regional as well as international agricultural trade and exacerbate informal trade (Lesser and Moïsé, 2009).

Trade development can also be supported through the promotion of market information systems; the enhancement of agricultural services and accessibility of inputs at the national level, as well as the regional level where such services are not affordable or viable nationally; and practical trade promotion measures, such as marketing structures and initiatives. Within this large range of possible activities and reforms, the quantification of the effect of various supply-side constraints to developing countries' agricultural trade can offer useful insights for the prioritisation of aid for trade actions and for supporting the dialogue between donor and recipient countries.

The array of potential constraints to agricultural trade in developing countries to be investigated in this report was identified taking into consideration the following:

- the initial list of constraints to overall trade, highlighted in the paper "Estimating the constraints to trade of developing countries" (Hallaert, Cavazos Cepeda and Kang, 2011), including complementary policies related to governance and education;
- the possible supply-side constraints specific to the agricultural sector in developing countries; and
- trade policy issues specific to agricultural trade, such as tariffs as well as the non-tariff measures applied to agricultural products.

What follows therefore attempts to cover what is known on potential supply-side constraints to agricultural trade, which can be broadly divided into productive capacity constraints related to the access to agricultural inputs or electricity, and trade-related constraints, such as transport and logistics quality or trade facilitation. The impact of trade policy aspects (tariffs and non-tariff measures) and complementary policies, such as governance issues or education on agricultural trade of developing countries[5] is also investigated.

II.a Productive capacity constraints

The capacity of developing countries to expand agricultural trade is first of all related to their ability to produce and thus to factors affecting agricultural productivity. While the agricultural supply capacity of a country is first of all determined by comparative advantage factors, such as rural labour and machinery, arable land or fresh water availability which are not amenable to aid interventions, productive capacity is often significantly restricted by a

5. Note, however, that all the variables reviewed in Section II have not been included in the quantitative analysis because of data availability issues.

number of constraints which can and should be addressed by policy and aid interventions. Institutional and regulatory issues as well as lack of infrastructure indeed often result in sub-optimal access to agricultural inputs, such as fertilisers and improved seeds, modern machinery, adequate irrigation systems and energy, appropriate storage capacity, or agricultural extension services. The 2012 Interagency Report to the Mexican G20 Presidency (G20, 2012) estimates that "*a successful strategy for sustainable agricultural productivity growth requires significant improvements in macroeconomic, structural and agricultural policies and institutions to provide the necessary incentives to farmers and the private sector to increase investments"*. Azam et al. (2012) find that in Cambodia capital endowment variables, such as land per worker and ownership of agricultural implements play an important role in generating food surpluses that can then be marketed, but so does the possibility to prove land ownership through a title, in particular for smallholders. Brambilla and Porto (2011) illustrate in rural Zambia the importance of access to and use of improved inputs (including higher yield seeds and more effective pesticides and fertilisers), agricultural extension services[6], and access to credit, which would allow farmers to better combine factors of production and boost farm output.[7] Similarly, poor access to, and application of agricultural inputs often due to credit access limitations are shown by the West Africa Trade Hub to have an important impact on yield and export potential[8] (USAID WATH 2011). Along the same lines, Nin-Pratt (2009) estimates that addressing agricultural productivity factors, such as access to higher yielding seeds, fertilisers, equipment and knowledge would allow West African countries to increase agricultural productivity for rice by a factor of 2, for cotton by 2.6, for maize and coarse grain by 3, and for other crops by as much as 10 to 50%.

Energy is also an important input for agricultural production, processing and marketing, even if agriculture is not the predominant user of energy in developing countries. Utz (2011) highlights that the direct energy use in agricultural production (i.e. energy for primary production, such as land preparation, cultivation, irrigation, harvest, post harvest and storage, excluding the energy required for transformation / processing, commercialisation and transport by agro-industries) accounts for only 4 to 8% of total final energy demand nationally in developing countries (compared to an even smaller proportion of around 3 to 5% in OECD countries). However, energy appears as a key driver for increasing productivity and modernising agricultural production. It is often a critical requirement for mechanical energy, irrigation pumps, post harvest cooling, modern drying, milling or pressing, or indirectly for the production of fertilisers and agrochemicals. Hallaert et al. (2011) find that electricity appears to be the main constraint to developing countries' trade expansion. The constraint, which refers to all sectors, including manufacturing trade, is more related to the reliability of electricity supply than to its availability. This finding is further corroborated by Ferro et al. (2011), who estimate that a 10% increase in aid targeting energy could increase manufacturing exports by 6.8%.

6. Agricultural extension services are defined as systems that should facilitate the access of farmers, their organisations and other market actors to knowledge, information and technologies; facilitate their interaction with partners in research, education, agri-business, and other relevant institutions; and assist them to develop their own technical, organisational and management skills and practices (Christoplos, 2010).

7. According to the authors, cotton marketing reforms in the country allowed yields per hectare to increase by 14.1%.

8. WATH used *isoprice* maps, which provide images depicting the special distribution of commodity prices and allow an assessment of the degree to which transaction costs between markets suppress the flow of commodities from surplus to deficit areas.

Mechanical, electrical and thermal energy shortages in many developing countries restrict agricultural production, processing and marketing by exacerbating reliance on human and animal sources of energy inputs, or by preventing the development of needed irrigation schemes, storage and refrigeration capacity and processing services. Sims and Kienzle (2006) show that a typical farm family relying on human power can only cultivate 1.5 hectares per year, 4 hectares if animal power is available and over 8 hectares supported by tractor power. The shortage of cold and dry storage facilities is partially responsible for high post-harvest losses related to spoilage, together with low quality packing and inefficient handling and transport. USAID (2011) estimates that post-harvest losses related to poor storage[9] represent approximately 20% of market logistics costs and more than 85% of avoidable market costs in West Africa. The lack of high-quality warehousing limits bulking which would enable contracts with larger buyers and improve negotiating capacity. However, controlled temperature storage is among the most energy-intensive activities in the agro-food industry. In many rural areas reliable connection to the national grid is economically and logistically unfeasible, so that farmers need to resort to decentralised power production, based on renewable energy, fossil fuel or hybrid systems. Rising energy prices have a significant impact on production costs.

Access to water is also a major determinant of land productivity, and irrigated land productivity is more than double that of rain-fed land (Utz, 2011). This is both a matter of increasing agricultural yields during the main harvest season and through improved possibilities for year-round cultivation, but also opening up previously barren lands for cultivation. Access to irrigation reduces the risk of crop failure, encouraging the adoption of higher-yielding varieties of food crops, diversification into higher-value cash crops, application of fertilisers and pest management, and intensification of farm labour and practices (Van Koppen et al., 2005). According to the World Development Report 2008 (World Bank, 2007), irrigated land does not exceed 4% of total agricultural land in Sub-Saharan Africa, compared with 29% in East Asia and 39% in South Asia. In areas where farmers mostly rely on rain-fed agriculture, water availability is one of the most binding constraints on agricultural production. Azam et al. (2012) indicate that actions to intensify cropping patterns through irrigation during the dry season could greatly improve market participation and commercialisation by smallholders in Cambodia. Fresh water resources may be adequate in particular regions, but a number of regulatory and infrastructure impediments often obstruct their use for productive purposes. For example, fresh water resources, including local groundwater or surface water are often transboundary, so that their management is seriously hampered by the lack of coordinated regional strategies (Nin-Pratt et al., 2009).

Finally, limited organisational capacity and lack of critical mass appears as an important constraint (USAID WATH 2011). In developing countries, markets for agricultural inputs and outputs, finance and other services, are often poorly developed, with small volumes traded, prone to large seasonal variability in demand and supply and significant difficulties in enforcing interpersonal contracts (Poulton et al., 2006). Smallholders also face considerable difficulties acquiring skills, including with respect to basic hygiene standards, merchandising, sampling or promotion techniques. Small operators cannot meet the size of orders or quality requirements from big buyers and often fail to cooperate efficiently so as to accumulate large quantities of agricultural commodities and move them efficiently to final demand markets. The absence of trade and producer organisations limits smallholders'

9. i.e. storage lacking properly designed granaries with cement floors, controlled air flows, limited access to vermin, proper preservation techniques such as sacks stacked off the floor on palettes and regular use of pesticides and fungicides.

bargaining power, weakens the horizontal and vertical integration of value chains and hinders the potential development of sustainable and efficient commercially oriented production and trade. The fact that a succession of small traders take limited amounts of cereals one small step at a time along the value chain, rather than from the farm gate directly to the consumption market, adds costs at each stage, through handling, repackaging and intermediaries' profit margins. The inability to supply consistent amounts of product finally results in uncompetitive, expensive and under-capacity processing as much as the lack of access to affordable processing equipment.

II.b Trade related constraints

The importance of barriers other than tariffs is well established in the economic literature. However, the specificity of the agricultural sector, where, for example, tariffs are greater than in the manufactured goods sector (Hoekman and Nicita, 2011) and where tariff-rate quotas and other market interventions further complicate the policy picture (Orden et al., 2012), suggests that the respective severity of different sources of trade costs might differ from what Hallaert et al. (2011) found as regards overall trade expansion[10].

The effect of different types of NTMs on food staples has been quantified by Cadot and Gourdon (2012). The authors calculated the effects of NTMs on 5000 different food staples in 30 African countries, using World Bank, UNCTAD and African Development Bank data, coded according to the 2009 MAST nomenclature.[11] They find that, while quantitative restrictions and prohibitions have receded, TBT and SPS measures are on the rise and do not correspond to local monitoring and testing capabilities. SPS measures would, on average, raise the price of food staples by anything between 12 and 25%, depending on the estimation method, and quantitative restrictions, where they are applied, add another 19%. The authors suggest that product-specific effects of SPS regulations can add up to 42% on rice import prices in Kenya, or 29% on edible oil import prices in Uganda. Such price increases have the potential to affect significantly the real income of poor households and limit trade and consumption volumes. Brenton et al. (World Bank, 2012) estimate that various NTM factors constraining East-African agricultural trade, combined with significant post-harvest losses, count for the major part of the consumer price, typically leaving less than 20% in the hands of African smallholder farmers.

In West Africa, USAID (2011) considers that if transaction costs affecting agricultural products were reduced by 10% of the farm gate price, production and the real income of farmers would each increase by 4%, while consumer food prices would fall by 8%. USAID's Agribusiness and Trade Promotion (ATP) project in West Africa estimates that transport and logistics account for approximately 59% and 18% of the end market price for maize and livestock respectively. According to ATP research (Table 1), direct transport costs accounted for USD 81 per metric tonne (MT) of maize, while product losses due to storage and handling problems between the farm and the end market added another USD 79 per MT. Finally, control procedures, including the acquisition of SPS certificates or paying bribes at the border was estimated at USD 40 per MT of maize.

10. According to Hallaert et al. (2011), electricity availability appears to be the main constraint to trade expansion of developing countries, followed by transportation problems and access to credit.

11. UNCTAD's Multi-Agency Support Team. The authors run regressions of country-level product prices on binary variables marking the application of various types of NTMs, using a panel of 1 260 country-product pairs. Interaction terms between NTMs and either region or country dummies provide tentative estimates of their price-raising effect in Africa or in specific countries.

Non-tariff barriers also influence the price and availability of key agricultural inputs, such as seeds and fertilisers, which could have substantial impact on agricultural yields and output, especially for smallholders. These include control of seed prices and production, diverging standards and sanitary, phytosanitary and plant quarantine measures, duplicative testing, and burdensome requirements governing the release of new varieties. The measures generate excessive delays and costs in the approval process and complicate the dissemination of otherwise widely available varieties, although regional attempts to harmonise seed trade are in progress[12]. Poor coordination between customs and SPS border agencies make the situation even worse when the agricultural inputs cross borders. This is particularly true in landlocked countries in Africa, where prices for fertilisers are as much as ten times higher than in other developing countries[13]. Brenton et al. (World Bank 2012) report that geography seems to be important, as farmers in coastal countries in Africa generally enjoy better prices for fertilisers (a little over USD 600 in South Africa and less than USD 500 in Kenya), but there are coastal states such as Nigeria paying very high prices and landlocked countries such as Kazakhstan enjoying access to fertilisers at relatively low prices, which suggests the influence of other factors, such as the regulatory policies adopted by the concerned countries as regards the seed and fertiliser markets.

Table 1. The Maize market: From Techiman, Ghana to Ouagadougou and Kantchari, Burkina Faso

	Systemic costs per MT	Feasible savings per MT	Per cent of farm gate price (USD 122 per MT)	Per cent of market price (USD 358 per MT)
Transport cost	USD 81.00	USD 10.12 - USD 40.50	8-33%	3-11%
Product losses	USD 79.00	USD 39.50	32%	11%
Control costs	USD 40.00	USD 11.00	9%	3%
Totals	USD 200.00	USD 60.62 – USD 91.00	50-74%	17-25%

Source: USAID (2011).

Standards and quality issues

The high incidence of *tariff and non-tariff barriers* and the failure of regional integration to adequately address those barriers are also among the main factors that impinge on regional trade for agricultural commodities (Pannhausen and Untied, 2010; Brookings, 2012; World Bank, 2012). Among the factors affecting African agricultural trade, Brenton et al. (World Bank, 2012) highlight especially the importance of *diverging standards and specifications* and of insufficient *testing capacity*, which impedes economies of scale in seeds, fertilisers and extension services. In their overview of the determinants of export success in Africa, based on interviews of successful exporting entrepreneurs in East Africa, Easterly and Reshef (2010) indicate that the *quality* of products is a key constraint when seeking to export

12. See for instance COMESA's Regional Agro-inputs Programmes (COMRAP), implemented since 2010, which aim at harmonizing seed trade for maize, rice, groundnuts, cotton, beans, cassava, wheat, potato, sunflower, soya beans, millet, and sorghum, so as to ensure that seeds having satisfied the release and certification requirements of one country should not have to "jump through all the same hoops again". In SADC a memorandum of understanding, signed in 2010 for the implementation of a harmonized seed regulatory system, is now being piloted by Malawi, Zimbabwe, Swaziland, and Zambia.

13. Farmers in Burundi, Malawi, Zambia, and Uganda pay between USD 2 700 and USD 1 100 for a tonne of fertilizers, while that price ranges between USD 250 and USD 500 in countries like Pakistan, Argentina or Brazil.

to OECD markets, in particular the EU and US markets, more than *trade costs*, which seem to matter more when exporting regionally. This is also clearly highlighted in the case study on Indonesia (Section V). Sellers do not try to develop a reputation for markets they perceive as being less demanding. In some market segments the price differential between high quality and low quality products[14] does not seem sufficient to justify small traders' investment in becoming familiar with standards and certification and making use of national public-sector laboratory testing and certification services. The varying quality of many agricultural commodities often restricts commercial exchanges to strictly immediate contacts, because of the lack of trust as to the quality shipped and pushes intermediaries to inspect and re-pack consignments at each transfer stage. Furthermore, the perceived risk of low-quality agro-food products exacerbates the shortage of formal credit in the sector.

Sanitary and phytosanitary (SPS), quality or environmental standards and their enforcement at the border influence developing countries' agricultural trade not only as regards the access of their products to regional and international markets but also the availability of the necessary inputs to agricultural production. An effective standards system would support the trade orientation of agricultural production by providing technical reference and supporting claims for value addition. Such a system implies technical norms and regulations which are both responsive to international demand and adapted to local circumstances, but also sufficient capacity to ensure compliance with those norms and regulations. In many developing countries relevant agencies lack adequate expertise and equipment, both at the standard-setting and at the enforcement stage, including at the border. They also lack clearly defined mandates, resulting in overlapping, uncoordinated activities, for which existing resources are spread too thin, and generating confusion, delays and duplicative expenses. As documented by Brenton et al. (World Bank 2012), capacities are often built with donor support, but they cannot be sustained without sufficient financing, and budgetary constraints impel regulatory agencies to focus on maximising revenue from their inspection and certification activities, rather than assisting trade. The authors report that only 28 out of a total of 56 entry points in Tanzania are endowed with Plant Health Service (PHS) inspectors, mainly international airports, major sea and lake ports, and selected border posts. All of them lack basic pest inspection tools and only six are equipped with a computer.

The recent economic literature on standards suggests that, while stronger or more harmonised standards are clearly associated with increased trade in manufacturing supply chains, this is less clear-cut in the case of agricultural trade. Agricultural trade increases, and in particular the movement of agricultural products from low-income to middle-income countries for intermediate processing, are often associated with weaker standards. Agricultural producers that are unable to meet the higher product standards required in developed country markets are pushed "upstream" in the supply chain (Ferrantino, 2012). On the other hand, van Tongeren et al. (2009) find that although meeting the standards' requirements generates additional production costs, standards may also expand trade as they enhance demand for a good through better information about the good or by enhancing the good's characteristics and attractiveness for the consumer. The costs of compliance with applicable standards will frequently shape the decision of producers whether or not to attempt to meet elaborate standards, sell to developed economies at higher unit values and possibly retain more steps of the production process at home.

Agricultural standards are generally set in industrialised countries, largely driven by the fact that nearly 80% of processed food exports from developing countries go to markets in developed countries (Jayasuriya et al., 2006). Developing countries' markets for agro-food

14. For instance, 10% price premium for high quality cereals in West Africa (USAID, 2011).

products are increasingly shaped by those standards and Cadot and Gourdon (2012) show that low-income countries generally apply SPS and technical regulations more extensively than supported by their limited monitoring and testing capabilities. On the other hand, agricultural commodities need standards for categorising purity, moisture content, germination rates, packaging etc., which most African countries currently lack (USAID, 2011). Giovannucci and Purcell (2008) estimated that the rejection of agricultural imports due to poor compliance with importing countries' standards cost low- and middle-income countries about USD 1.6 billion in 2000-01. A growing part among those standards addresses health and environmental concerns, relating to higher value added, ready-to-eat processed food products.

Important differences among standards applied in different industrialised countries in areas such as aflatoxin content or pesticide residues can increase the compliance cost for exporting countries (Mohanty, 2007). At the same time, despite similar agro-ecological conditions for pests and diseases, many regions in Africa or Asia lack regionally harmonised SPS and food safety standards which would facilitate the free movement of food across borders and reduce the costs of food safety controls with respect to plant health, pests, and diseases. The Brookings Africa Growth Initiative (Brookings, 2012) stresses that food safety, fair trade and organic certification standards as well as labour, environmental and labelling standards and certification measures diverge quite considerably among ECOWAS members. In East Africa, food producing companies in Kenya often find it easier to meet the strict technical regulations for exporting to the Japanese, European, or Singapore markets, than the widely diverging and poorly administered regulations in other African countries[15] (World Bank, 2012).

In addition to agricultural standards set and implemented by government authorities (mainly sanitary and phytosanitary -SPS- regulations), an increasing number of agricultural trade standards is privately set by groups or firms and apply primarily to their specific needs, in particular value chain management needs, or the need to reduce the importing firm's exposure to risk. Private standards usually have a larger scope or require higher levels of performance than the baseline government regulations (they can apply to such areas as quality, process management, packaging requirements, or social concerns) and, as they evolve more rapidly than government regulations, they can be more difficult to follow and implement (Giovannucci and Purcell, 2008). Although voluntary, private standards are becoming the basic *de facto* entry requirement for trade with many of the large-scale operators and leading production and distribution chains. Standards going beyond basic entry requirements can represent important opportunities for increased market share or price for many agricultural products, but they can also entail significant challenges for developing country producers and exporters faced with capacity constraints at the production and processing levels.

For the private sector, constraints linked to the compliance with applicable public and private standards relate mainly to *expertise*, *equipment* and *information*. Producers and traders in developing countries have poor awareness and understanding of applicable standards and of their relevance. Accessing a particular market will entail collecting and digesting relevant information and data on the applicable requirements, a time and resource consuming operation, especially given the scarcity of institutions in developing countries to

15. A series of regional standards' harmonization processes are currently put in place in Africa, such as COMESA's Green Pass and similar endeavors by ECOWAS, SADC and EAC to harmonize standards for maize, rice, wheat and other cereals and encourage recognition of conformity assessment procedures, but none is yet implemented.

facilitate standards awareness and adoption. Implementation of the more sophisticated standards will call for specific expertise that developing countries producers often lack and that would need to be acquired through investment in new processes and infrastructure, and training for personnel. Compliance with the more sophisticated standards may in addition require equipment for internal testing and controls, laboratory testing, analysis and certification of products, all of which are in short supply in most developing countries. Lack of testing and inspection services or their concentration in capitals far from the border and food producing areas is an additional cost factor, especially for SMEs. Shortage in required equipment will call for specific investments which introduce a capital-bias into the food processing export sectors of developing countries (Jayasuriya et al., 2006). As an illustration, Mohanty (2007) states that establishing a moderately-sized laboratory in India for testing and analyzing samples of spices costs approximately 4 million Indian rupees (USD 88 000), while compliance costs range from 5 to 15% of the fob value of agricultural products in general. In Thailand compliance costs for a substantial number of firms can reach up to 5% of sales; in the case of a few firms, it exceeds 15% of total sales. USAID's West Africa Trade Hub has calculated that, among key trading corridors between Burkina Faso, Ghana and Benin, the cost of obtaining an SPS certificate for maize (or paying a bribe at the border when such a certificate is not on hand) is USD 40 per tonne, equivalent to 9% of the farm gate price (USAID WATH, 2011).

Smallholder farmers and SMEs, including small and medium producers and processors, which form the bulk of producers and processors in developing countries, will face particular challenges. Those companies often lack the internal capacity and the economies of scale to establish effective quality assurance and traceability systems (Giovannucci and Purcell, 2008). Hillary (1995) shows that the impossibility to employ specific staff to deal with standards, as large businesses may be able to do, restricts the capacity of SMEs to monitor changing legal requirements and interpret and implement necessary controls. Finally SMEs will tend to focus on immediate economic survival rather than potential benefits derived over the long term (Yapp and Fairman, 2004). Thus, unless these sectors can make standard compliance cost effective and guarantee traceability for the buyers, many producers and processors will be marginalised and excluded from competitive markets both regionally and internationally with consequences for economic growth, poverty alleviation, and even food security (Giovannucci and Purcell, 2008).

Trading costs and inefficient value chains

Trade transaction costs, including procedural barriers at the border and high *transportation costs* appear quite significant among the constraining factors identified in the economic literature on agricultural trade (Biau et al., 2008; Cadot et al., 2009; Easterly and Reshef, 2010; Dorosh et al., 2010; Freund and Rocha, 2011; USAID, 2011; World Bank, 2012). High trade costs related to transportation, border procedures compliance, or lack of competition may be less in the case of agro-food products which are part of simpler supply chains than manufactures, but they will likely have a greater proportional impact on the price of most agricultural products, especially unprocessed ones, because of their low value-to-weight ratio. Agricultural products, which are often perishable, suffer particularly from delays, which may be one of the most significant contributing factors to post-harvest losses[16], in addition to inefficient harvesting, packaging and storage. The disproportionate

16. The African Postharvest Losses Information System (APHLIS) has estimated that physical losses for grain (before processing) could be between 10–20%, representing losses of USD 1.6 billion per year, or about 13.5% of the total value of grain production (USD 11 billion) for Eastern and Southern Africa alone.

impact of trade costs on low value, perishable products appears clearly in the case of Cameroon, where domestic handling and transport costs for fresh cassava dispatched over a 130 km distance can account for 21–35% of total final value, compared with less than 12% for cotton lint transported over 1 200 km (World Bank, 2012).

Cadot et al. (2009) find that although farmers' capacity to switch from subsistence to market-oriented agriculture is heavily influenced by risk and price instability[17], the most significant constraints come from high transaction costs related to transportation and anti-competitive practices, and from insufficient market information. Likewise, Balat et al. (2009) point to marketing, transport and intermediation costs in agricultural supply chains as the most significant factors preventing the adoption of high-return crops that would have offered farmers the benefit of higher export prices and enhanced global market access opportunities. As the authors show, farmers focusing on export crops are on average less poor than farmers more oriented towards subsistence activities, but trading costs and inefficient value chains block significant opportunities for poverty reduction. According to USAID (2011), direct transport costs, such as fees paid to transport-service operators, as well as losses in transit, are the factors weighing the most on the movement of commodities along transport corridors, followed by market logistics costs.

There is an extensive debate as to what are the key factors explaining transportation costs. For some authors these are mainly related to poor road, rail or port infrastructure (Nkuepo, 2012), as well as to regulatory and procedural barriers at the border or during transit, including inconsistent and unpredictable implementation of applicable rules and procedures. In African countries, multiple road blocks cause significant delays and offer rent seeking opportunities[18]. Until recently institutional, regulatory and procedural measures, generally grouped under the label of trade facilitation used to receive less attention in assistance projects than infrastructure. Aid for trade facilitation represented only 0.46% of total disbursements in 2009, or 0.48% of total disbursements on average during 2006-09 (OECD Aid for Trade at a Glance, 2011). Brenton et al. (2012) note that, although generally less costly, trade facilitation reforms were not as high in the aid for trade agenda because they require political momentum and their effects are less visible as they are more difficult to measure. Their weaker representation among assistance projects can also be explained by the fact that they attracted a lower priority among recipient country requests.

Although transportation and logistics costs vary across products and countries, smaller markets are more heavily affected. Nordas et al. (2006) point to the difficulties generated by the lower frequency of transport services, as well as the difficulty to ensure backhaul freight, which result in agricultural exports to developed countries bearing twice the shipping cost. Port efficiency can be associated with both technical factors (such as the efficiency and productivity of cranes and other port equipment) and with management factors, including the ownership and operation of port assets and services, such as berths, warehouses, etc. In addition to poor road quality and uncompetitive transport and freight forwarding services, the lack of efficient and affordable cold storage and warehousing inflate transportation costs even further. Port productivity also plays an important role[19]. World Bank estimates that

17. The OECD Committee of Agriculture pursues extensive work on risk management in agriculture. See in particular document TAD/CA/APM/WP(2011)25.

18. According to the latest, 18th Road Governance Report of UEMOA bribery dropped overall by 19% but the number of controls increased by 10% compared to the previous quarter, so that a roadworthy and legal truck still pays about 35 000 FCFA (about USD 65) on average per trip in West Africa. The report counts 38 roadblocks between Abidjan and Bamako, a distance of about 1 100 kilometres.

19. In Africa, six of the 90 total ports, three in Egypt and three in South Africa, handle 50% of total trade.

between 29 and 48% of the delivered price of grain, fruits and vegetables imports into Central America come from logistics costs (Schwartz, 2011).

The impact of high transportation and delivery costs is more acute for farmers living in remote areas with poor infrastructure or transportation. A number of studies have focused on the impact of rural roads on neighbouring communities (Jacoby, 2000; Renkow, Hallstrom and Karanja, 2004; Mu and van de Walle, 2007; Jacoby and Minten, 2009). Those studies find that rural roads reduce poverty in connected villages, by integrating labour and goods markets, thus providing new economic opportunities to their inhabitants, improving access to food and securing higher profits for farmers thanks to cheaper agricultural inputs and higher farm gate prices for their crops. Stifel and Minten (2008) find, in the case of Madagascar, that isolation implies lower agricultural productivity and increased poverty, while Dercon et al. (2008) using household data from Ethiopia find that the proximity of a road is a major factor in reducing poverty. Dorosh et al. (2008) find that in sub-Saharan Africa agricultural production and proximity to urban markets is highly correlated. Jedwab and Moradi (2012) find that rail transportation infrastructure built in colonial Ghana between 1901 and 1923 had a strong effect on cocoa production and on demographic growth and urbanisation, which persists even after the complete displacement of rail by other means of transport. The resulting improved connectivity had large and persistent welfare effects as districts connected to the railway system are now more developed despite thirty years of marked decline in railway transportation. Diop et al. (2005) stress in particular the importance of reducing rural transport costs, which effectively delink farmers from national and international markets and depress farm gate prices, discouraging specialisation in commercial products. Based on a household survey and a diagnostic study of constraints to trade in Rwanda, the authors estimate the transport cost from the farm-gate in Rwanda to the port in Mombasa to about 80% of the producer price. Half of it, i.e. 40% of the farm gate price is represented by rural transport costs alone, from the farm gate to the capital, Kigali.

According to the World Bank's Rural Accessibility Index, only 34% of the rural population in Sub-Saharan Africa lives within 2 kilometres of a road that is passable in all weather (Brookings, 2012). The region has some of the worst connectivity in the world, with only 128 metres of road per 1 000 residents and a road density of only 16.8 kilometres per 1 000 square kilometres, compared with 700 metres of road per 1 000 residents and a density of 37 km per 1 000 sq km in other low-income regions. Roads account for 80 to 90% of all freight and passenger movement in Africa, so road density is an effective proxy of how well connected areas of a country are. Most of the roads in rural areas are unpaved, bringing vehicle operating costs to about 50% higher than on good quality roads[20] and maintenance projects are often neglected and underfunded, resulting in significant loss of road networks, even though such projects are significantly more cost-effective than creating new infrastructure, or rehabilitating decrepit infrastructure (Biau et al., 2008). For many farmers, roads are not accessible or totally inadequate and head carrying is the only available mode of transport. According to UNECA (2010) the fact that only about 30% of African roads are paved, combined with the continent's low port productivity, explains why shipping a vehicle from Addis Ababa to Abidjan costs USD 5 000, while it would cost USD 1 500 to ship from Japan to Abidjan. Landlocked countries that depend on neighbours' road networks to bring products to global markets are particularly affected.

Brenton et al. (World Bank, 2012) on the other hand underscore that high transportation costs affecting agricultural trade in East Africa have more to do with the lack of modern and

20. Observations drawn from the 2005 World Bank Diagnostic Trade Integration Study about the impact of the lack of road maintenance on vehicle operating costs.

competitive transport services than with transport infrastructure problems. They estimate that, along the major international trade corridors, road infrastructure has greatly improved and is no longer the primary reason for high transport costs. USAID (2010) and USAID (2011) reach a similar conclusion for West Africa, although both reports stress that, outside the main regional network, road quality is uneven and much lower. On the other hand, the operation of transport cartels, nurtured by outdated trucking regulations and cross-border restrictions[21] significantly increases prices for transport services and exacerbates informality in the trucking sector[22]. It also removes the incentive to invest into new, more efficient trucks and prevents the modernisation of old and unroadworthy trucking fleets, impacting further on the cost and timeliness of transport and damaging road infrastructure. Raballand et al. (2010) dispute the capital importance of roads, which are often underused and generally expensive to build and maintain relative to the economic development they produce, failing to reduce poverty as much as expected. They stress the relatively high vehicle operating costs due to poor economies of scale and the cartelisation of the trucking industry, which prevents cost savings from being passed on to farmers. The study demonstrates that from a cost-benefit perspective the additional cost of extending an all-weather road two more kilometres to the farmer's door outweighs the benefits in most cases. Reaching a Rural Access Index (RAI)[23] of 50% would be beyond the financial resources of many countries, whereas the average value in other regions is around 65% already.

Brenton et al. (World Bank, 2012) also stress the constraint of inefficient distribution services with burdensome entry requirements, lengthy registration procedures, poor market information and high numbers of intermediaries. The structure of export value chains has a significant impact on poverty and welfare in rural areas, in particular as regards concentration in the distribution sector, which tends marginalise small-scale farmers. Porto et al. (2011) find that greater competition among processors and traders of crops benefits smallholders through higher farm gate prices.

USAID (2011) also considers that *regulatory* and *competition* inefficiencies along the value chain, which diminish the competitiveness of regional cereals and livestock suppliers, are key barriers to food trade, which drive cross-border trade from formal into informal channels. The report points in particular at small scale and multiple intermediaries, the inadequacy of trade information systems, poor product quality, limited access to credit and lack of appropriate storage. Among them, the most burdensome factor, according to Freund and Rocha (2010), is bureaucratic delays, with customs and port delays coming second and transit delays third. World Bank (2011) estimates that the effect of crossing national borders on relative prices of a range of agricultural commodities[24] is equivalent to pushing the two markets an additional 174 km further apart in the case of the Burundi–Rwanda border,

21. Including queuing systems for trucks to be allocated freight within national shares, allowing to charge fees for administering queues and to obtain bribes; and bans on cabotage (i.e. carriage of freight entirely within a country by a truck from another country).

22. Between 80-95% of West Africa's trucking capacity lies in the informal sector.

23. The RAI is used as a basis for estimating the proportion of the rural population which has adequate access to the transport system. It measures the number of rural people living within two km of an all-season road as a proportion of the total rural population. An all-season road is a road that is passable all year round by the prevailing means of rural transport (typically a pick-up or a truck which is not four-wheel-drive). Occasional interruptions of short duration during inclement weather (e.g. heavy rainfall) are accepted, particularly on light traffic roads.

24. Beef, fish, maize, maize flour, beans, palm oil, and cassava flour, based on FAO prices of agricultural goods.

1 824 km further apart in the case of the Burundi–DRC border, and an extra 1 549 km in the case of the DRC–Rwanda border. Border barriers include multiple fees, permission requirements, redundant documentation and burdensome border procedures. Documents such as certificates of origin and import/export permits, usually issued in capital, are difficult to obtain for small cross-border traders in remote regions (Lesser and Moise, 2009).

Supply-side and market access constraints act as important incentives to trade informally rather than formally; addressing those constraints could not only reduce the incentives to informal trade but also enhance the total volume of actual trade flows. Formal regional trade seems particularly below potential in Africa, where it represented only about 10% of total trade in 2010, compared to roughly 17% in Asia and more than 60% in the EU. The "missing" volumes may be trade that did not take place, but also represent informal trade, which is not captured by official statistics and which is quite widespread in Africa. According to Lesser and Moise (2009), informal trade concerns more particularly staple food commodities and low quality consumer goods and could represent as much as USD 231 million worth of goods, or 86% of official export volumes, in the case of a country like Uganda in 2006. This could be particularly significant, considering that intra-African trade is what drove much of Sub-Saharan African export growth over last 15 years, representing an increase of 13% per year on average, during a period where export share to destinations outside Sub-Saharan Africa steadily declined from 71% in 1994 to 53% in 2008.

Market information and access to finance

Another central factor influencing transaction costs for agricultural trade relates to the collection of *market information*, including the identification of potential markets and buyers; information about the prices of products at the local markets and at the level of the final consumer; about quality requirements and consumer taste and demand; but also about the legislative framework covering product safety and quality (Cadot et al., 2009; USAID, 2011; Azam et al., 2012). Based on research in Cambodia, Azam et al. (2012) stress that the farmers' capacity to participate or not in agricultural trade is affected by both fixed and variable transaction costs and by institutional factors, while the decision on how much to trade is affected by variable costs only. In particular, the lack of accurate and reliable market information on crops supply, demand and stocks discourages farmers and traders from taking additional risks, such as expanding production and exporting to new markets. It can also produce ill-defined and uncoordinated policy responses which contribute to food price volatility.

The lack of reliable information on standards and their implementation not only compromises the ability to position agro-food products in target markets, but also limits agricultural producers to low-return market segments. Siringoringo et al. (2009) show that although concrete information on prospective foreign markets is essential before exporting can occur –firms using relevant, accurate and timely information are in a better position to respond to export problems–, this is a serious challenge for SMEs in developing countries, who often lack the internal resources to acquire essential information, digest it and use effectively the vast quantity of general information and flood of statistical data that are routinely handed to them in response to their enquiries.

Farmers also face difficulties as regards the negotiation of *marketing* conditions and price. In order to overcome size constraints, increase their bargaining power, allow economies of scale and lower marketing and negotiation costs, smallholders need to organise in farmers associations and cooperatives. As with transportation costs, poor market information and bargaining capacity tend to be more constraining for small-scale producers and traders living in remote areas. Poor communication and transportation infrastructure

limit farmers' capacity to collect market information and increase the role and power of intermediaries. Price-information systems established by national governments, for instance with respect to West African cereals markets, are of varying data quality and timeliness, rarely include information from markets in neighbouring countries and are not typically available to the private sector in user-friendly, market-supporting ways that alleviate inequality of access to price information. Smallholders failing to access publicly available information on market prices typically establish contacts through mobile phones for undifferentiated low-quality commodities (USAID, 2011). However, new technologies, in particular the increasing coverage and decreasing cost of mobile phones[25], contribute significantly in overcoming those constraints, especially in more remote markets and those without paved roads. Second generation market information systems already operate, such as the online *Esoko*[26] model, which provides a platform for the quick and affordable exchange of agribusiness information in and out of rural areas using mobile phones.

In West Africa, farmers list *access to finance*[27] as among the most important problems they face, in addition to logistics and access to land issues (USAID, 2011). Likewise, Azam et al. (2012) state the lack of rural credit and insurance as one of the major obstacles for converting from smallholder, subsistence farming to commercial farming in Cambodia. Access to finance is a critical problem not only for farmers and processors but also for their suppliers along the vertical chain - such as for equipment and agricultural inputs (e.g., seeds, chemicals) - and logistics providers. It is particularly acute for small-scale agro-food traders, most of whom operate in the informal sector. Farmers' and agro-food traders' limited means to finance the storage or trade of their products, lack of access to futures markets or crop insurance schemes for harvest failures, limited and expensive access to bank credit, obliges them to operate solely with their own capital. This limits considerably the volumes they can trade and encourages a quick stock rotation in order to maximise turnover. Linguistic and family bonds, which are prevalent in informal trade, make up for the non-availability of credit, but they are often insufficient for long distance trade, for which credit and guarantees are required in order to reproduce equivalent levels of trust. The challenge is even more significant for agricultural exporters, who often state lack of access to credit as the single biggest factor constraining their growth (Cardno, 2010).

Financial institutions in many developing countries have a weak capital base, limited knowledge and experience in managing counterparty risks and limited correspondent banking relationships (Nkuepo, 2012). Financing trade is complicated further by the lack of efficient payment mechanisms to cover insurance requirements and customs guarantees for transiting consignments, as also shown by the case study on the cashew nut sector in Mozambique, as well as by the non-convertibility of certain currencies. Agricultural financing providers include a broad array of public, private and community based

25. Brenton et al. (2012) report that, thanks to mobile phones, agricultural prices dispersion across markets was reduced by 10% in Niger between 2001 and 2006.

26. Esoko was put together by a partnership of IFC, IFPRI, USAID, CIRAD, IFAD, FAO and GIZ. The system relies on individuals feeding prices for standardized commodities through mobile phones to a server that makes these data available to others on their mobile phones. It allows access to prices, stock, offers and harvest information, communication with clients and members, tracking stock and inventory, finding buyers and sellers and pulling interactive data from the field.

27. Agricultural finance refers to funding and financial services including equity and quasi-equity instruments (e.g. convertible loans); short-, medium- and long-term loans; leasing and other specialized instruments and insurance and risk management products (e.g. weather, crop and livestock insurance) covering the entire agribusiness product cycle (ranging from project preparation, through implementation, production and processing, and, finally, to the distribution of agro-food products).

organisations, including government development banks and specialised funds, such as pension and equity trust funds; bi-lateral and multi-lateral donors; development finance institutions (DFIs) and sovereign investment funds; hybrid social funds; private sector equity investors and funds; commercial banks; leasing companies; rural and micro-finance institutions; and, finally, community-based lending societies. However, despite this wide range of sources of financing, agribusiness financing represents a very small percentage of the total supply of credit, for example only 5% on average in West Africa (USAID, 2011).

Local financial institutions are reluctant to lend for agricultural projects, particularly to smallholders, because of their low familiarity with the agricultural sector, their perception that agricultural risk is highly linked to seasonality and weather conditions, and the shortage of available security. This is clearly highlighted in the case study on Zambia. The difficulty of verifying titles and property rights in rural areas raises issues in providing collateral, but in some parts of Africa financial institutions increasingly accept "warrants" [28]. Warrantage is used for smallholder farming in francophone Africa, Burkina Faso, Mali, Niger and Senegal and is increasingly receiving the support of the World Bank, EU, FAO, USAID and other donor and microfinance institutions. On the other hand, farmers often lack the formal educational background to be able to present well-prepared documents and financial statements to loan officers and their remoteness from urban centres and dispersed demand due to low population densities considerably increases transaction costs for service providers (USAID, 2011).

A promising initiative is the Making Finance Work for Africa (MFW4A) partnership[29], aiming to establish a common platform for the harmonisation and facilitation of financial sector development and knowledge sharing in Africa, so as to unleash the full potential of Africa's financial sector in order to drive economic development and reduce poverty across the continent. The Partnership brings together donor partners, African governments, the private sector, and other financial sector stakeholders[30] to promote country and region-led financial sector development projects. Their agricultural sector donor mapping and agricultural finance assessments seek to ascertain which initiatives are being supported by a range of donors—whether already implemented or planned for the future, so as to identify overlaps and gaps in implementation. Ferro et al. (2011) estimate that banking services are quite amenable to aid-for-trade support.[31] However, as shown by the case study on Zambia, the sustainability of alternative funding programmes is not easy to achieve and works better in combination with mentoring programmes to improve concerned firms' market operations.

28. Receipts from regional warehouse receipt schemes (WRS) which bulk and secure commodities, that indicate the deposited goods' value and can be used as collateral. The use of warrants as collateral for agricultural finance is called warrantage.

29. A G8 initiative launched in October 2007 with the involvement of the AfDB.

30. Existing institutions that operate within the agricultural sector include the African Development Bank (AfDB), the Alliance for a Green Revolution in Africa (AGRA), the World Bank and its private sector arm, the International Finance Corporation (IFC) which finances private sector investment, mobilizes capital in the international financial markets, and provides advisory services to businesses and governments, USAID and its implementing agencies, Germany's KfW Bankengruppe (KfW Banking Group) and France's Agence Française de Developpement.

31. A 10% increase in aid to banking services would bring about a 4.7% increase in manufacturing exports

II.c Institutional and regulatory inefficiencies

In addition to the removal of production and trade-related constraints, developing countries which managed to harness agricultural growth and trade to reduce poverty, seem to have benefited in particular from an improvement of the country's general macroeconomic context and the reduction of regulatory and trade policy distortions such as high *export taxes*, overvalued *exchange rates* and inefficient *state interventions* in the agricultural markets (Cervantes-Godoy and Dewbre, 2010). The overview of the determinants of export success in Africa from Easterly and Reshef (2010) shows that successful export performance relies on overcoming or addressing distortions in the general economy, such as detrimental *macroeconomic policies*, *bureaucracy* and *poor rule of law*. Brenton et al. (World Bank, 2012) highlight the damaging impact of *unpredictable and discretionary regulatory environments* with export and import bans[32], variable tariffs and quotas, restrictive rules of origin, price controls, lack of transparency and poor communication.

Agricultural trade policies appear at the centre of many regulatory constraints. Although regional agreements address a wide array of regulatory barriers[33], for instance by prohibiting export-licensing regimes, establishing duty-free status for certain products, offering inter-state road transit insurance[34] and promoting harmonisation and mutual recognition of standards, these achievements are poorly implemented in practice. In addition, national policies are mostly inconsistent, implemented unevenly and create an opaque business environment. A number of African countries impose export authorisations by the provincial administrator, regional governor or local chamber of commerce for certain types of commodities despite the prohibition at the regional level. They also assess duties on commodities or impose VAT payment when crossing borders on goods that are normally duty or VAT free under regional schemes. Transit bonds, providing insurance which allows goods in transit to move freely through the region are often not recognised, obliging road transporters to buy new insurance at each crossing, and a similar situation applies to SPS and veterinary certificates of neighbouring countries.

However, according to a West Africa Trade Hub Technical Report (USAID, 2011) the most important trade policy constraint is often the widespread application of seasonal import/export bans. The report notes that the enhancement of regional trade is often sacrificed to a national agenda of food self-sufficiency, despite guidelines codified in regional agreements on the elimination of tariff and non-tariff barriers, signed by all, but lacking implementation. Reports from the Permanent Inter-State Committee for Drought Control (CILSS) and FEWS-NET[35] are not always followed and the determinations are made

32. Import bans during good harvest years to ensure domestic production is consumed first, and export restrictions or bans during periods of low yields. Quantitative restrictions and bans reduce output prices and limit farmer's incentives to produce, keeping output below potential in the case of export restrictions, while import bans will increase consumer prices in food deficit areas. The authors highlight the effect of uncoordinated and non-transparent implementation of such measures on price stability.

33. See for instance the ECOWAS Trade Liberalisation Scheme, which applies to agricultural products since its inception in 1979. Under the scheme unprocessed livestock, fish and plant products are totally exempt from import duties and taxes and from quantitative restrictions.

34. For instance the Inter-State Road Transit (ISRT) Convention and Logbook in ECOWAS established a regional insurance scheme and ISRT Bond.

35. The Famine Early Warning Systems Network (FEWS NET) is a USAID-funded activity that collaborates with international, regional and national partners to provide timely and rigorous early warning and vulnerability information on emerging and evolving food security issues in Africa,

on the basis of political factors or manipulation of market data. This results in reducing the predictability of market dynamics and trends, increasing investment risk, hampering the ability of the private sector to allocate resources efficiently and generating incentives for informal trade with its extensive opportunities for bribery and corruption.

Yet, open food trade policies can bring significant benefits not only to the exporting countries, through higher production, exports and trade, but also at the regional level, by allowing flows from surplus to deficit areas and helping lower domestic prices and smooth seasonal fluctuations in net food importing countries. USAID (2011) reports that Uganda's open and consistent trade policies benefit not only its immediate neighbours[36], but also the continent more widely, through Ugandan maize and beans procurements from the World Food Program (WFP), aimed at covering periodic food shortages in Kenya, Burundi, Tanzania, Sudan, DR Congo, and Rwanda. These open trade policies and the marketing opportunities they have created for Ugandan producers encourage increased production from maize and beans farmers and promote efforts to meet WFP's quality and quantity requirements.

II.d. Complementary policies

The importance of complementary policies is highlighted in Hallaert et al. (2011). In particular, *education* and training are important factors influencing developing countries trade performance through their impact on labour productivity. Besides the high transport costs and poor market integration generated by poor physical infrastructure, a major obstacle for converting from smallholder, subsistence farming to commercial farming according to Azam et al. (2012) is the low level of formal education and training in new techniques. Subsistence farmers may find themselves unable to share in the market-based growth for lack of skill and labour, which would suggest that aid interventions upgrading skills through better extension services, could greatly improve market participation and commercialisation by smallholders. Ngo (2006) confirms the importance of literacy and numeracy skills as pre-conditions for agricultural growth. Calculating the effect of educational attainment on rice productivity in Vietnam, the author finds that the returns to literacy and to holding upper secondary diplomas on rice yields are 38% and 31% respectively.

The most important effect of education on agricultural growth seems to be through its role in modernising agriculture, rather than its impact on traditional agriculture (Alene and Manyong, 2007). The authors show that formal education and extension services have higher productivity-enhancing effects for farmers cultivating improved varieties and applying a package of new inputs than for farmers using largely traditional technology, which can be formalised and passed on from generation to generation. This suggests that that the generation and dissemination of improved agricultural technologies should be coupled with formal farmer education to have a maximum impact on agricultural productivity and that formal farmer education not only enhances agricultural productivity following modernisation and the adoption of new technologies, but also promotes technology adoption itself.

Central America, Haiti and Afghanistan. This information helps decision makers act to mitigate food insecurity through contingency and response planning efforts.

36. Kenya receives annually around 120 000 tonnes of maize, Rwanda another 50 000 tonnes and southern Sudan is becoming a growing market for Ugandan products. The WFP purchased 109 000 tonnes of food from Uganda in 2010 (World Bank, 2012).

Finally, *conflicts and political instability* are also important obstacles to consider (Nkuepo, 2012). The prevalence of regional *conflict* is highlighted in particular as an important constraint that impinges on regional trade for agricultural commodities in a number of recent studies (Pannhausen and Untied, 2010; Brookings, 2012; World Bank, 2012).

III. The link to poverty reduction and food security

A distinction should be made between the role of agriculture and that of agricultural trade in economic development, poverty reduction and food security. An abundant economic literature, reviewed by Cervantes-Godoy and Dewbre (2010), and more recently the analysis of Agricultural Policies for Poverty Reduction (OECD, 2012b) have focused on the former, discussing the process of structural transformation of economies, from the least developed, in which economic activity is largely based on agriculture, to high-income countries where industry and services sectors dominate. Several studies conclude that agricultural growth is more poverty reducing than growth in non-agricultural sectors, and suggest a strong link with the labour intensity of agricultural production, which is also highlighted in our case study on the cashew nut sector in Mozambique. OECD (2012b) nevertheless highlights the importance of anticipating structural changes in agriculture, including labour movements from a modernising agricultural sector, where technical change reduces labour demand, to growing non-agricultural sectors.

Given the important share of poor people involved in agriculture, improved agricultural performance will increase the income of a significant proportion of poor people, and may also translate into an increase of the purchasing power of poor consumers. Among the four "transmission mechanisms" between agricultural growth and poverty reduction highlighted by a 2004 DFID paper, it is worth noting agriculture's contribution to the generation of economic opportunity in the non-farm sector[37]. Viewing agricultural and rural development as an important stepping stone for economic development in general, the G8 pledged in 2009 to substantially increase aid to agriculture and food security including through pledges to commit USD 20 billion over three years.

The links between agricultural trade, poverty reduction and food security are complex. Agricultural growth affects poverty and overall economic growth directly and indirectly through linkages with the non-agricultural sector; at the same time, reinforcing economic activity in rural areas has a significant impact on the disproportionately large number of poor living in those areas (see empirical studies on Ethiopia by Diao and Nin-Pratt, 2007; on Ghana by Breisinger et al., 2008; and findings by Datt and Ravallion, 1998; Christiansen, Demery, and Küh, 2006, who find that agricultural growth had an impact 13.8 times larger than non-agricultural growth on poverty). Nin-Pratt et al. (2009) consider poor growth in agriculture to be a key factor behind the overall weak performance of West African economies. The authors stress the mismatch between the old-fashioned, low productivity and high risk production patterns that are still prevalent in the region and the role of the agricultural sector as the main provider of employment, rural livelihoods, export revenues, and more generally national income. Azam et al. (2012) consider that increasing the commercialisation of agricultural products and expanding the market participation of rural poor raises living standards and reduces the vulnerability of rural populations. However, the

37. DFID (2004), *Agriculture, Growth and Poverty Reduction* refers also to the direct impact of improved agricultural performance on rural incomes; the impact of cheaper food for both urban and rural poor; and agriculture's support of economic transition from primarily agricultural activities towards a broader base of manufacturing and services.

positive impact of agricultural trade expansion on smallholders is not straightforward, as the distribution of benefits will depend on a number of additional factors, such as the producers' organisational capacity and their access to information on demand and on prices (see above, sections II.a and II.b).

A number of recent studies (Pannhausen and Untied, 2010; Brookings, 2012; World Bank, 2012) note the significant contribution of regional trade to food security through the trade of commodities from surplus to shortage areas and the possibility to make the most out of different seasons, rainfall patterns and production increases or declines generated by climate change. They also highlight the role regional trade can play to enhance socio-economic development and reinforce countries' integration into the global economy by creating economies of scale, establishing and strengthening product value chains (production and distribution of seeds and fertilisers, advisory services, grains storage, transport and logistics, distribution and retailing, processing), facilitating transfer of technology and knowledge, stimulating infrastructure development and attracting FDI.

Enhanced trade of agricultural products can contribute to food security[38]. This can be done by improving poor people's access to food and by increasing returns to poor farmers for the food they produce through the expansion of food markets and the growth of agricultural production in surplus zones, in addition to any efforts to improve productivity in deficit areas. Brenton et al. (World Bank 2012) show that if existing regional trade agreements and efforts for policy and regulatory harmonisation in Africa had succeeded in removing barriers to regional trade in food staples, food security would be improved by linking farmers to consumers across borders which often artificially separate food surplus areas from food deficit ones[39]. This would mitigate the effects of periodic national food shortages and of escalating global food prices. Regional trade in food staples could help moderate price volatility in African food staple markets, but existing barriers make it very difficult to trade with neighbours. Most food demand is currently supplied from outside the continent[40]and this demand, which is expected to double by 2020, can significantly burden import bills. The gravity framework employed in the following section for assessing the constraints to exporting agricultural products provides evidence for the importance of stronger regional integration in ensuring regional trade in agricultural products. The gravity model identifies partial equilibrium effects of such constraints. Meanwhile, the linkages between agricultural trade, poverty and food security need to be analyzed through a more complex conceptual framework that considers the dynamics of such interactions. Such an analysis focused on a wide range of developing countries remains subject to strong data limitations.

One of the most important paths for enhancing food security is to address poverty challenges through the improvement of rural incomes (Brooks, 2012). The author suggests that the strategy for strengthening rural incomes and facilitating smallholder adjustment is not only to improve agricultural productivity but also to promote a more diversified rural

38. Food security implies *both physical and economic access to sufficient food* to meet dietary needs for a productive and healthy life (USAID definition) and is determined by availability, access, utilization and stability of supply, as defined by FAO.

39. The authors provide the example of Northern Mozambique, which produces large amounts of maize, but is far from the main area of national consumption in the south of the country. That production could usefully address the persistent food shortages of nearby Southern Malawi. Likewise, Kenya's maize deficit makes it dependent on imports, especially from Tanzania.

40. FAO estimates that, contrary to Asian countries, just 5% of all grain imported by African countries originates from regional sources.

economy that offers additional sources of income. For many agricultural producers, the importance of barriers will determine not only the volume they trade but also the likelihood that they may envisage exportation at all (Nordas et al., 2006), with significant implications for employment opportunities. The expansion of food markets has employment repercussions beyond mere farm work, not only supporting jobs in rural areas, but also jobs in processing, transport, distribution and retailing.

IV. An empirical assessment

Drawing on the overview of the various supply-side constraints reviewed above, and building on the gravity model literature, this section explores the relative impact of various constraints on developing countries' exports of agricultural products, with a view to prioritising and sequencing domestic reform and aid-for-trade programmes to maximise their trade potential.

Model specification and econometric strategy

The classical cross-sectional gravity approach, in which the value of trade is regressed on a number of time-invariant trade impediments such as different measures of physical, cultural and administrative distance, is augmented with a series of *key explanatory variables*, reflecting trade related and productive capacity constraints identified in the preceding section. In addition, variables are introduced to control for complementary policies, such as education or governance, and a number of comparative advantage factors which are not directly amenable to aid interventions -- areas which are likely to impact both the productive and trade capacities of a country.

Data availability has been a significant challenge in developing the database of key explanatory variables. As data availability varied across countries, key explanatory variables were selected with the dual objective of covering as many important constraints as possible but also of maximising the total country coverage to avoid selection bias.

The key explanatory variables include:[41]

- Two constraints on the productive capacity: (i) access to fertilisers is proxied by *fertiliser consumption* (taken from the WB's World Development Indicators, WDI) although the proxy is imperfect in that it also reflects demand-side factors. Access to fertilisers is, itself, a reflection of a number of regulatory and business environment issues as access to fertilisers is likely to be influenced by access to credit and insurance, contract enforcement institutions and the development of the inputs sector. And (ii) electricity availability is proxied by *total electric power consumption* (also from WB's WDI), although, again, the variable reflects demand-side factors as well. Data limitations did not allow for the inclusion of agricultural machinery.
- An *index of infrastructure quality* which reflects the quality of a number of trade, transport, logistics and connectivity related infrastructure elements, such as ports, railroads, roads or information technology. This index is a sub-component of the World Bank's Logistics Performance Index.
- Two aspects of trade policy: (i) an *index of tariff trade restrictiveness* for agricultural products, referred to as the TTRI, which is compiled as the bilateral average of the tariffs imposed by a country on its imports weighted by this country's bilateral

41. Data sources and descriptions for the variables included in the model estimation are presented in Annex 2.

import composition; and (ii) an *index of NTM restrictiveness* for agricultural products, referred to as NTMRI, similarly compiled, as a bilateral weighted average of NTMs tariff-equivalents, including, among others, price and quality control measures, technical regulations and monopolistic measures. These indices, drawn from Kee, Nicita and Olarreaga (2009), provide the best country coverage available to date for both tariffs and NTMs. Their computation is described in more detail in Annex 2. The advantage of weighted indicators of trade barriers is that they give a more realistic view of the actual constraints faced by individual countries in practice. However, a key drawback is that such indicators mask the impact of prohibitive tariffs and, more generally, tend to give a lower weight to a barrier, the higher it is. An alternative specification was thus tested in which tariffs are directly introduced instead of the TTRI, but the results were comparable.

- Two variables which reflect a country's comparative advantage for agricultural production: (i) *agricultural land availability* and (ii) *renewable internal fresh water resources* (both taken from the WB's WDI). As in the case of the level of fertiliser consumption, the indicator for freshwater resources availability can also be a good proxy for a wider set of constraints across the agricultural value chains. The inclusion of comparative advantage factors offers a more accurate perspective to the relative impact of supply-side constraints, even though they cannot themselves be directly addressed by means of aid for trade or policy interventions.
- Two complementary policies: (i) *education* – proxied by the primary and secondary school gross enrolment rates taken from the World Bank World Development indicators, and (ii) *governance quality* – proxied by an index of political stability and absence of violence taken from the World Bank World Governance Indicators.

The data limitations referred above did not allow the inclusion of additional constraints identified in the preceding section, such as information on the business environment or the availability of credit for the agricultural sector as well as other comparative advantage-related variables such as rural labour or availability of agricultural machinery. Unfortunately, when available, such information covered only very restricted sub-samples of countries; its inclusion therefore induced important selection effects on the results. Likewise, it was not possible to include more disaggregated information on rail and road transport networks, or on NTMs, differentiating between TBT and SPS requirements, for which data is very sparse in the case of developing countries. For this reason, these aspects are further explored the case studies that follow in sections V, VI and VII.

The focus of the paper being to explore the impact of constraints for developing countries, exporters in the baseline specification only include developing countries (as defined by the World Bank income categories low-income, lower-middle income and higher-middle income countries). This is referred to as the "developing countries only" specification. The dataset then includes bilateral trade flows between 64 developing countries and their trading partners (the trading partners including both developed and developing countries). The sample of countries is listed in Annex 3. It includes a representative set of countries from all continents, a number of landlocked countries, least developed countries (LDCs) and major emerging economies.

In addition, the model is also run on a larger dataset (referred to as the "full sample") that includes both developing and developed countries as exporters and where the supply-side constraints are interacted with a dummy variable that denotes developing countries, so as to test for a disproportionate impact of the key explanatory variables on developing countries. When these interacted terms are significant, the non-interacted terms capture the effect of constraints on developed countries' exports while the effect on developing countries' exports

is given by the sum of the interacted and the non-interacted coefficients. The chief reason to expect a potentially disproportionate effect of some constraints in developing countries is the fact that constraints are likely to interact with each other, with some constraints increasing or inhibiting the effect of others. For example, poor infrastructure quality might inhibit the impact of market access barriers, as high tariffs imposed by trading partners will not make much difference in cases where goods cannot reach the port of export. Conversely, conflict will exacerbate transport difficulties in a country with already poor infrastructure. It would have been interesting to test these interactions themselves, but, in practice, data availability does not allow to do so. However, we test for potentially disproportionate effects in developing countries, where such bottlenecks are more likely to be present. In this specification, the sample includes 33 additional developed countries as exporters, the list of which is given in Annex 3.[42]

The dependent variable is bilateral agricultural trade in value.[43] The model is estimated using a cross-sectional dataset rather than a panel, as two of the key explanatory variables, the TTRI and NTMRI, are available only for two very close periods (2005-06 and 2008). In this setting, the model is not run for one specific year, but over a 5-year average for the period 2003-07.[44] This strategy maximises the country coverage and mitigates the problem of measurement errors.

The traditional gravity model establishes a link between bilateral trade flows, the sizes of two economies (proxied by their GDPs), and various measures of physical and cultural distance between country pairs taken to reflect bilateral trade costs. This traditional specification of the model has however been revised to account for the fact that (i) trade between two countries is affected not only by absolute bilateral trade costs but relatively to the trade costs among all country-pairs, and (ii) the sizes of other economies matter too – this is often referred to as "multilateral resistance". The easiest way of controlling for "multilateral resistance" and obtaining unbiased coefficient estimates is to use country or country-pair specific fixed effects (Eaton and Kortum, 2002; Feenstra, 2004). The key drawback of this estimation method is that it precludes the inclusion in the model of explanatory variables that vary only in the country or country-pair dimensions, such as our key explanatory variables. We therefore adopt Baier and Bergstrand's (2009) alternative approach, which consists in computing "multilateral resistance" (MR) terms based on bilateral trade cost data between all country pairs and the size of one economy relative to the size of all others (see Annex 1 for details).[45]

Three sets of robustness checks are run as alternative ways to account for the "multilateral resistance terms" and are described in Annex 1 (outputs are reported in Annex

42. The list of importer countries is also given in Annex 3.

43. The dataset is based on reported bilateral import flows, which are considered to be more reliable than reported export flows (as countries have an incentive to report imports better than exports in view of collecting tariff revenues). Data come from the WITS COMTRADE database. We also verify that results are consistent when looking at disaggregated trade using product-level trade data. In this case, the nomenclature used is SITC Revision3 at the most detailed level available (SITC 5-digit or SITC 4-digit level, where no further disaggregation is available in the nomenclature). The main advantage of this estimation strategy is a more precise estimation of the effect of tariffs on export flows as we use bilateral applied tariff at product level instead of the aggregated index TTRI.

44. The composition of the 5-year averages varies across variables and countries as data was not available for all years between 2002 and 2007 for all variables and countries.

45. Following Baier, Bergstrand and Mariutto (2011) and Hoekman and Nicita (2011) no constraints are imposed on the bilateral trade costs variables and its related MR term.

6). The results for the key explanatory variables remain stable across these alternative specifications. Following the literature, as the model is run at the agricultural sector level, the size of the economy (i.e. GDP) is replaced by the size of the sector, proxied by the value of agricultural production in exporting countries and by the value of expenditure on agricultural products in importing countries (Anderson and Yotov, 2010).

When the gravity model is estimated in a log-normal specification, zero trade observations are discarded. However, just as it is interesting to observe the level of trade between two countries, it is also interesting to observe the fact that some countries do not trade at all in some products. This is all the more important when seeking to identify constraints to trade. In line with the recent developments in the literature, this issue is addressed by (i) adding 1 to all trade flows when estimating the model using Ordinary Least Squares (OLS) and (ii) estimating the model using a Poisson Maximum Likelihood Estimation (Poisson) instead of OLS (Santos Silva and Tenreyro, 2006).

Results for the "developing countries only" specification

The estimated coefficients (OLS and Poisson) and the corresponding elasticities are reported in Annex 5 for the "developing countries only" specification (see Annex 1 for details on the calculation of elasticities).[46] According to these outputs, it appears that developing countries' agricultural exports are particularly sensitive to the quality of transport and trade-related infrastructure, followed by political stability, education, fresh water availability and tariffs.[47]

Results for the classical gravity variables are generally in line with the literature. Distance remains an important impediment to bilateral trade, while sharing a border or a common language increases trade flows between two countries.[48] Obviously, countries with higher agricultural production levels tend to trade more, while landlocked countries tend to trade less. In line with the empirical evidence (Behar and Venables, 2010), being landlocked reduces trade volumes by 40% (for importers) and 60% (for exporters). This result is particularly informative for Sub-Saharan Africa where 40% of people live in landlocked countries (Ndulu et al., 2007).

As expected, the quality of transport and trade-related infrastructure yields a positive impact on developing countries' exports. Bouet et al. (2008) underline the fact that quantifying the impact of separate types of infrastructure on trade remains difficult mainly owing to the interactive nature of different types of infrastructure. Using an aggregate index accounting for the quality of roads, ports and telecommunications is therefore appropriate in this perspective. Although data did not allow comparing the effect of this index with the effects of each of these components, the results confirms the significance of their combined

46. We report heteroskedasticity robust standard errors. The inclusion of key variables of interest adds to the total number of explanatory variables typically introduced in the classical gravity model. This could possibly raise multicollinearity issues. However, the regressors' correlation matrix shows that there are no powerful correlations between any pair of explanatory variables. In addition, introducing the key variables of interest one by one in the regression raises results that are similar to those found with the full regression presented in the paper, both in terms of sign and significance of the coefficients.

47. We base our discussion of results on the coefficients obtained from the Poisson estimation as it better takes into account the observations where trade is equal to zero and deals with potential heteroskedasticity issues.

48. The fact of sharing a border is a significant constraint only in the OLS regression.

impact on trade: a 10% increase in the index of transport infrastructure quality would raise exports by 30%.[49]

The results also point to the importance of complementary policies, such as the quality of governance and education which have a positive and significant impact on exports. A 10% improvement in the index of political stability and absence of violence or in the secondary school enrolment rate seem to be associated with increases in trade value of 8.5% and, 7.2% respectively, most probably both through their positive impact on agricultural productivity and market participation of agricultural producers, as highlighted in section II.d. While this is not surprising, in light of the existing evidence presented in the previous section, the magnitude of these effects is noticeable. Indeed, political instability interrupts production processes, can lead to the destruction of productive assets and transport systems, and undermines investors' confidence. It further weakens the incentives to build state capacities which include the power to enforce contracts and regulate markets, with negative outcomes on the market economy and development (Besley and Persson, 2011). As for education, its beneficial effects on farmers' ability to acquire new skills that contribute to improving their productivity are well known. The case studies on Indonesia and Zambia highlight the importance of literacy, numeracy and technical skills in farmers' capacity to seek agricultural credit and to implement SPS and quality standards. The efficiency of extension services is likely to increase with education, which is also likely to improve farmers' market participation perspectives.

Unsurprisingly, comparative advantage variables are also found to have a significant impact on countries' capacity to export. Greater availability of fresh water by 10% would increase trade by 3.9%. The availability of agricultural land is positive but not statistically significant. Policy implications for reforms and aid for trade in this respect are only indirect since endowments in arable land and water resources are more or less a given. However, domestic reforms supported by aid for trade can enable producers and exporters to use natural resource endowments more efficiently, productively and in a sustainable manner.

With regard to trade policy, tariffs are found to have a significant negative impact on agricultural trade. A decrease of 10% in the tariff trade restrictiveness would lead, on average, to a 3.7% increase in agricultural exports. This is in line with the findings of other studies that consider overall trade (Hoekman and Nicita, 2011; Hallaert et al., 2011). Being part of a regional trade agreement proves to have a significant and important positive impact on trade. This can reflect the fact that being part of a trade agreement does not only imply the benefit of preferential tariffs but also of other economic gains (i.e. FTAs can promote economic cooperation by offering a political forum of discussion) (Martin et al., 2010). Together with the results for common border and language, this points to the importance of stronger regional integration for boosting agricultural exports. Contrary to expectations, the effect of the NTMRI term is found to be positive and significant. Data and measurement issues could explain the difficulty in finding results that match expectations regarding the impact of NTMs. Nevertheless, as underlined in Section I, recent studies suggest that, in the case of agricultural products trade, NTMs (especially SPS standards) can enhance rather than

49. It was not possible to disaggregate this index into its different components (e.g. roads, railways, port quality, etc.) because, owing to the poor country coverage of these variables, the results did not prove robust across specifications. The inclusion of such variables would induce major changes in the country coverage. We tried to control as well for different trade facilitation indicators (such as cost of export or the efficiency of the clearance processes by the border control agencies) and although some tests would suggest a significant impact on trade flows, the results were not robust to different checks.

reduce trade, as they diminish information asymmetries (van Tongeren et al., 2009; Crivelli and Gröschl, 2012)[50].

It proved difficult to capture robust impacts on exports of the productive capacity variables (electricity and fertilisers). Fertiliser consumption is found to have a negative and non-significant impact in the baseline Poisson specification, while its effect is found to be positive and significant using an OLS estimator (in this case a 10% increase in fertiliser consumption would increase exports by 2.1%, on average). Similarly, the coefficient for electricity consumption is not significant in the Poisson nor in the OLS regressions. These inconsistencies might be explained by the fact that these two variables remain imperfect proxies for the patterns of fertiliser and electricity availability in the agricultural sector. Lower values of fertiliser consumption can point to a more efficient use of fertilisers in particular regions, allowing for a reduction of such inputs while obtaining the same amount of agricultural output. Meanwhile, for many developing countries the intensity of fertiliser use remains still extremely low when compared to some developed countries (Hernandez and Torero, 2011) and low fertiliser use appears as one of the factors explaining lagging agricultural productivity growth in regions such as Sub-Saharan Africa (Morris et al., 2007). Similarly, national electricity consumption imperfectly reflects the availability of electricity for the agricultural sector since, as stated in the previous section, the agricultural sector is not the predominant consumer of energy in developing countries.

Although most of the key explanatory variables introduced in the regressions can be considered as fixed in the short term, as their values vary very little over time and we have used their average over the 2003-07 period, endogeneity issues could still arise since the regression is based on cross-sectional data. The direction of causation should thus be very carefully interpreted. Nevertheless, these results support a strong correlation between the key explanatory variables and trade flows.

Comparative results for the "full sample"

The results for the "full sample" specification, which considers both developing and developed countries as exporters, are reported in Annex 5. Results are very much in line with the results for the "developing countries only" specification, although the magnitude of elasticities slightly differs for some variables. In addition to constituting a necessary robustness check of previous results, this specification gives interesting insights into the specificity of the constraints faced by developing countries as compared to those faced by developed countries.[51] It appears that tariffs, NTMRI, primary school enrolment, governance and fresh water availability have a more significant impact in developing countries than in rich countries. The fact that the coefficient of the developing country dummy is negative despite controlling for the size of the sector and various constraints, suggests that there are still constraints that we have not managed to capture.

Data limitations did not allow robust results to be obtained when investigating the potentially different effects of constraints on specific sub-groups of countries such as

50. The results for the whole sample, of a negative and non-significant coefficient for developed countries, seem to further confirm this interpretation.

51. The Chow test reported in Annex 4 confirms that the difference in the coefficients for the two groups (developing countries versus developed countries) is statistically significant.

landlocked countries or LDCs. The available data cover very small samples of exporter countries that are not sufficiently representative of the groups under analysis.[52]

A more informative way of ranking constraints

While the elasticities reported above indicate the impact on developing countries' exports of a percentage change in the key explanatory variables, it remains difficult to fully compare the effect of a 1% increase in political stability to a 1% increase in infrastructure quality. To identify the key constraints to agricultural trade in developing countries, elasticities have to be considered jointly with average levels of the various variables in these countries. In order to try to rank the potential impacts of lifting different constraints on trade in a more informative way, we compute the effect of bridging the gap between the average level of the constraints observed in the poorest developing countries of the sample and their average level in the richest developing countries. This allows reflecting not only on the sensitivity of trade to various constraints, but also on the inequality, across countries, in terms of prevalence of these constraints.

To this end, the sample of developing countries is divided into three sub-groups of countries based on their GDP for the period considered. The lists of the poorest and better-off countries is given in Annex 4 (the poorest countries group includes all nine least-developed countries in the sample). The increase in trade that could potentially result from convergence is then derived by multiplying the estimated elasticity of each constraint by the difference in average level in the two country groups.[53]

Table 2 reports these effects using the "developing countries only" Poisson estimated elasticities.[54]

Table 2. Effects of convergence from the poorest developing countries to the better-off developing countries

Constraint	Percentage change in constraint	Percentage change in trade (exports)
Political_stability	100.7%	137.2%
Infrastructure_quality	24.3%	111%
Secondary_enrolment_rate	80%	57.7%
Freshwater_availability	67.5%	26.9%

Note: For a variable in log, the change in trade is the estimated elasticity multiplied by the percentage change in the variable. For index-type variables the change in trade is calculated as the exponential of the difference in the index multiplied by the elasticity, minus 1. The nature of the variable may also impact on these percentage changes (freshwater availability is in levels while other variables are shares or indices).

Source: Authors' calculation.

52. Working on such groups would mean considering a sample of 13 landlocked exporter countries and nine least developed exporter countries, respectively, without a representative geographical balance.

53. For example, in terms of education, we examine the impact of an increase in secondary school gross enrolment rate from 48.3% (the average in the poorest countries) to a completion rate of 86.9% (the average in the richest countries) – that is, an increase of 79%.

54. For fresh water availability, the percentage change in the variables reflects the absolute adjustments that would bring the relative levels of these constraints in the poorest countries to the same relative levels as in the richest countries. We therefore equalize the ratio for fresh water availability per total area.

Table 2 shows that the gap between low- and high- income countries is particularly large in terms of political stability and enrolment in secondary education. With regards to the impact on trade, it suggests that the largest boost for the poorest countries would come from improvements in infrastructure and political stability. The high elasticity of trade to infrastructure quality indeed means that bridging a however moderate gap in infrastructure quality between the poorest and the richest countries could more than double the poorest countries' agricultural exports. The same is true for bridging the more important gap in political stability. Educational and social reforms that increase participation in secondary school would also significantly improve trade performance and favour a more sustainable social and economic development. It is interesting to note the sizes of the effects of enhanced political stability and education relative to the improvements in infrastructure, which often attract the largest amount of aid for trade. Although there is a very large inequality in the volume of freshwater availability between the two country sub-groups, the impact on trade is much smaller due to a relatively low elasticity.

This ranking exercise is not sufficient in itself to direct aid flows or prioritise domestic reforms. Policy conclusions for aid for trade investments should be drawn by comparing these outcomes with the cost and feasibility of actually achieving the improvements being discussed. The econometric approach, while suffering from data limitations, serves to highlight the relative importance of different constraints to agricultural development in developing countries, and the need to take into account country-specific circumstances in designing aid for trade programmes. The three case studies presented in Sections V to VII below seek to highlight these considerations.

V. Case study – Indonesia: Addressing the challenges of standards and conformity assessment

This case study analyses the challenges faced by Indonesia in capitalising on its large agricultural export potential to the European Union. This potential has not been fully exploited as regards fisheries and processed agro-food products, mainly due to the difficulty of Indonesian exporters to conform to public and private standards applied in foreign markets, in particular EU markets. The study reviews actions undertaken by the government in order to overcome those supply-side constraints and discusses the responses brought by several Aid for Trade programmes in support of these actions.

Indonesia has been quite actively involved in the Aid for Trade Initiative, as illustrated by the country's replies to the Aid for Trade questionnaire and the two case stories submitted to the WTO/OECD for the Third Global Review on Aid for Trade[55]. Indonesia's replies to the questionnaire show that trade policy and regulation, and in particular adaptation and compliance with regulation and standards, was a major priority in Indonesia's trade strategy. This was confirmed during interviews with Indonesian officials in late 2011, who outlined that improving the capacity of exporters to comply with foreign market requirements was of paramount importance for Indonesia. One of the case stories submitted to the WTO/OECD focuses on the Trade Support Program, financed and implemented by the European Commission in 2006, with the objective to help Indonesia overcome the supply side constraints faced by the exporters of fisheries and processed agro-food products, who seek to meet standard and regulatory requirements in the EU market. This case study reviews the relevant literature in order to assess the success of this endeavour, while pointing at remaining challenges. The remainder of this section is structured as follows: after a

55. Available at: *www.oecd.org/dataoecd/9/8/47713306.pdf* and *www.oecd.org/countrylist/0,3349,en_21571361_46750445_46846376_1_1_1_1,00.html#I:*

description of the structure and operation of the agricultural sector in Indonesia, the section highlights the standards-related constraints of agro-food and fisheries production and processing in the country; the section then explains the actions undertaken by the government of Indonesia in order to address those constraints, and the Aid-for-Trade interventions undertaken by the European Commission.

Background

The importance of the agricultural sector for the Indonesian economy is clearly highlighted in the OECD *Review of Agricultural Policies in Indonesia* (OECD, 2012). The share of agriculture in GDP declined from 19% in 1990 to 13% in 2007 and increased again to 15% in 2010 mostly due to the good export performance of perennial crops such as palm oil and natural rubber. Agriculture was also the most important source of employment in 2010, supporting more than 38% of active population (or approximately 41.5 million persons employed in agriculture). Indonesia has been a net exporter of agro-food products[56] over 1990-2010. While rupiah devaluation contributed to boosting agricultural exports in the aftermath of the Asian crisis, over the last ten years the increase of palm oil exports has become the main contributor to the growing positive agro-food trade balance.

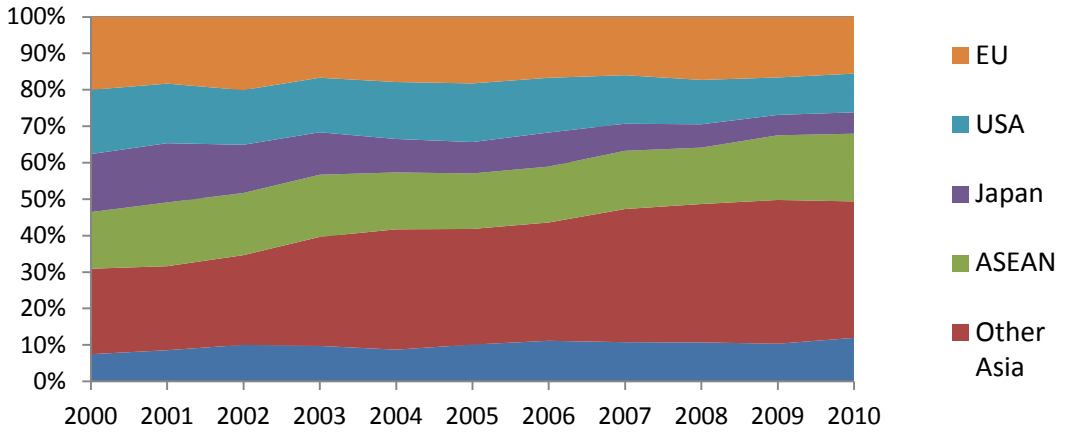
The products currently dominating Indonesia's agro-food exports are perennial crops such as palm oil, natural rubber, cocoa beans, coffee and coconut. It is interesting to note however that the relative importance of products in total agro-food exports has changed over time. At the beginning of the 1990s, the key agro-food products exported were actually fish and crustaceans, followed by natural rubber and coffee, while palm oil represented only 7% of the total agro-food exports. By 2008-10, fish and crustaceans represented only 6%, while the share of palm oil increased massively to 40%. The share of fruit and vegetables also experienced a decrease, from 4.4% in 1990-92 to 1.3% in 2008-10 (OECD, 2012).

The share of agro-food exports destined to the Triad markets (European Union, Japan and the United States) in total agro-food exports has fallen from 54% in 2000 to 32% in 2010 (Figure 2), while most of these exports were redirected to the ASEAN regional market and other Asian markets such as India and China (UN COMTRADE, 2012). Driven by the increasing palm oil exports, India became the most important export market (15% of the Indonesia's total agro-food exports in 2010), followed by China (12%) and the United States (11%). The share of Indonesian agro-food exports destined for the EU market has declined from 20% to 15.6% over the last decade, despite a decline over the last decade in the EU average applied tariffs to agricultural products imported from Indonesia (WITS TRAINS, 2012). This agro-food export contraction has also been observed in the share of Indonesia's exports directed at the United States and Japan[57] (UN COMTRADE, 2012).

56. Agro-food trade includes fish and fish products as well as natural rubber, but does not include forest products.

57. Indonesia's share of total agro-food exports to the United States was fairly stable throughout the 1990s (at around 19.1% of total exports), but declined to 10.6% by 2010. The percentage of Indonesia's total agro-food exports destined to Japan has dropped more significantly in the last 20 years, from 19.3% of total exports in the mid-1990s to 5.9% in 2010 (UN COMTRADE, 2012).

Figure 1. Indonesia's total agro-food exports by region



Source: UN COMTRADE, 2012.

The trends for processed agro-food products[58] in particular are similar to the ones characterising overall agro-food trade. Once again, the EU market absorbed 11% of Indonesian processed agro-food exports in 2010 compared to 18% in 2000. ASEAN remains a very important destination market for Indonesian processed agro-food products, with around 38% of such exports directed at neighbouring countries in 2010, especially to the Philippines, Malaysia, Viet Nam and Thailand (UN COMTRADE, 2012), destinations where the need for quality controls is much more reduced and regulations governing marketing, health related requirements and packaging are not as strict as those in the EU (Lord et al., 2012). China has also become a more important destination market over 2000-10, reaching a share of 2.58% of the processed agro-food exports compared to only 0.34% in 2000. Fruit preserves, pasta, coffee and tea extracts, and fruit juices are among the major processed agro-food products destined to export.

The fisheries sector is highly labour intensive –approximately 90% of Indonesia's fishery sector can be classified as small-scale– and the country ranks among those having the largest number of fishers and fish farmers: in 2009, more than 2.7 million of Indonesia's population was directly involved in capture fisheries, and another 2.5 million employed in aquaculture activities (Lord et al., 2010). Capture fisheries compose 60% of the gross value of fisheries output. Aquaculture, which accounts for the remaining 40% is a growing activity, as ten years ago it contributed less than 19% of total output. Fish is also the most important source of protein intake in the Indonesian diet (OECD, 2012). All these aspects have led the Government of Indonesia to place a high development priority on the sector in the context of its employment and poverty alleviation strategy. Indonesia is the fourth major fish producer after China, India and Peru, but only the world's tenth exporter of fish and fish products, with export performances weakening during the last decade. While domestic consumption has indeed been growing, with consumption per capita of fish and seafood increasing from 15kg in 1990 to 24.3kg in 2007, challenges relating to strict sanitary and environment-related

58. Agro-food processed products included here refer to the following Chapters in the Harmonized System classification: HS 19 (Preparations of cereals, flour, starch or milk); HS 20(Preparations of vegetables, fruit, nuts or other parts of plants); HS 21 (Miscellaneous edible preparations) and HS 1601, HS 1601 of HS 16 (Prep of meat, fish or crustaceans, molluscs etc), HS 1702, 1703, 1704 of HS 17 (Sugars and sugar confectionery); HS 1804, 1805, 1806 of HS 18 (Cocoa and cocoa preparations); HS 0401-0406 of HS 04 (Dairy products).

standards remain high when exporting to key markets such as the European Union, the United States or Japan (OECD, 2012).

The EU market absorbed 10% of Indonesia's total fisheries exports[59] in 2010. Another 34% of Indonesian fisheries exports went to the United States and 24.1% to Japan in 2010, while approximately 11.6% were destined to ASEAN countries. In the last decade Indonesia lost one third of its EU market share due to external competition from large exporters like Ecuador and China, as well as internal inertia in addressing applicable standards and certification requirements (Lord et al., 2010). Consequently, there seems to be considerable scope for Indonesia to increase the amount of fishery products exported to the EU market. Lord et al. (2010) estimated that if Indonesia had managed to expand its share of fish and fish products exports to the EU market in proportion to the EU share of world imports, its foreign exchange revenue from fishery exports would have more than doubled. Such an increase in exports could produce economy-wide impacts due to the additional employment and reinforce linkages with downstream and supporting industries.

The reduction in the share of Indonesian exports to EU markets can seem thus paradoxical given the country's favourable economic and commercial features. The food industry has a huge potential, as EU demand for imports of fisheries products and agro-food processed products is projected to grow by nearly 8% and 3.5% a year respectively between 2010 and 2015 (Lord et al., 2010). Indonesia is in a particularly favourable position in that it has both the world's largest catch of the species consumed by the EU and a large variety of tropical and exotic fruits, prepared vegetables and fruits, and condiments and seasonings for which a strong demand exists in the EU.[60] Moreover, Indonesia has the possibility to use trade preferences under the Generalized System of Preferences (GSP) to promote its agricultural exports to the EU. However, while 40% of the total EU imports from Indonesia would be eligible to preferential treatment under the GSP, only around 23% are actually covered under the GSP scheme and the majority of the products are non-agricultural (Lord et al., 2010).

The challenge of standards-related requirements

While conformity to standards is a global difficulty affecting all exporters around the world, evidence suggests that the decline of Indonesian processed agro-food exports to EU and other Triad markets is mostly due to the difficulties of Indonesian exporters in conforming to applicable food safety and quality standards, and certification requirements for products and management systems (Lord et al. 2010). Beyond mandatory requirements, private standards, such as GLOBALG.A.P[61] certification, are now a *de facto* prerequisite for doing business with most European agro-food companies.

59. Fisheries exports includes here the following Chapters in the Harmonized System classification: Chapter 03 (Fish and crustacean, mollusc and other aquatic invertebrates) and part of HS 16 covering HS 1604 (Prepared or preserved fish; caviar and caviar substitutes prepared from fish eggs) and HS 1605 (Crustaceans, molluscs and other aquatic invertebrates, prepared or preserved).

60. The fruit subsector is the most dependent on foreign supplies and one of the fastest growing markets in the EU. The average import growth rate reached 4% in 2009 (Lord et al., 2010).

61. GLOBALG.A.P (formerly EUREPGAP) is a private sector body that sets voluntary standards for the certification of production processes of agricultural (including aquaculture) products around the globe. It results from the effort of several European supermarket chains and their major suppliers to harmonize supply chain standards for good agricultural practice (GAP) in order to bring conformity to different retailers' supplier standards. It is now the world's most widely implemented farm certification scheme. For further detail see:

H.E. Mr. Erwidodo, Indonesia's ambassador to the WTO and former chairman of the Committee on Trade and Development, stresses the particular challenges the country faces in meeting standards in foreign markets[62]. The ambassador estimates that, while poor infrastructure (in particular highways, roads, public transportation and electricity) and high logistical costs (in cargo handling, storage and warehousing, packaging, maritime and air freight transport, rail and road transport and other supporting services) are major obstacles to the promotion of agricultural trade in domestic Indonesian markets, low quality of processed agricultural export products, lack of standards at the local level and challenges in conformity with foreign standards are the main constraint to exports promotion on foreign markets. He argues that, due to this constraint, Indonesian processed agricultural products do not enjoy the price premium to which they could lay claim, cannot upgrade to new, more profitable market segments, but they are also subject to automatic detention in some of their export destinations, mainly the US and EU markets. Indonesia's difficulty to meet developed market standards relegates the country to the production of raw materials and products which have relatively small value-added (nearly 40% of the country's total non-fuel exports were in the form of unprocessed goods in 2009) and produce few economic linkages generating growth in the wider economy. It has increasingly allowed other fast-growing ASEAN economies, where, contrary to Indonesia, upgrading to industrial processing activities had already occurred, to use Indonesia's natural resources in their unprocessed forms to move up the value chains and produce greater quantities of processed and high-tech products.

According to Soesastro and Basri (2005) standards-related challenges for Indonesian exports are to a large extent linked to supply-side difficulties, in particular in the fisheries and processed agro-food sectors, where many products fail to meet the high standards applied to them in global markets[63]. The difficulties in meeting standards requirements for processed agro-food and fisheries products in the EU market relate essentially to export quality and infrastructure constraints. Some of them, which affect not only agro-food but also manufacturing industries, relate to testing and accreditation difficulties, while others are specific to the agro-food industries and mainly relate to SPS requirements. Overcoming these obstacles would not only permit Indonesian exporters to gain greater access to the EU market, but also expand exports to other developed markets.

One of the major constraints, common to all Indonesian industries exporting into the European Union, is their poor access to satisfactory testing and certification facilities and agencies. Indonesian laboratories lack the capacity to test and assess the conformity of products with EU requirements, primarily due to the shortage of qualified technical experts and of the necessary equipment and physical infrastructure. Shortcomings in quality assurance, calibration and method verification limit the ability of laboratories to perform the whole array of testing and analysis required by the European Union. Certificates issued by local certification bodies for Good Agricultural Practices (GAP)[64], Good Handling

www.globalgap.org/cms/front_content.php?client=1&changelang=1&parent=&subid=&idcat=9

62. 2011 interview with the OECD Secretariat. See also Oktaviani and Erwidodo (2005).

63. 2011 interview with Dr.Tahlim Sudaryanto, Assistant Minister for International Cooperation in the Ministry of Agriculture of the Republic of Indonesia.

64. GAP promote basic food safety principles to minimize biological, chemical and physical hazards associated with crops from seed through harvest storage. They specifically address the following topics: site selection; adjacent land use; water; fertilizers; herbicides/pesticides; hygiene; field, facility and worker hygiene; product cooling; and transportation.

Practices (GHdP), Good Manufacturing Practices (GMP)[65] and Hazard Analysis Critical Control Point (HACCP)[66], are not always recognised internationally, as most of these bodies develop their own criteria rather than following internationally harmonised criteria. This creates important problems for the accreditation of national certification bodies, which is vital for demonstrating conformity to management system standards[67]. The high cost of accreditation, which most certification bodies are unable to afford further complicates things.

Box 1. The particular case of organic products

Certification issues are clearly highlighted in a case study on organic certification systems undertaken by the Indonesian Agricultural Sciences Association (IASA, 2011). While it is widely recognised by firms and farmers that certification is an important factor for developing the trust required for price premiums to organic agriculture products, Indonesia faces difficulties in organising standardisation for organic food products and organic farm products. Organic standards are set by individual practitioners, traders and handlers, re-packers or individual producers of certain products who use them for internal purposes only, but few generally acceptable standards exist that are elaborated and approved at the national level through the wide participation of practitioners of the organic agriculture movement. This fragmentation and the related lack of any legal protection or quality signs make both certification and labelling impossible for most of these standards, according to IASA.

Indonesia has only a few officially recognised and legally accredited certification bodies that certify organic products, though their number has increased in recent years. Most of these certification bodies only provide certifications for the recently adopted basic national standards for the domestic market, which are different from those applied by foreign certification agencies. As suggested by IASA (2011), this is problematic for the promotion of Indonesian products in international markets.

As an example, while there are numerous laboratories, public and private, involved in the testing of fisheries products[68] and all are in principle required to be accredited in accordance with ISO 17025[69], most of them are not accredited for the entire scope of the testing performed and their competence in regards to certain test parameters is not recognised internationally, generating serious obstacles for the detection of antibiotics and heavy metals in products designated for export. Certificates issued nationally by bodies lacking accreditation and on the basis of divergent domestic standards are of little use to companies willing to export on foreign markets. For those companies the only available path to export is to use international certification bodies, an extremely costly proposition that most companies

65. GMP begin from the harvest and storage stage and serve to guide people working in contact with food, its packaging materials, and work environment to conform to basic sanitation and hygiene practices so as to protect against food contamination from both direct or indirect sources.

66. HACCP is a systematic analysis for potential food safety risks within, for example, a post-harvest or processing operation.

67. Accreditation implies costs for the initial set-up and the maintenance of quality systems, but improves the national and global reputation and image of the laboratory and stimulates a continuous improvement of data quality and laboratory effectiveness. It allows laboratories to obtain contracts from public and private organizations that only deal with accredited laboratories, as well as from organizations that do not mandate accreditation but give preference to accredited laboratories in competitive situations. For further details, see: *www.labcompliance.com/tutorial/iso17025/default.aspx*.

68. Such as 39 provincial fishery laboratories, 53 laboratories under the Ministry of Marine Affairs and Fisheries (MMAF) dealing with fishery diseases in aquaculture, the Balai Besar Industri Agro (BBIA) research centre for agriculture industry, private laboratories and the laboratories of fishery companies.

69. ISO 17025 is the global quality standard for testing and calibration laboratories used as the basis for accreditation from accreditation bodies.

simply cannot afford. In 2011, an Indonesian processing company operating in the fisheries sector and seeking to access European markets would have to face about USD 10 000 of costs associated with certification and audit to British Retail Consortium's standards[70].

In the area of fruit processing, quality and health safety testing of fruit juices for pesticides, heavy metals and against microbiological criteria, operated by external laboratories is also extremely costly. It is however the only possibility for small-scale farms, which, contrary to larger companies, cannot afford to operate in-house quality testing laboratories, due to the importance of analytical equipment and operational costs. As a result, most small-scale farms do not conduct the required tests and are therefore unable to certify the respect of required hygiene and product safety criteria.

An EU inspection mission conducted in 2009 in several official laboratories[71] discovered shortcomings regarding proficiency tests and the use of standard methods. While tests for histamine and heavy metals reported unsatisfactory results, the analytical method used for histamine detection was not the method required by the European Union and was not validated against that method. Moreover, most laboratories, especially those located in remote provinces, were unable to comply with EU requirements when performing testing for health certificates, because they lack competent personnel, especially with regard to the analytical measurement of heavy metals, histamine and antibiotics, or, in the case of processors laboratories, sufficient expertise with quality assurance applications. Finally, the equipment in many laboratories is not calibrated and, where calibration is conducted as required, inexperienced technical staff is often unable to interpret the calibration certificate.

Export quality and infrastructure problems *specific* to the agro-food industries are mainly related to SPS requirements in the EU market and could be classified in four categories, which will be further detailed in the following paragraphs:

- poor knowledge of EU mandatory requirements and applicable standards and practices among producers and processors;
- lack of sufficient financial, technical and managerial resources for the agro-food value chains to implement the requirements;
- infrastructure and equipment shortages; and
- insufficient enforcement capacity among the supervising authorities.

Awareness of the required specifications for agro-food products destined for export is quite limited, in particular among Indonesian small and medium-size enterprises, which concentrate the bulk of food production in the country[72] (Alimi, 2007). Information on foreign standards is difficult to access because the distribution channels are opaque: small producers do not have direct access to information on EU regulations and the information channels from the Ministry of Marine Affairs and Fisheries (MMAF) to the companies are quite slow, in particular among producers and processors based in remote areas. Even in cases where the information is adequately communicated, the information content is complex and highly technical, making it unintelligible to enterprises having limited training and understanding in order to digest it. Poor awareness of GAP, GHdP and EU regulations and restrictions on antibiotics among small, family sized aquaculture businesses located in remote areas, largely explains the widespread use of antibiotics for disease prevention in

70. *www.brcglobalstandards.com/GlobalStandards/About.aspx*.

71. *ec.europa.eu/food/fvo/rep_details_en.cfm?rep_id=2226*

72. With the exception of palm oil, which is mainly produced by large industrial plantations and mills.

fishery farming. Farmers lack information on production process controls, disease prevention, application of medicines and feed, applicable Indonesian and EU regulations, resulting in a 20% rate of EU border inspection of products originating from Indonesia (Lord et al., 2010).

Many processing agro-food SMEs are unable to provide the required quality, not only due to the *shortage of qualified staff* but also because of *excessive costs* associated with standards conformity, and the inability to pay for the service offered by laboratories or access the credit needed for such a purpose. SMEs in Indonesia face in particular difficulties providing reliable supplies as regards the presence of contaminants. As a consequence, Indonesian processors exporting to the European Union cannot guarantee[73] that requirements on permissible concentration thresholds for contaminants that are contained in food regulations "from farm to fork" are being met. Likewise, the fishery supply chain lacks traceability at the level of farmers and fishery vessels. In both wild sea catch and fish or shrimp farming the product is collected by middlemen and generally sold to the fishery processors[74], who then export to the EU market. Middlemen, who are essentially family run SMEs, collect from several fishery vessels and farmers and usually mix the products from different sources, so that the traceability requirement cannot be met. Although the MMAF promotes implementation of GHdP, most middlemen have still insufficient understanding and quality assurance capacity, while controls undertaken by the Ministry itself and the local authorities are still inadequate. Fishery processors are required to audit their suppliers in regard to GHdP, but audits are rarely performed due to the shortage of competent auditors deployed by the local authorities.

Quality and food safety problems are also due to the shortage of *infrastructure* and *equipment* meant to preserve the appropriate temperature and hygiene conditions. In the fisheries sector, the lack of an appropriate cooling chain on boats and at the harbour during collection and transport to processors, and the presence of antibiotics result in fishery products failing EU hygiene and sanitary norms. Implementation and certification of GAqP and GHdP in the wild catch supply chain is problematic, especially at the level of SMEs. The Indonesian fishing fleet consists mostly of small fishing boats[75], which have problems in complying with the strict hygienic requirements due to insufficient knowledge about hygiene and limited space on the boats. Proper storage of the catch with ice is usually not ensured – block ice factories supplying fishery vessels sometimes do not meet the necessary sanitary standards – and the control of hygienic conditions is poor. Only a small percentage of the operating fishing vessels are inspected by the MMAF, the competent authority as regards conformity with EU requirements. Proper detection of antibiotic residues by processors prior to incoming inspections requires the purchase of costly screening methods that only large companies can afford.

Fruit farming, mainly undertaken in small farms[76], faces similar constraints at the harvesting, pre-processing and sorting stages. The size of the farms, poor awareness and training on GAP and HACCP and financial constraints for acquiring the necessary

73. Most processors only have the capacity to perform visual inspections.

74. However, fish processors prefer purchasing directly from farmers or fishing vessels, as long as the supplier can provide sufficiently large amounts of products.

75. However, seven large freezer vessels are operating in Indonesia. On these freezer vessels the catch is processed on board ready for export.

76. However, some large farms exist, which are specialized in certain fruit types, such as pineapple in Sumatra.

equipment, do not facilitate the implementation of required hygiene regulations[77] and the application of process steps meant to avoid contamination from soil, water, fertiliser, plant protection and biocide products and ensure the sterilisation of storage containers and vehicles. Since only visual inspections can be performed during purchasing, the risk of exceeding allowed contaminant level in the final product is high. Consequently, Indonesian fruit juice exporters prefer not to rely on small and medium size farms and to operate their own farms or to purchase fruit pulp from foreign suppliers. The processing steps, when fruit is peeled, cut in pieces, and blended to pulp or juice, raise challenges for proper pasteurisation, sterilisation and bottling in accordance with GMP and HACCP. Beyond equipment shortages and financial constraints for adapting premises to GMP requirements[78], the implementation of these practices is complicated by the perception that the HACCP system is too administrative, too complicated and too expensive.

Finally, there is often insufficient control of producers and products from the Ministry of Agriculture and the MMAF, and this is problematic as merchandise not conforming to EU requirements may be exported and then rejected at the border with important financial implications due to merchandise destruction or repatriation.

Interventions by the government of Indonesia to address supply-side constraints in the agro-food and fisheries export sectors

The current 2010-14 strategic plan for agriculture covers four priority objectives of agricultural policy: (a) achieve food self-sufficiency, (b) enhance diversification of production and consumption, (c) raise the competitiveness and value added of production, and (d) increase farmers' welfare. In addition to the above four, two other priorities gained importance during the last decade, namely ensuring the environmental sustainability of production, as well as improving governance structures and accountability (OECD, 2012).

In order to achieve these objectives, the government and local authorities in Indonesia have taken a series of steps aimed at addressing supply-side constraints and facilitating and improving the compliance of exporters to EU requirements. These steps range from institutional and regulatory interventions to the promotion of good practices, and the provision of direct material and financial support to firms. Most of the interventions covering processed agro-food and fisheries products were directed at the fisheries sector, most likely because demand for Indonesia's processed fisheries products in global markets is relatively higher than for its agro-food products and because these products offer greater opportunities for small and medium sized farms in moving to higher-value activities. Important efforts have been undertaken to raise awareness and provide partial support for building capacity and overcoming financial and equipment constraints. On the other hand, interventions to address the general challenge of access to satisfactory testing and certification facilities were more limited.

The most important institutional intervention was an extensive restructuring of the testing and certification sector undertaken by the MMAF with the aim of reducing the number of testing laboratories and achieving higher efficiency and better quality among them (Lord et al., 2010). At the same time the authorities in charge of quality and food safety controls for fishery products, previously divided into three Directorates with poorly defined responsibilities, were brought under a single Fish Quarantine and Inspection

77. For instance, EU regulations on maximum pesticides residue.

78. Such as the requirement that tables, walls, ceilings, doors and equipment are designed so that they do not easily accumulate dirt and are easy to clean.

Agency (BKIPM) and a quality management system based on ISO 9001 implemented throughout the entire value chain. The rationalisation of the testing and certification sector is a useful step in the direction of the sector's endeavour to obtain international recognition and accreditation; however, no particular steps were taken to address the lack of harmonisation between national and international standards, or help improve the available technical competencies of laboratories and certification bodies.

In the regulatory front, the government of Indonesia has banned the use of antibiotics during shrimp cultivation and has developed a monitoring scheme for coastal farming (Mohanty, 2007). This has resulted in the reduction of antibiotics in exported shrimp and the revocation by the EU of its requirement (CD.2001/705/EC) for all food including shrimps and other coastal farmed seafood products from Indonesia to undergo a thorough antibiotic residue examination under the Rapid Alert System. The number of EU rejects of Indonesian fishery products due to the presence of antibiotics has been reduced since 2005 (Table 3), although the use of antibiotics is still common, particularly in traditional cultures (Mohanty, 2007), and additional efforts are necessary to achieve the desired results.

Table 3. Rejections of Indonesian Fishery Products in the EU

Year	Carbon Monoxide	Heavy Metal	Hista-mine	Anti-biotics	Micro-biology	Organo-leptic	Others	Parasite	Total
2005	25	4	5	6	9	0	6	-	49
2006	3	20	4	9	2		-	-	38
2007	2	9	5	3	1	-	-	-	20
2008	-	4	1	1	1	-	-	-	7
2009	-	3	-	4	-	-	-	-	7
2010	1	3	1	2	3	-	-	-	10

Source: Lord et al. (2010).

In parallel, the government has undertaken campaigns of information dissemination meant to help farmers understand GAP requirements and achieve the related certification (Lord et al., 2010). The campaigns include the provision of brochures on different aquaculture topics and of guidelines for GAqP practices and certification. They also comprise technical guidance on fish farming for various fish species, fish feeding and feed production, and direct consultancy and guidance to farmers during field visits. Central and local authorities have paid particular attention to the proper implementation of GHdP and the fight against widespread practices among farmers and collectors to forego the required refrigeration conditions and store the shrimp in water without ice for several hours in order to increase their weight by up to 10% (Lord et al., 2010). The promotion of proper handling practices of fishery farming products should be accompanied by increased control of the middlemen in the near future.

The Ministry of Agriculture (MoA) seeks to promote the application by small and medium size farmers of GAP such as GLOBALG.A.P in order to secure a reliable supply of fruits to large Indonesian fruit juice producers that currently resort to other supply sources (Lord et al., 2010). MoA good practices campaigns include a guidebook to encourage the implementation of good hygiene practices among small-scale farmers and the development of a certification scheme[79] to support small farmers willing to improve their quality and food

79. The scheme offers three levels of increasing ambition: the lowest level focuses on the management of residues, the second level includes the entire HACCP food safety system and the highest level is equivalent to GLOBALG.A.P.

safety management. Other programmes complement capacity building on GAP to farmers with fruit juice processing equipment and capacity building to processing companies, such as in context of a pilot project in Kuningan, West Java, led by the Ministry of Industry in cooperation with external consultants.

More generally, a series of interventions by the government took the form of direct support to processing firms in order to help them improve the quality of their equipment, often in combination to awareness and capacity building projects. For instance, in addition to actions in the fisheries sector aimed at improving awareness of appropriate hygiene conditions during the collection, handling and transport of fishery products, the government of Indonesia has provided assistance to selected fishermen and farmers in specific regions to obtain access to refrigeration equipment, such as ice box or cold storage equipments (Alimi, 2007; interview with Dr. T. Sudaryanto, 2011).

In the agro-food sector, the MoA is promoting a model for grouping the large number of existing small-scale farmers into farming groups, in order to increase the competitive advantage of small farmers due to economies of scale, facilitate farmers' access to bank loans and increase the quality and safety of their produce by implementing a food quality and safety management system (Lord et al., 2010). To encourage farmers' participation to this model, the MoA provides financial incentives in the form of a revolving fund allowing farmers group to access loans up to IDR 100 million for investment.

Aid for Trade programmes targeting the agro-food and fisheries sectors in Indonesia

The Trade Support Program (TSP)[80] financed and implemented by the European Commission (EC) in 2004 targeted some of the shortfalls of government interventions to address the supply-side constraints of Indonesian processed agro-food and fisheries exports to the EU market. Three out of four components of the TSP[81] focused on harmonisation problems between national and international standards, and on the lack of capacities of laboratories and certification bodies, aspects that were insufficiently addressed by government actions. Their actions sought to support the identification, adaptation and dissemination of EU technical standards to the local processing industry, together with the improvement of quality control processes and sanitary/phytosanitary compliance of Indonesian exports. The related case story submitted by the Republic of Indonesia for the third Global Review on Aid for Trade considers that the extensive discussions between the EU and the government of Indonesia, aimed at ensuring that the amount of EUR 9.4 million and three-year capacity building programme would be targeted at problems and issues linked to national priorities, were a decisive factor in the success of the programme.

The second component of the TSP aimed at reinforcing management, IT and human resources systems within the National Standardisation Body (*Badan Standardisasi Nasional*, BSN), harmonising Indonesian standards with EU and international standards, and disseminating these standards to the local industry. The TSP provided technical assistance to BSN in order to improve the institutional and human capacities of this relatively new agency, including steps to improve the computer hardware, software, network and internet facility, as well as to update the website of BSN's standards information system. It also provided

80. See Aid for Trade Case Story: Indonesia, Trade Support Programme, submitted in January 2011, available at: www.oecd.org/aidfortrade/47450410.pdf.

81. The remaining (first) component of the programme had a wider scope and aimed at improving WTO-related knowledge of government officials and various domestic stakeholders (private sector and civil society).

training programmes to the members of the 76 standards-related technical committees of the BSN, particularly on TBT notification requirements. In order to help Indonesia harmonise its standards with those of the European Union and other international bodies (such as ISO), the TSP organised several *train-the-trainers* programmes and study visits to Europe in association with the German National Standards body (DIN). Finally, the TSP provided assistance to SMEs in the standards area, including in the form of a dedicated guide on standards (European Union, 2008).

The objective of the third component of the programme was to improve the access of Indonesian companies to up-to-date technical conformity data and recognised testing certificates in selected industrial sectors, including the agro-food and fisheries sectors. Support was mainly directed to six of the research and development centres[82] of the Agency for Research and Development of Industry (ARDI), which provide conformity assessment and testing services to the domestic industry. Support included training and laboratory management techniques and testing procedures according to international standards, as well as support to marketing of services to the industry and facilitation of contacts with international laboratories. The Centre for Agro-based Industry (*Balai Besar Industri Agro*, BBIA)[83] was provided technical assistance on chemical and microbiological food testing methods and on developing HACCP, GMP, and ISO 22000[84] (European Union, 2008). BBIA's objectives were redefined and measurable targets were set.

The last component of the programme was specifically focused on the fisheries sector, identified as an activity with significant export potential. EU requirements for virus-free and antibiotic-free shrimp imports since September 2001 created important difficulties for Indonesia because of the lack of capacity by MMAF to exercise control over the entire seafood chain, in particular to analyse the quantity of antibiotic residues in shrimp, and by domestic fisheries laboratories to support this process (European Union, 2008). The TSP promoted training programmes and purchase of equipment in order to upgrade the testing capacity of MMAF's fishery laboratories and allow them to meet applicable EU health and safety regulations.

Several of the TSP actions have been implemented to date. The final evaluation of the TSP (European Union, 2008) shows that in the standardisation area results included 140 workstations with printers and scanners, and 4 servers installed and connected with the local network; the BSN website was also substantially improved to include two languages (Indonesian and English); BSN personnel have been equipped with IT equipment needed for their jobs, and about 40 training courses, 6 road shows, 5 regional workshops, and 2 dissemination workshops were organised, covering both technical and management aspects of standards issues. In parallel, and in order to improve standards development, 83 standards technical committee members received training, four study visits to Europe were organised, and 20 assistance missions to SMEs in the standards area were also undertaken by the Indonesian Chamber of Commerce and Industry (KADIN), and finally a Guide to assist SMEs on standards was prepared. Outcomes in the area of conformity assessment and certification included the maintenance and improvement, through training and coaching, of

82. Centres for Chemicals and Packaging, for Pulp and Paper, for Textiles, for Ceramics, for Material and Technical Products and for Agro-Based Industry.

83. See the Centre's official website: *www.bbia.go.id/*.

84. ISO 22000 is a standard developed by the International Organization for Standardization dealing with food safety.

the Quality Management System (QMS)[85] of test laboratories in order to fulfil ISO 17025:2005 requirements[86]; and the upgrading of BBIA's expertise and operating methods so as to improve its efficiency, profitability and the quality of services provided to Indonesian producers and exporters (European Union, 2008). On the other hand, the Indonesian National Accreditation Committee (KAN) that is placed under the umbrella of BSN and has the authority to provide accreditation services to conformity assessment institutions lacks international recognition in a number of its activities and would require substantial capacity building in order to expand such recognition in new fields in the future.

The TSP component focusing on fisheries allowed the training of central and provincial level laboratories in management and technical quality assurance according to ISO 17025. In 2006 for instance, a programme for analytical testing of heavy metals in fishery products involved participants from 6 provincial laboratories and the National Reference Laboratory (NCQC). Training sessions and direct technical assistance sessions were also provided to 10 provincial laboratories and the NCQC, to strengthen QMS. Testing and analysis in compliance with EU requirements is now possible not only thanks to new equipment for fishery laboratories, purchased with TSP funds, but also thanks to the restructuring of the MMAF authority in charge of food safety controls in fisheries and to the revision of its operating legal and regulatory framework in line with EU requirements. Finally, training on development and implementation of food safety management systems was provided to processing companies, and a market orientation programme for Indonesian SMEs was implemented to assist companies to understand and respond to the practices and consumer requirements in Europe.

The implementation of the actions described above and the design of the programme so as to address Indonesia's most important needs as regards processed agro-food and fisheries supply to the European markets suggest that positive impacts may be generated in the near future. However, the 2008 evaluation of the programme concluded that, despite progress observed in the capacity of competent authorities, much remains to be done. While it might still be too early to assess long term impacts, because capacity building programmes need time to generate effects on the ground, it appears that the project was insufficiently endowed with financial resources in view of its extremely ambitious objectives. Important delays to the programme's implementation until the second quarter of 2006 led to the compression of some activities for a much shorter implementation period and the impossibility for others to be completed before the end of the project, foreseen for end 2007. An agreed four-month extension of the implementation phase until April 2008 proved insufficient and led to the conclusion in the programme evaluation that the implementation period of roughly thirty months was too short to achieve efficient trade related capacity building (European Union, 2008). Implementation of technical assistance activities requires a long-term commitment and needs time for planning and delivery.

Another major problem of the TSP, detected at the evaluation phase, was the lack of balance in the allocation of budget funds among the different components. While the standard-setting component was overloaded in regard to the rather small staff of BSN, the remainder of the programme was completely under budgeted. Indeed, that component got by far the largest financial resources from TSP, i.e. EUR 2 706 539 (or approximately 30% of the entire budget), but the BSN was not able to absorb all allocated funds. At the end of April 2008 only 79% was spent. In contrast, support for BBIA was insufficient to cover the

85. A QMS can be expressed as the organizational structure, procedures, processes and resources needed to implement quality management.

86. General requirements for the competence of testing and calibration laboratories.

Centre's needs and other centres have not been covered at all, including the National Agency for Drug and Food Control (BPOM).Likewise, the fisheries component was particularly underfunded: EUR 720 000 were allocated to the purchase of laboratory equipment, the remaining budget of EUR 400 000 was too small to pay for sufficient technical expert support to the Indonesian administration.

The 2008 evaluation has led to the adoption of a TSP II project. The purpose of TSP II was to further upgrade the infrastructure for implementing and controlling quality, so as to support Indonesia's access to international markets, taking into account the lessons learned during the evaluation of the TSP I. The budget of the project, which started in December 2009, has been significantly increased to EUR 15 million. TSP II focuses specifically on establishing a cohesive legal, regulatory and institutional framework to support export quality infrastructure.

The case study illustrates the wide range of actions that may be required in order to upgrade efficiently capacities to implement, monitor and certify conformity with internationally harmonised standards. Although a number of actions have been undertaken, both directly by the government of Indonesia and with donor support, many of the constraints faced by Indonesian agricultural exporters have been addressed in an insufficient manner. Assessments of those actions point to the need for long-term commitment, and for sufficient planning and delivery time necessary for obtaining satisfactory results.

VI. Case study – Zambia: Enhancing access to credit

The case study of Zambia highlights the challenges of access to finance for agricultural producers, processors and traders, especially smallholders and emerging commercial farmers. The particular risks of the agricultural sector, exacerbated by a particularly risk-averse financial services sector and unpredictable government policies limit access to agricultural finance to a narrow group of large farmers and preclude smaller farmers from the possibility to finance the modernisation of their production and the expansion of their trade. The study discusses actions put in place by Aid for Trade programmes aimed at enhancing access to agricultural credit. The remainder of the section is structured as follows: a description of the structure of the agricultural sector in Zambia and of the specific constraints burdening the financing of agricultural production and trade; and a discussion of the aid-for-trade interventions meant to address those constraints.

Background

Zambia is a landlocked country with a population of 14.3 million, a per capita GDP of USD 1 600 and 64% of the population living below the poverty line (CIA World Factbook). Agriculture occupies 85% of the labour force and represents 21.4% of the country's GDP. The country has one of the best land and water endowments in Africa, and following agricultural reforms since the mid-1990s the agricultural sector is growing at a yearly average of 4.5%, in particular in the direction of export crops. However, the significant agricultural potential is still largely untapped and is the key priority in the government growth and poverty reduction programme. The sector seems to suffer both from policy distortions and the country's landlocked situation, reliance on rain-fed agriculture and vulnerability to droughts and flooding. Resources to the agricultural sector have sharply declined since the agricultural reforms in the 1990s, with 2006 figures only 20% of their 1986 level, and the private sector not having filled the gap left by the suppression of certain government interventions. A small number of large commercial farms, concentrated along the railway, coexist with emerging commercial farms facing difficulties to access input and

output markets (referred to in this paper as "emergent farmers") and subsistence smallholders, who represent approximately 40% of rural households (Bonaglia, 2008).

Export-oriented agriculture, involving essentially emergent commercial farmers, faces numerous challenges, including inconsistent implementation of agricultural sector liberalisation policies, under-developed markets that limit production, low agricultural productivity and poor or non-existent infrastructure including telecommunications, roads and power facilities. Business surveys and donors' diagnostic studies have identified poor access to finance as one the main constraints to agricultural development and small-scale rural agribusiness competitiveness (USAID, 2008; USAID 2011; Taylor et al., 2009; Melzer et al. 2010; Zambia Business Survey, 2010). The challenge of agricultural financing complicates the government and donors attempt since the mid-2000s to reorient smallholders towards a more business-minded approach and facilitate their access to markets.

Constraints and challenges of agricultural financing in Zambia[87]

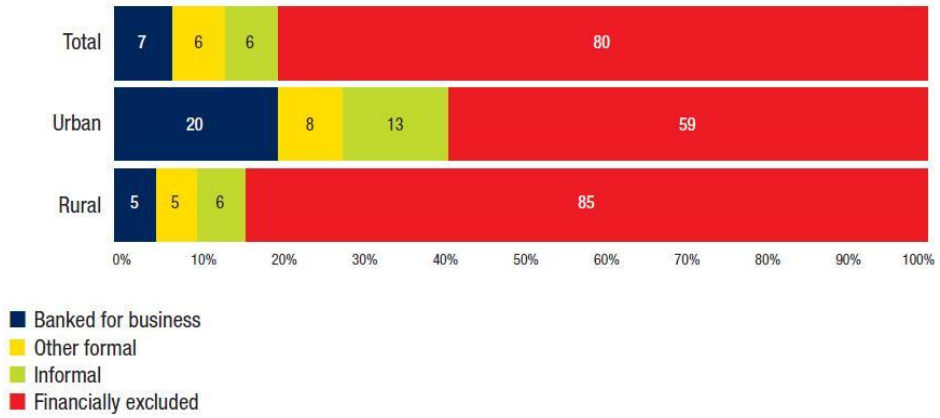
Large commercial farms and processors have relatively easy access to credit and other financial services, including insurance. This easy access has enabled them to thrive thanks to the use of agricultural financing in order to acquire and maintain advanced agricultural technology, equipment and irrigation systems. At the same time, their growth and close links to the financial sector have helped the growth and liquidity of the latter. The intermediate category of small, emerging commercial farmers generally has satisfactory levels of literacy and land ownership and has some experience with formal credit, such as commercial credit from an agro-dealer, loans from a micro-finance institution or contract farming[88] with a large buyer. They may enter into contract or cooperative relations with large farmers to gain access to export markets thanks to those farmers' commercial networks.

The remaining rural populations are largely unbanked. Among rural micro, small and medium enterprises (MSMEs) only 5% use formal bank services, compared to 20% of MSMEs in urban areas. Even when informal financial services are included the share remains still low: 85% of them have no access to any type of financial services, compared to 59% of urban MSMEs (Figure 3). Most of these populations are effectively unbankable, because of the very high levels of real and perceived risk related to Zambian smallholder agriculture and the very large extent of informality. Furthermore, an estimated 17% of Zambians do not have an official identity document, required in order to open a bank account. Most small Zambian farmers do not have clear title to land or other property that can be used for collateral, nor do they have a business license, or no credit history, while many of them are illiterate or innumerate, complicating dealings with financial institutions.

87. Information on the agricultural financing constraints in Zambia is drawn to a large extent from Taylor et al. (2009), Melzer et al. (2010), Zambia Business Survey (2010) and USAID (2011).

88. "Contract farming", or "outgrower schemes" are interlinked transactions whereby small farmers receive external inputs, such as seed, fertilizers, sprays, tools or other equipment on credit by large agricultural buyers, against the commitment to sell the buyer the entire crop at a previously agreed price.

Figure 2. Percentage of Zambian MSMEs that use banking services, services from informal and formal providers and that do not use any services



Source: Zambia Business Survey 2010.

Zambia's financial sector is robust by regional standards, with 18 commercial banks and 71 non-bank financial institutions, including 25 registered microfinance institutions (Bank of Zambia, 2008 and USAID, 2011) and relatively well engaged with the agricultural sector compared to other African countries. Bank branches are not distributed evenly around the country, but concentrated along the railway, with few branches in rural areas, limiting access for farmers even when they are otherwise bankable. About 40% of MSMEs do not have physical access to bank branches. However, it is estimated that projects to bring banking services to rural clients using cell phones[89] would increase access only modestly, as 59% of MSMEs would still not be able to afford the service and over half would need improvement in ICT infrastructure to achieve access to cell phone technology. The micro-finance sector is one of the smallest and weakest in the region, with a total micro-finance portfolio of less than USD 10 million and accounting for less than one per cent of all lending[90].

Approximately 18% of the rural population is banked by formal financial institutions, and agriculture makes up for 15% of the portfolio of commercial banks, while the latter figure is less than 5% in most Sub-Saharan African countries. However, access to agricultural finance is difficult, in particular for emerging commercial farmers and smallholders. The high cost of banking products is an important constraint to banking access, but even more so the lack of productivity of most MSMEs: the Zambia Business Survey 2010 estimates that between 67 and 83% of MSMEs do not generate enough revenue to qualify for the basic banking services provided by existing providers.

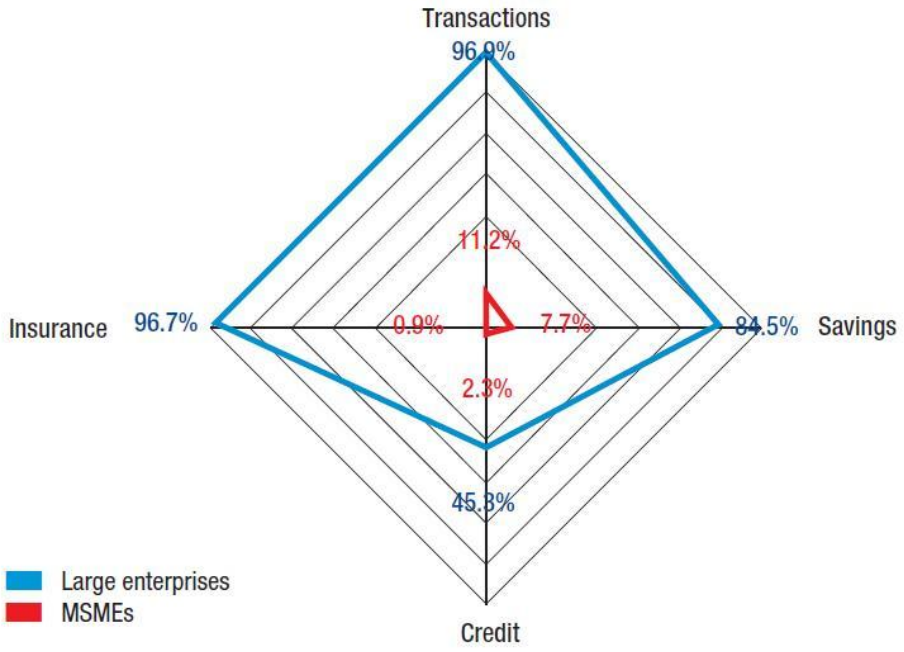
In addition to the risks generally associated with agricultural production, i.e. weather, macroeconomic instability and price volatility, lending risks are exacerbated by unpredictable government interventions, such as ad hoc export or import bans, introduction or removal of import or export duties, or government off-loading of publicly stored crop onto the market. The majority of commercial bank loans and a large minority of micro-finance

89. For instance, the PROFIT project, a six-year agricultural development program by USAID/Zambia focusing on integrating small rural businesses into commercial input and output markets sought to improve the program's target subsectors' access to key financial services. PROFIT used mobile technologies to facilitate payments to farmers in rural areas in order to reduce the cost of transactions and decrease the time needed to complete the payment.

90. In Zambia micro-finance lending is less than one dollar per capita, while it is three dollars per capita in Uganda and more than twenty dollars in Senegal.

loans are thus secured by real property. This makes this form of financing inaccessible to the majority of Zambian farmers, as only 2.5% of the rural population, and almost no smallholders, have a true title[91] to their land that would be acceptable to a bank. Furthermore, as in most developing countries, banks tend to over collateralise their loans, putting them further away from the reach of smaller customers. Banks are generally short of personnel understanding well agricultural markets and capable to assess and manage agricultural loans. Most banks require a business license or evidence of regular, formal employment in order to issue even small personal or consumer loans. Business that are not registered, for whatever reason, as is the case for a number of emerging commercial farms, have no access to commercial credit. Only 2.3% of MSMEs use credit products, compared to 45% of large businesses and the contrast is even larger for insurance products (Figure 4). Agricultural trade expansion beyond the large commercial farms that already have satisfactory access to finance will require finding other forms of security.

Figure 3. Percentage of MSMEs and of large enterprises using various types of financial services in Zambia



Source: Zambia Business Survey 2010.

As capital comes mostly from short-term deposits and few banks issue bonds or borrow on international markets, the majority of bank loans are short term: less than 5% span to more than five years and over 40% are for one year or less. This makes those loans largely inappropriate for agricultural equipment financing. Interest rates are particularly high and the extensive dollarisation of agricultural loans implies currency fluctuation risks that small, poorly educated farmers are ill-equipped to manage. Micro-finance institutions make very few loans to agricultural producers, mainly to small traders and agro-processors, even if they seem more tolerant than banks to informality. Finally, the general risk aversion of financial institutions is exacerbated by the poor enforcement of loan agreements, due to a slow and overcrowded court system that has a limited understanding of contracts and commercial law.

91. Most availing of traditional forms of ownership only.

Non-performing loans in the agricultural sector exceed 37%, against 13% across all other sectors of the economy.

The agricultural insurance sector has developed quite strongly in Zambia in the last decade, but is still essentially limited to large commercial farms. In order to enlarge their market the insurers are now seeking to expand their offer to emergent farmers but cash shortage and limited awareness among this population makes the expansions of the agricultural insurance market a slow process.

Farm equipment such as tractors and irrigation equipment is mostly financed through finance leasing, whereby farmers use capital goods that are formally owned by the leasing company. The extension of operating leases to emergent farmers that have difficulty accessing any kind of credit is only a recent, still circumscribed development. However the financial leasing sector has seriously contracted since 2008, following tax law amendments which reduced its attractiveness.

In some subsectors such as tobacco and cotton, interlinked transactions whereby external inputs are provided on credit by the ginning or processing companies ("contract farming" or "outgrower schemes") largely compensate for smallholders' shortage of credit, which seriously limits the affordability and use of various external inputs required (Delpeuch and Vandeplas, 2012). Contract farming involving small scale growers has been the most important route to expansion of production in these sectors and the cotton outgrower schemes now involve some 220 000 small farmers (Bonaglia, 2008). Similar schemes are established in horticulture and paprika, with extensive donor support. However, the whole contract farming system suffers from inefficient enforcement of the interlinking contracts. When coordination and informal mechanisms to enforce contracts are unaffordable by the companies providing such credit, high rates of loan non-repayment have been witnessed as farmers engage in side-selling of the concerned commodities to other high-bidding buyers at harvest, instead of the company that has pre-financed the agricultural inputs (Delpeuch and Vandeplas, 2012). As a result the sustainability of the contacts is reduced, related risk premiums rise and contract farming loses ground.

Furthermore, the 2010 Agricultural Credit Act introduced a system of warehouse receipts setting up rules for the issuance, sale, trade and transfer of warehouse receipts. Reliable warehouse receipts are important trading instruments allowing the transfer of ownership without physical delivery; encouraging the use of warehouses for storage thus reducing post-harvest losses which can be quite high at the smallholder level due to theft and spoilage; and providing a means for promoting quality control and assuring grain quality. They also enable farmer groups to bulk their crop into economic lot sizes that can be sold further down the marketing chain to processors, millers and other large traders, developing a greater direct involvement of smallholders. Used as collateral, warehouse receipts provide easier access to commodity finance, help reduce trade margins and seasonal price variability and enhance the involvement of the financial sector in agricultural marketing. Confidence in the reliability of the receipts is an absolute prerequisite for such schemes to succeed and the lack of confidence has led to the failure of previous attempts to introduce a warehouse receipt system in Zambia[92].

92. The Zambian Agricultural Commodities Association (ZACA), a large-scale, donor funded scheme, failed to gain the confidence of banks and other lenders and closed its doors in 2006.

Aid for Trade interventions

The concerns about inadequate sources of finance and capital have led USAID/Zambia to pursue the provision of financial and business development services for the private sector as one of the components of their *Market Access, Trade and Enabling Policies* (MATEP) project that ran in Zambia between 2005 and 2010. Noting that local demand, beyond basic food needs, was limited and that only exports would allow Zambia to raise the incomes of its rural population, MATEP aimed at enhancing the competitiveness of small- and medium-scale agriculture and natural products producers and processors under Zambia's 2004-10 Country Strategic Plan. The project sought to achieve a raise in exports[93] from a USD 405 million baseline to a USD 600 million target by providing better access to markets, production technologies, finance and business development services (BDS), and through initiatives to improve the enabling environment and reduce barriers to trade and investment. Within this framework, a finance component was established in the form of a USD 2 million investment fund managed by the Zambia Agribusiness Technical Assistance Centre (ZATAC), in order to provide credit for small and medium-sized enterprises and ultimately help those enterprises access formal sector credit.

The MATEP investment fund (MIF) was set to provide, on a revolving fund basis, export-oriented and tourism companies short-term (one year or less) export credit for trade finance and other working capital requirements; and medium-term loans (up to three years) for capital investments in plant and equipment as well as working capital. The medium-term facility was designed to promote increased access to commercial financial markets for MATEP clients by transferring both the loan and the risk to commercial lending institutions, such as commercial banks, within the tenure period of the loan. MATEP sought to help clients establish strong credit track records and export performance so that they could become clients of formal financial institutions in the future. In addition, the programme was meant to create a demonstration effect that would encourage commercial banks and other sources of capital to lend to or invest in companies that "graduate" from the fund. The MIF was aimed as a complement to commercial financial services and its credit facilities were priced in line with prevailing lending rates in the commercial banking sector, based on market surveys periodically conducted by MATEP.

Furthermore, MATEP's financial services were accompanied, where required, with technical assistance in business plan preparation, market information and market development services, in order to overcome the constraint of targeted businesses' inability to articulate good written business plans. This involved business consultancy to coach entrepreneurs to develop promising business concepts into fully-fledged bankable business plans. MATEP has supported three SMEs to prepare business plans in the textiles, wood processing and aquaculture sub-sectors.

The investment fund disbursed a total of USD 3 049 816, of which USD 2 311 741 went for short-term export financing and another USD 958 059 was provided for medium-term financing. A total of 33 loans have been disbursed servicing 17 sub-sectors, including, in the agricultural field, canned horticultural produce, processed beef, horticulture (cucumbers), honey, molasses, groundnuts, organic cotton, paprika, poultry, seed and soy cake. Furthermore, in order to increase the capital available to clients, MATEP sought to leverage resources from commercial financial institutions and managed to secure USD 5 006 970 from the Zambia State Insurance Corporation (ZSIC), the ZATAC Investment Fund and

93. In eight core agro-food value chains, horticulture/floriculture, coffee, livestock, cotton, honey, paprika/chili, maize/seed and cassava, and on tourism.

Barclays Bank Zambia Ltd., benefitting mainly paprika processing, horticultural canning and groundnuts grading and processing.

MATEP's final assessment judged the finance component quite successful, despite the poor relative performance of the rest of the project[94]. MATEP's impact in terms of increased exports was primarily linked to the financial support it provided, in the form of both small grants and larger loans from the MATEP investment fund. The observation that the second most valuable intervention had been technical assistance to exporting companies, such as help in designing marketing brochures, upgrading labelling and packaging to meet international expectations, and developing new and better products has led the assessment team to conclude that financial support and technical assistance are more powerful in combination, with finance providing incentives and technical assistance helping ensure efficient use of the funds. MATEP also provided capacity building and technical assistance to ZATAC so as to enable it to continue operating the investment fund in the future.

A number of exporting firms received loans that allowed them to expand their businesses. Some loans from MIF seem to have had a very substantial positive impact on the firms that received them. For example Freshpikt, a canned fruit and vegetables manufacturer, reported that it would not have survived without the USD 150 000 initial loan it received from MATEP, which in turn positioned the company to receive a much larger loan from the Zambia State Insurance Corporation (ZSIC). Freshpikt continues to grow and reports that it now consistently exports about USD 1.2 million per year. The additional external financing MATEP was able to leverage for its clients contributed to a total financing facility of USD 19.1 million.

On the other hand, the Fund seems to have paid insufficient attention to the creditworthiness of borrowers, so that 60% of the loans outstanding at the term of the project were in default and the cost of pursuing them could easily exceed their recoverable value. That could mean a loss of some USD 2 million, an amount roughly equal to USAID's initial investment. Of the total short-term loans disbursed, USD 1 254 311 have been repaid, representing 41% of the total funds disbursed. A further 42% were performing loans in repayment (USD 1 263 288 of disbursed capital) and 17% were non-performing (USD 532 217). Of the medium term loans disbursed USD 209 275 have been repaid (23% of total disbursed). Debt rescheduling has been necessary for many of the MATEP loans. Managing the loan portfolio under conditions of poor credit quality was more expensive than anticipated and the project did not provide sufficient resources to allow constant contact with borrowers, including unannounced on-site visits, periodic financial reviews, verification of sales orders, and efficient legal action for delinquent loans.

While MATEP's financial component successfully responded, within its limited means to the clearly identified, fundamental need for affordable and responsive credit, the overall problem of access to agricultural credit remains unsolved and more work is needed to further alleviate this constraint. Although the situation seems to be improving slowly, interest rates remain relatively high, repayment periods are short, and banks often take months to reach a decision on whether to grant a loan, which is a major issue for agricultural producers. MATEP staff and beneficiaries estimated that the fund "could easily have been USD 10 million", but the challenge of ensuring creditworthiness and sustainability has not yet found a credible solution. The end-of-program evaluation report suggested inviting

94. Mainly due to the lack of support and commitment by concerned partners and the weak monitoring and evaluation of its performance indicators, especially as regards the trade policy and tourism components.

commercial banks to co-invest in the fund and participate in its management, as a means of transferring knowledge and building the capacity of local banks to offer trade finance.

The case study highlights the impediments jeopardising satisfactory access to finance for agricultural producers, processors and traders. The constraints are now well understood by partner governments and the donor community, but the actions undertaken to address them are confronted with several challenges. The balance between extending credit solutions to farmers otherwise excluded from commercial sources of finance and ensuring the sustainability of alternative funding programmes through stronger creditworthiness controls is not easy to achieve.

VII. Case study – Mozambique: improving the cashew value chain to reduce poverty

The case study of Mozambique illustrates how programmes focusing on increasing employment and promoting production that is adapted to local endowments can make a significant contribution to poverty reduction in developing countries. It underscores the interest of targeting the SME sector, which is a major creator of employment opportunities in poor countries. The active involvement of the private sector was particularly relevant in this case, providing ownership and local buy-in consistent with the whole approach of Aid for Trade. The project design relied on the initiative, and willingness to incur risks, of small and medium private entrepreneurs, supported by donor know-how. The decision to opt for a business support structure that was owned by the participating processing industries and which provided services usually assumed by the donors themselves, helped to sharpen the private entrepreneurs' sense for business opportunities and to enhance ownership of the programme.

The study demonstrates the importance of serious preparatory field work to collect relevant market insights and identify the most efficient, country-specific approach to building supply, production and marketing capacities. It also shows that the emergence of (partly private and commercial) standards that focus on food safety, produce traceability as well as social and environmental compliance can successfully be introduced in developing countries.

Background

Mozambique is one of poorest countries in the world (ranking 184 out of 187 in UNDP's 2011 *Human Development Report*). Although the country experienced sustained economic growth since the end of civil war in 1992, at an average of 8% per year during the 1994-2005 period, GDP per capita was USD 418.4 in 2009 and the share of the population living below USD 1.25 per day was 60% in 2008. Since the turn of the century the country offered a variety of investment and export opportunities, including in energy, mining and agriculture and fisheries, the business climate however remained challenging. Although the World Bank's *Doing Business 2011* report notes that several business climate reforms were achieved in Mozambique, the country still ranks poorly in terms of the ease of doing business.

Cashew nuts are an important crop for the country. Around 42% of Mozambican farmers own cashew trees, for most of them between 10 to 20 trees on average, while in the main cashew growing districts the share of farmers owning cashew trees reaches 60% to 80%, mainly inherited after independence. Cashew trees can be grown in marginal lands which are unsuitable for other crops. They are relatively easy and inexpensive to maintain, require neither large agricultural plots, nor intensive farming care other than simple but regular plant protection measures, and can yield above 10 kg per tree, providing cash to farmers and

improving rural income. They can also provide supplementary crops in subsistence production, especially in drought years, when food is scarce. Most smallholders are semi-subsistence farmers, growing in parallel maize, cassava, beans, ground nuts or other crops for home consumption, as harvesting does not coincide with peak labour demands for other food crops.

In the 1970s, Mozambique was the leading cashew nut producer in the world, exporting in 1974 240 000 tonnes of cashew nuts, of which 210 000 tonnes were processed within the country. The sector involved millions of smallholder farmers and more than 10 000 processing workers, making it the fourth largest employer after the railways, sugar and textiles. But by late 1990s the post-independence civil war, a slowing economy and poor policy decisions had destroyed the sector.

After Mozambique's independence in 1975 and with the outbreak of the civil conflict, cashew nut production started to decline. Abandon and neglect gradually led to the spread of pests and diseases, the over-maturing and halt of replanting of cashew trees, and uncontrolled forest fires which affected important parts of cashew orchards. Processing capacity also deteriorated, both physically and in terms of human expertise. Following independence the government banned the export of raw cashew nuts to stimulate domestic processing. Mozambique became the first African country to process cashews on a large scale and by 1980 the country had 14 processing factories, but the ban kept raw nut prices at the farm gate artificially low, while the severe inefficiencies of the processing sector were not addressed. Total production dropped to as little as 22 000 tonnes in 1990, and Vietnam, India, West African countries and Brazil supplanted Mozambique as leading suppliers, profiting from the significant growth in cashew nuts demand in the world market.

The government began to loosen restrictions on raw cashew production in the late 1980s, following World Bank advice. The ban on exporting raw cashews was lifted in 1991 and replaced with an export quota and export tax. The quota was subsequently removed, and the export tax on raw nuts came down from 60% in 1991 to 14% in 1999. As the domestic processing industry and its marketing capacities had declined too much to be able to match prices offered by exporters, most raw nuts were sold to Indian processors. Factories shut down, eliminating many jobs and reducing the domestic demand for raw nuts. McMillan et al. (2002) estimated that efficiency gains generated by the removal of the export restrictions amounted to approximately USD 6.6 million annually, or about 0.14% of Mozambique GDP, largely offset by the costs of unemployment in the processing industry, corresponding to an estimated 7 000 to 10 000 workers, or around USD 6.1 million. The additional income accruing to the farmers was around USD 5.3 million, or USD 5.30 per year for the average cashew-growing household, but 90% of the cashew processing workers appeared still unemployed in 2001. By 2002, production had recovered to only 50 000 tonnes, or 5% of the world's total, of which none were processed locally, and the Mozambican cashew industry was worth around USD 80 000. Even then cashew nuts remained one of Mozambique's leading exports and were a source of income for almost one million families or approximately five million people (McMillan et al. 2002).

This moment of zero domestic value addition is the reference point against which to read the results from the cashew nut value chain project described below, and aimed at enhancing employment and income, both for the primary producers of cashew nuts and for workers in cashew nut processing factories.

Constraints and challenges in the cashew value chain

Endeavours to revive the cashew sector after independence consisted mainly of industrial and trade policies, with little attempts to identify and address the supply-side constraints of the sector, including the low productivity of smallholder farms, the lack of capacity for quality processing, and the important market imperfections for commercialising and exporting the commodity.

The important geographic fragmentation of the cashew value chain, reinforced by the significant transport costs due to the country's poor infrastructure, offered little opportunities to obtain a better price at the farm gate. Storage capacity is also important and farmers who can afford to store their raw cashew and sell them towards the end of the season could obtain a much higher price. Small-scale traders operating in distinct areas of 5 to 8 villages, usually at a distance from main roads, would purchase the whole local production, ranging from 5 to 12 tonnes annually, and resell to larger traders or wholesalers located in bigger towns on main trading routes. These larger traders varied greatly in size, handling between 50 and 400 tonnes annually and supplied the raw nuts directly to a small number of exporters, based in Maputo or Nacala, in the cashew growing area, for export mainly to India's processing facilities. At the same time, world prices for the commodity, although stable over the long term, were highly volatile in the short term. Smallholders lacked the necessary information and organisation that would allow them to improve their negotiating power and control the marketing and exporting of the nuts.

As regards processing, the move to mechanise an important part of the processing of raw cashew nuts in the 1960s was inconsistent with Mozambique's comparative advantage in labour-intensive activities. The processing sector was structured around large-scale processing plants, with a capacity of around 10 000 tonnes, which relied on mechanical technology for roasting, extraction and shelling, although cleaning, sizing and grading remained labour-intensive manual operations. The required equipment required high capital investment of around USD 600 per tonne, and the operating cost was USD 1.30 per kilogram of output, with machines vulnerable to breakdown and shortage of spare parts.

Mechanical processing operations achieved lower quality than manual operations, which preserve a considerably higher percentage of whole nuts. Yet, Mozambique could only regain and preserve its position in an increasingly competitive world market by offering high quality and specialty products (for instance produced through eco-and social-friendly processes), for which consumers around the world would be willing to pay a premium. The sector would further need to communicate efficiently about its first-rate quality products by means of appropriate quality and environmental labelling, certification, branding, marketing, and export promotion. At the same time, post-independence Mozambique suffered from a shortage of the sophisticated management skills that would have been necessary in order to run the old large-scale plants.

Finally, working capital availability was and continues to be a major constraint for local entrepreneurs who would be otherwise interested in entering the sector. Currently only 5% of the population in Mozambique has access to financial services and a mere 2% has access to credit. Micro-finance institutions serve mainly small traders with loans up to USD 500, while the totality of the country's ten commercial banks cover the needs of no more than 7-8% of small and medium-sized enterprises (Bais, 2010). The lack of capital for year-round operations constraints the plants' ability to maintain stable commercial relations with prospective buyers and limits employment opportunities.

The road to recovery

The second attempt to revive the cashew nut sector in Mozambique resulted from the involvement of TechnoServe, an NGO which focuses on private sector development in developing countries by locating emerging entrepreneurs and nurturing them through training, mentoring and networking[95]. The NGO started working in Mozambique in the late 1990s by seeking to identify promising industries that could generate income and economic growth for the country. Despite the disappointing results of the first attempts to revive the sector, it was quickly obvious that the cashew nut industry still bore significant potential, because of Mozambique's history in cashew production, its excellent environmental conditions and its low labour cost. Thanks to the growing demand for quality cashew kernels worldwide, cashew production and processing could offer a promising tool for lifting smallholders out of poverty.

With initial funding from USAID, TechnoServe undertook analysis of the cashew sector in order to decide on a competitive strategy. It opted for an increase of revenue rather than of quantities, by seeking to upgrade the sector to a quality niche. At the heart of the NGO's competitive strategy, and meant to secure the impact and sustainability of TechnoServe's support operations, was the collaboration with local entrepreneurs able to build viable businesses. Such entrepreneurs were more likely than cooperatives to provide small-scale farmers with a reliable buyer and to create spill-over and example effects to the benefit of the larger economy.

An efficient production and processing approach

The chosen strategic approach involved three important elements: (a) locating factories near farms, in order to reduce transportation costs and increase supplier loyalty and commitment. This implied (b) several smaller processing plants rather than a few large-scale ones, and (c) made it possible to privilege labour-intensive manual processing, which was better suited to the small units while securing better quality outputs when workers are properly trained and motivated. It was noted that value addition by processing could cause prices per unit weight or volume to leap by 100% or more, while the presence of local processing facilities would help raise farm gate prices for the raw nuts due to enhanced competition in the producing areas (SECO 2011).

The small-scale plants had a capacity of around 1 000 tonnes; they used manual shelling technology for a capital cost of USD 140 per tonne, and operating cost of USD 0.56 per kilogram of output, i.e. much better suited to Mozambique's endowments. The lower investment and operating costs of these smaller plants made them more feasible for local entrepreneurs. Each plant would employ around 200 workers, enjoying an official minimum wage salary[96], one month paid vacation, all insurance, health and pension entitlements, one meal a day and child care. Furthermore, each plant would provide a reliable market for raw cashew nuts from about 10 000 small-scale farmer families and pay a premium price for quality. TechnoServe trained local farmers to operate cashew farms and helped them organise under a collective name to increase their selling power.

95. TechnoServe indicates its mission is "to help entrepreneurial men and women in poor rural areas of the developing world to build businesses that create income, opportunity and economic growth for their families, their communities and their countries" *www.technoserve.org*.

96. A typical factory worker earns USD 300 a year, nearly four times the income of a typical subsistence farmer.

The first processing plant, which served as a "working laboratory" to refine the business model and train other interested entrepreneurs, was Miranda Caju, the product of TechnoServe's partnership in 2001 with a determined Mozambican entrepreneur, Antonio Miranda. Miranda Caju benefited in the early phase from intensive business advisory support for recruiting supervisors, selecting workers, establishing the compensation system, training workers, designing plant layout, identifying equipment and designing locally fabricated equipment such as the boiler[97]. During the building of the plant assistance was also provided for identifying prospective buyers and the Rotterdam-based company that decided to purchase the entire production of the factory on account of the high quality of its output also agreed to loan funds for working capital and for expansion. In 2002, at the plants' opening, over 1 000 people showed up for 64 jobs. In 2004 revenues were USD 1 million and Miranda Caju opened a second 1 000 tonne plant. By 2006, nine start-up enterprises with a total capacity of 11 700 tonnes had been established benefitting from TechnoServe's business advisory services, including strategic planning, marketing, technical advice, quality control, supply chain management, and facilitating access to investment and working capital. The plants employed around 5 000 factory workers, of which 50% were women.

In 2005, a three year programme, supported by the Swiss State Secretariat for Economic Affairs (SECO) with a budget of CHF 418 000, was set up to improve the processing plants' capacity to adopt, and have certified standards for quality, hygiene, worker safety, fair trade, and the factories' environmental impact. The programme aimed at facilitating those factories' exports and access to more demanding and more rewarding markets, mainly by introducing quality assurance systems based on Hazard Analysis and Critical Control Points (HACCP). A follow-up program with a budget of CHF 250 000 took place from 2008 to 2009 to consolidate the processing factories' achievements in the area of standards and certification, while also addressing issues pertaining to trade policy and regulation.

Thanks to the introduction of a quality management system and improved management structures and processing methods, cashew nut production in Mozambique increased significantly and adapted to meet international demand. As a result, sales have been ensured and bank guarantees afforded on more favourable terms. However, despite considerable progress since the beginning of the programme, none of the participating industries had been independently certified until the end of SECO's financial support to the project in 2009. Work to introduce food safety certifications is now taken over by the Association of Agribusiness Industries (AIA).

Addressing the marketing challenges

The revival of the cashew nut sector implied a delicate tradeoff between the appropriate size for production and processing and the critical mass for an efficient marketing of the commodity for export. Small rural enterprises do not have the scale to develop and maintain effective communications and commercial relationships with foreign buyers, let alone develop proprietary brands. The logistics of export markets require container size shipments of uniformly graded and sorted cashew nuts, which favours much larger scale. The challenge of efficient marketing and branding was initially addressed through business advisory services from TechnoServe and in the longer run with the development of AIA. AIA is a private holding company owned by the leading cashew processing companies and is in charge of marketing and exporting processed cashew nuts for its members, as well as for some third companies. In this capacity it also assumes quality control for HACCP and

97. Miranda Caju paid TechnoServe USD 5 000 per year for consulting services, a mechanism that ensured TechnoServe was really adding value. For later industry entrants that fee was replaced by the firms' financial support to the industry trade associations, AIA and AICAJU (see below).

GLOBALGAP[98], organises bulk purchases of equipment and consumables, and offers some training and technical assistance to its members, most services proposed on a for-profit basis. AIA has developed a brand, Zambique, to communicate the superior qualities of AIA-branded cashew nuts and to control product quality. TechnoServe also worked with the industry to resuscitate the trade association AICAJU as an advocate of the entire sector.

The poor availability of working capital was another challenge that had to be addressed during the efforts to reinvigorate the cashew sector. In 2000 a loan guarantee programme supported by the government was set up by INCAJU, the government agency responsible for promoting the cashew nut industry, with the assistance of TechnoServe. When needs expanded beyond INCAJU's resources, a loan guarantee programme offered by the Ministry of Industry and Commerce and supported by USAID was put in place. Since 2009, the objective of the government is to have the loan programme gradually taken over by local commercial banks, an endeavour that is still challenging. Funding difficulties have caused some smaller firms to go out of business.

The impact on jobs and income[99]

In 2005, Mozambique produced 82 000 tonnes of raw nuts, of which 9 000 tonnes were processed locally, and exports amounted to USD 3.6 million, with strong potential for further growth. In 2007, the Mozambican cashew industry had grown to become a USD 20 million industry and the fourth largest cashew producer in the world. In 2008, TechnoServe ceased direct support in the country, considering that the aim of reviving the domestic processing industry has been achieved[100].

Indeed, while total cashew exports grew from 50 000 tonnes in 2002 to only 66 000 tonnes in 2008, the proportion of processed cashews jumped from zero to 36%, and proceeds from the export of processed nuts reached USD 10 million. The processing industry counted already 16 processing plants, employing over 4 700 people and paying USD 1.6 million in wages, an average of USD 343 per annum (up from only 407 workers in 2002/03 with an annual average pay check of USD 213, although still considerably less than the 10 000 workers of the 1970s). In the vicinity of the processing plants the entrepreneurs provided funding for schools and healthcare for the workers and their families.

The incomes of about 120 000 small-scale farmers also increased significantly based on a combination of yield improvement and better prices. While in the period 2001-04, the average farmer's share relative to the international FOB raw cashew price was 32%, it rose to 42% in 2005-08, due to increased demand stimulated by domestic cashew processing. For 2007 and 2008 it was estimated that the price increases attributable to the domestic processing industry generated just under USD 2.5 million of additional income for farmers. In Nampula Province, where 40% of the country's cashew nut production is located and where human development indices are lower compared to the national averages, the project was particularly poverty relevant.

98. GLOBALG.A.P is a private sector body that sets voluntary standards for the certification of production processes of agricultural (including aquaculture) products around the globe.

99. Drawn extensively from SECO (2011).

100. TechnoServe is now replicating the approach first tested in Mozambique and subsequently used in Tanzania, Kenya and South Africa, in a large program of support to the cashew sector in West Africa (*TechnoServe to Help Implement Two New Bill & Melinda Gates Foundation-Funded Programs in West Africa*, www.technoserve.org/press-room).

Table 4. Impact of growth of cashew processing on smallholder producers

Year	Number of smallholder producers	Value of purchases from smallholders
2003	9 530	USD 574 000
2004	41 800	USD 1.4 million
2005	79 800	USD 2.8 million
2006	111 500	USD 3.9 million
2007	146 000	USD 5.1 million

Source: TechnoServe.

Finally, the local economy received extra stimulation both on account of related infrastructure investments, such as road upgrading, and thanks to the higher wages of cashew nut farmers and factory workers. Although the government of Mozambique lost export duty revenue levied on the export of raw nuts (equivalent to USD 2.6 million in 2007/08), the aggregate positive impact of the cashew nut processing industry on the economy of Mozambique from 2001 to 2008 was calculated at USD 11.5 million, including through the creation of over 6 200 formal sector jobs within and beyond the cashew industry (support services, construction, maintenance, transport).

VIII. Conclusion

This report provides quantitative evidence on the severity of supply-side constraints to developing countries agricultural trade performance. The analysis was motivated by the need to identify the most important factors constraining developing countries' agricultural exports in order to inform prioritisation and sequencing of domestic policy reforms, as well as targeting of donor interventions.

The recent food crisis has generated renewed interest of the international community for a sector that is widely considered as an important contributor to developing countries economic growth and fight against poverty and food insecurity. The report confirms that some of the insights of previous work on the constraints to overall trade performance (Hallaert et al., 2011, *Estimating the Constraints to Trade of Developing Countries)* are equally valid in the case of agricultural trade but also identifies a number of specific obstacles to this sector.

According to the quantitative analysis, developing countries' agricultural exports are highly responsive to the quality of transport and trade-related infrastructure. An improvement of 10% in the transport and trade-related infrastructure quality index has the potential of increasing developing countries agricultural exports by 30%. This finding confirms a large body of literature which highlights the impact of efficient and accessible transport on countries' capacity to explore market access opportunities for their agricultural products. Tariffs are also found to have a significant negative impact on agricultural trade. Yet, despite the higher level of tariffs on agricultural products, the analysis shows that their impact is not necessarily stronger than on manufactures. On average, a reduction of tariffs by 10% would increase trade value by about 3.7%. Although data limitations have not allowed controlling for the impact of other trade-cost related constraints, such as standards and conformity assessment, and access to credit, case studies have illustrated how badly these constraints affect the agricultural trade performance of developing countries, in particular as regards small and medium agricultural producers, processors and traders. In the case of standards and conformity assessment, the wide range of actions necessary to upgrade efficiently implementation, monitoring and certification capacities is impossible to bring to

fruition without long-term commitment and extensive planning. Satisfactory access to finance appears as a prerequisite not only for undertaking export trade activities but also for addressing a number of comparative-advantage constraints that limit agricultural productivity growth.

Focusing on the poorest countries in our sample, it appears that large trade boosts could also be achieved by lifting constraints on access to governance and infrastructure quality. However, important gains can be obtained from lifting constraints on education and fresh water availability – and this because poor countries lag far behind better off developing countries in this respect. While not much can be done with regards to water availability and it is often not desirable to distort a country's resource allocation by subsidising water, this suggests an important role of aid for trade in terms of helping address the regulatory and infrastructure issues that prevent the use of existing water resources. Such improvements could in addition enable greater participation of the private sector in irrigation systems or input and credit markets. Meanwhile, programmes for fostering the use of specific input factors in agricultural production need to be integrated into a value chain approach. While infrastructure often receives the largest sums of aid for trade, this finding reminds of other important bottlenecks that remain in the poorest countries.

The analysis also highlights the important impact of complementary policies such as education and political stability on developing countries agricultural trade performance, in line with evidence from the related literature. A 10% improvement in secondary education enrolment rate would generate a 7.2% increase in agricultural trade value. Aid interventions aiming at upgrading skills could contribute to agricultural modernisation and improve the market participation of smallholders.

Finally, case studies have illustrated how programmes providing donor support to promote private sector initiative can make a significant contribution to poverty reduction through increased employment and the promotion of production adapted to local endowments.

The exercise conducted in this report is of course not sufficient in itself to direct aid flows or prioritise domestic reforms. Policy conclusions for aid-for-trade investments should be drawn by comparing these outcomes with the cost and feasibility of lifting the different constraints identified. Serious preparatory field work to identify the most relevant, country-specific approach to building supply, production and marketing capacities is paramount in the success of such endeavours.

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Annex 1.

Model and estimation method

To estimate the impact of possible binding constraints on agricultural trade flows in developing countries, our gravity model posits the value of agricultural trade flows to be a function of a number of variables reflecting different types of potential constraints, while controlling for the "classical" determinants of trade. The choice of the gravity model was motivated by its relative ease to use as data requirements are relatively limited and because it has been theoretically and empirically validated in empirical trade analysis. Anderson and van Wincoop (2003) provide the theoretical background of the derivation of the gravity equation, such a discussion being out of the scope of the present paper.

Following the literature, our estimated equation using Ordinary Least Squares is:

$$\ln(xij) = \alpha + \beta_1 \ln(Prodi) + \beta 2 \ \ln(Expj) + + \beta_3 \ln(DISTij) + \beta_4 FTAij + \beta_5 CONTIGij + \beta_6 LANGij + \beta_k \sum MRk + \beta_{11} \ln(TTRIj) + \beta_{12} \ln(NTMRIj) + \beta_{13} LLi + \beta_{14} LLj + \beta_z \sum Cz + \varepsilon ij$$

where:

i denotes exporters and j importers

x_{ij} represents total agricultural exports from country i to country j

$Prod_i$ denotes the value of total production of agricultural products in country i (exporter)

Exp_j denotes the value of total expenditure on agricultural products in country j (importer)

$DIST_{ij}$ represents the geographic distance between the two countries

FTA_{ij}, $CONTIG_{ij}$, $LANG_{ij}$ are dummy variables accounting for the fact that countries are part of the same trade agreement, share a common border or a common language

MR_k denote the multilateral resistance terms for the bilateral costs variables

$TTRI_j$ represents the trade restrictiveness index of tariffs

$NTMRI_j$ represents an index of non-tariff measures trade restrictiveness

LL_i and LL_j are dummies taking into account if the trading partners are landlocked

C_z denotes the set of key constraints to agricultural exports: land availability, water availability, fertilizer consumption, electricity availability, infrastructure quality, air transport volume of freight, primary education, political stability and absence of violence.

Multilateral resistance (MR)

The bilateral trade flow between the two countries depends not only on a specific bilateral trade cost between them, but the extent of that cost relative to the ones characterising the trade with the rest of the world. Anderson and van Wincoop (2003) refer to these effects as "multilateral resistance". Different empirical approaches have been applied in order to control for MR in the gravity model. One of the first approaches was to control for MR by including country fixed effects. However, introducing country-specific variables in the econometric estimation precludes the use of fixed effects to control for multilateral resistance in the estimation (Behar et al., 2010). Using a log-linear Taylor expansion of the multilateral resistance expression defined by Anderson and van Wincoop (2003), Baier and Bergstrand (2009) express the multilateral resistance by using the GDP-share-weighted average trade costs faced by the two trading partners relative to the GDP-share-weighted average of those trade costs between all the other countries. The MR term is thus a linear approximation of the MR between countries that allows capturing bilateral trade costs, such as distance or border, between countries relative to those of the rest of the world. This allows us, without introducing fixed effects, to identify the impact of each country-specific constraint on trade.

The Multilateral resistance (MR) terms are calculated as follows:

$$MR_\text{var}_{ij} = \sum_k \left(\frac{Y_k}{Y_w} * \ln(\text{var}_{ik})\right) + \sum_m \left(\frac{Y_m}{Y_w} * \ln(\text{var}_{mj})\right) - \sum_k \sum_m \left(\frac{Y_k}{Y_w} * \frac{Y_m}{Y_w} * \ln(\text{var}_{km})\right)$$

where:

var_{ij} denotes the bilateral trade cost variable (e.g. distance, common border)

Y_w denotes global total GDP

Elasticities

In the OLS estimation, since the dependent variable is in a logarithm form (log y) the coefficient (β) of variables measured in a logarithmic scale (log x) would give us the elasticity values (as in a standard log-log model). For variables not in a logarithm form (usually ratios and indices), the coefficient would represent a semi-elasticity (as in a standard log-level model). To get the elasticity for these variables we simply multiply the coefficient for the variable's average value ($\bar{x}$ only for the developing countries included in the regression).

In the Poisson model, the estimated coefficient measures the relative change in the conditional mean of y (E[y|x]) induced by a unit change in the variable x. As in the OLS model, if the variable x is measured in a logarithmic scale, the estimated coefficient is interpreted as an elasticity; if the variable is not in a logarithm form, to get the elasticity we simply multiply the coefficient for the variable's average value.

In both models, the elasticity for the dummy variable is calculated using the consistent Kennedy (1981) formula:

$\beta_{elast} = 100\ (\exp(b - V(b)/2) - 1)$, where b is the estimated coefficient and V(b) its estimated variance.

Robustness checks

We run a different set of robustness checks related to a range of ways to account for the "multilateral resistance terms". First, following Baier and Bergstrand (2009), we restrict the bilateral trade cost variables and the related multilateral resistance terms to have coefficients of equal value and opposite signs. Second, following Behar, Manner and Nelson (2011) we extend this approach to non-bilateral trade related costs such as TTRI, NTMRI and the infrastructure quality index. Finally, we use a two-step approach. We start by accounting for the "multilateral resistance" by using exporter and importer fixed effects in a classical (non-augmented) gravity model. The exporter fixed-effects estimated in this first stage are then used as the dependent variable in a second regression which includes all key explanatory variables. Results on the effects of supply-side constraints prove largely stable and consistent across these specifications.

Annex 2.

Variables specification and data sources

Gravity variables: The gravity equation includes the following standard variables: the geographic distance between the two trading partners, and binary variables accounting for the existence of a common border, common language, the existence of colonial ties, whether the countries share a common currency, as well as a binary variable that takes into account whether the two countries are members of the same regional trade agreement. Distance is weighted by population. The standard gravity variables are drawn from the *Centre d'Etudes Prospectives et d'Informations Internationales* (CEPII)[1] for the period 2002-06. The missing observations up to 2007 are inputted from data available from the World Bank's World Development Indicators (WDI) and publicly available command files for generating gravity variables[2].

Production and Expenditure data: Expenditure is proxied with data for the value of total consumption of agricultural products. Data for exporter's production and importer's consumption of agricultural products are from the FAO ResourceSTAT. We select Gross Production Value (in current million USD) as a measure of production. Value of gross production has been compiled by multiplying gross production in physical terms by output prices at farm gate. Thus, value of production measures production in monetary terms at the farm gate level. Since intermediate uses within the agricultural sector (seed and feed) have not been subtracted from production data, this value of production aggregate refers to the notion of "gross production". Consumption for each importer countries is computed by summing production and total import and subtracting total exports. For comparable issues, also the import and export data are form the FAO ResourceSTAT.

Tariff Trade Restrictiveness Index (TTRI): Trade policy is determined at product level and not at a sectoral level. Simple tariff averages can lead to misleading conclusions (Kee, Nicita and Olarreaga, 2009). Indeed, while African countries face the lowest levels of tariffs in their export markets, notably thanks to preferences, these preferences largely cover products which African countries do not export. We employ an index compiled by Kee, Nicita and Olarreaga (2009) and used in Hoekman and Nicita (2011) for the agricultural sector. This index controls for the impact of a country's own tariffs on its imports. It represents the uniform tariff that, if applied, would leave a country's imports at their actual level. It is compiled as the sum of a country's tariffs lines weighted by its import shares and demand elasticities. Data used in the paper is based on Kee, Nicita and Olarreaga (2009) and Kee, Neagu and Nicita (2010)[3].

Non-tariff Measures Restrictiveness Index (NTMRI): The index of non-tariff measures (NTM) restrictiveness is an aggregation of the tariff equivalents for NTMs for which

1. *http://www.cepii.fr/anglaisgraph/bdd/gravity.asp*

2. *http://jdesousa.univ.free.fr/data*

3. *http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/0,,contentMDK:22951240~pagePK:64214825~piPK:64214943~theSitePK:469382,00.html*

data was widely available: price and quantity control measures, technical regulations, monopolistic measures such as single channel for imports, agricultural domestic support etc. It is taken from Kee, Nicita and Olarreaga (2009), and it represents the difference between the Overall Trade Restrictiveness Index (OTRI) and the TTRI as in Kee et al. (2009), Hoekman and Nicita (2011). Data used in the paper is based on Kee, Nicita and Olarreaga (2009) and Kee, Neagu and Nicita (2010).

The set of constraints

Agricultural Land: Agricultural land refers to the surface of land area that is arable, under permanent crops, and under permanent pastures. The variable is expressed in sq km. Resource: World Bank World Development Indicators 2011.

Fresh water availability: Renewable internal freshwater resources flows refer to internal renewable resources (internal river flows and groundwater from rainfall) in the country. The variable is expressed in cubic meters: World Bank World Development Indicators.

Fertiliser consumption (kg per ha of arable land): Fertiliser consumption measures the quantity of plant nutrients used per unit of arable land. Fertiliser products cover nitrogenous, potash, and phosphate fertilisers (including ground rock phosphate). Traditional nutrients-animal and plant manures-are not included. For the purpose of data dissemination, FAO has adopted the concept of a calendar year (January to December). Some countries compile fertiliser data on a calendar year basis, while others are on a split-year basis: World Bank World Development Indicators (background data from the FAO).

Infrastructure quality: Quality of trade and transport related infrastructure, including ports, railroads, roads, information technology; 1 is the lowest score and 5 is the maximum score: World Bank Logistics Performance Index.

Electricity consumption: Electric power consumption measures the production of power plants and combined heat and power plants less transmission, distribution, and transformation losses and own use by heat and power plants: World Bank World Development Indicators.

(Gross) School Enrolment in Primary (and Secondary) Education: Gross enrolment ratio is the ratio of total enrolment, regardless of age, to the population of the age group that officially corresponds to the level of education shown. Primary education provides children with basic reading, writing, and mathematics skills along with an elementary understanding of such subjects as history, geography, natural science, social science, art, and music. Secondary education completes the provision of basic education that began at the primary level, and aims at laying the foundations for lifelong learning and human development, by offering more subject- or skill-oriented instruction using more specialised teachers: World Bank World Development Indicators.

Political stability and absence of violence: Measures the perceptions of the likelihood that the government will be destabilised or overthrown by unconstitutional or violent means, including domestic violence and terrorism. The index is running from approximately -2.5 to 2.5, with higher values corresponding to a better score: World Bank World Governance Indicators.

Annex 3.

Country coverage

Table A3.1 Exporters in the "developing countries only" sample

Albania	Honduras	Panama
Algeria	India	Paraguay
Argentina	Indonesia	Peru
Armenia	Iran	Philippines
Azerbaijan	Jamaica	Romania
Bangladesh	Kazakhstan	Russian Federation
Belarus	Kenya	Senegal
Bolivia	Kyrgyz Republic	South Africa
Bosnia and Herzegovina	Latvia	Sri Lanka
Brazil	Lebanon	Sudan
Bulgaria	Lithuania	Tajikistan
Cambodia	Macedonia, FYR	Thailand
Cameroon	Malaysia	Togo
Chile	Mexico	Tunisia
China	Moldova	Turkey
Colombia	Mongolia	Ukraine
Costa Rica	Morocco	Uruguay
Ecuador	Mozambique	Venezuela
Egypt	Namibia	Yemen
El Salvador	Nicaragua	Zambia
Ethiopia	Nigeria	
Ghana	Pakistan	

Note: The list contains 60 countries. Developing countries are considered here as defined by the World Bank depending on the following three income categories: low-income, lower-middle-income, higher-middle income countries.

Table A3.2. Exporters in the "full sample"

Albania	Egypt	Lithuania	Saudi Arabia
Algeria	El Salvador	Luxembourg	Senegal
Argentina	Estonia	Macedonia	Slovak Republic
Armenia	Ethiopia	Malaysia	Slovenia
Australia	Finland	Mexico	South Africa
Austria	France	Moldova	Spain
Azerbaijan	Germany	Mongolia	Sri Lanka
Bangladesh	Ghana	Morocco	Sudan
Belarus	Greece	Mozambique	Sweden
Bolivia	Honduras	Namibia	Switzerland
Bosnia and Herzegovina	Hungary	Netherlands	Tajikistan
Brazil	India	New Zealand	Thailand
Bulgaria	Indonesia	Nicaragua	Togo
Cambodia	Iran	Nigeria	Tunisia
Cameroon	Ireland	Norway	Turkey
Canada	Israel	Pakistan	Ukraine
Chile	Italy	Panama	United Kingdom
China	Jamaica	Paraguay	United States
Colombia	Japan	Peru	Uruguay
Costa Rica	Kazakhstan	Philippines	Venezuela
Croatia	Kenya	Poland	Yemen
Cyprus[4]	Korea, Rep.	Portugal	Zambia
Czech Republic	Kyrgyz Republic	Qatar	
Denmark	Latvia	Romania	
Ecuador	Lebanon	Russian Federation	

4. Footnote by Turkey: The information in this document with reference to "Cyprus" relates to the southern part of the Island. There is no single authority representing both Turkish and Greek Cypriot people on the Island. Turkey recognizes the Turkish Republic of Northern Cyprus (TRNC). Until a lasting and equitable solution is found within the context of United Nations, Turkey shall preserve its position concerning the "Cyprus" issue.

Footnote by all the European Union Member States of the OECD and the European Commission: The Republic of Cyprus is recognized by all members of the United Nations with the exception of Turkey. The information in this document relates to the area under the effective control of the Government of the Republic of Cyprus.

Table A3.3. Importers

Albania	Greece	Norway
Algeria	Honduras	Paraguay
Argentina	Hungary	Peru
Australia	Iceland	Philippines
Austria	India	Poland
Bangladesh	Indonesia	Portugal
Belarus	Ireland	Romania
Belgium	Italy	Russian Federation
Bolivia	Japan	Saudi Arabia
Brazil	Jordan	Senegal
Burkina Faso	Kazakhstan	Slovak Republic
Cameroon	Kenya	Slovenia
Canada	Latvia	South Africa
Chile	Lebanon	Spain
China	Lithuania	Sudan
Colombia	Luxembourg	Sweden
Costa Rica	Madagascar	Switzerland
Cote d'Ivoire	Malawi	Thailand
Cyprus	Malaysia	Trinidad and Tobago
Czech Republic	Mali	Tunisia
Denmark	Malta	Turkey
Egypt	Mauritius	Ukraine
El Salvador	Mexico	United Kingdom
Estonia	Morocco	United States of America
Finland	Netherlands	Uruguay
France	New Zealand	Venezuela
Germany	Nicaragua	Zambia
Ghana	Nigeria	

Annex 4.

Sub-groups of developing countries

Table A4.1. Poorest and better-off developing countries

Poorest countries (30th percentile)	Better-off countries (70th percentile)
Bangladesh	Argentina
Bolivia	Belarus
Cambodia	Brazil
Cameroon	Bulgaria
Egypt	Chile
Ethiopia	Colombia
Ghana	Costa Rica
India	Jamaica
Kenya	Kazakhstan
Kyrgyz Republic	Latvia
Moldova	Lebanon
Mongolia	Lithuania
Mozambique	Malaysia
Nicaragua	Mexico
Nigeria	Namibia
Pakistan	Panama
Senegal	Romania
Sri Lanka	Russian Federation
Sudan	South Africa
Tajikistan	Turkey
Togo	Uruguay
Yemen	Venezuela
Zambia	

Annex 5.

Regression results

Table A5.1. Regression outputs for the "developing countries only" sample

Dependent variable: bilateral import value		**OLS**		**Poisson**	
Variables	***Expected sign***	***Coefficient***	***Elasticity***	***Coefficient***	***Elasticity***
$\ln(Exp_j)$ (importer)	+	0.939*** [0.0288]	0.939	0.863*** [(0.0490)]	0.863
$\ln(Prod_i)$ (exporter)	+	0.304 [0.214]	0.304	0.171 [0.176]	0.171
$\ln(distance_{ij})$	-	-1.158*** [0.103]	-1.158	-0.591*** [0.162]	-0.591
FTA_{ij}	+	0.552*** [0.171]	0.711	0.653*** [0.115]	0.908
$contig_{ij}$	+	0.737*** [0.198]	1.05	0.264 [0.319]	0.238
$comm_lang_{ij}$	+	0.690*** [0.165]	0.967	0.443*** [0.125]	0.545
$MR_distance_{ij}$	+	0.460** [0.179]		-0.093 [0.108]	
MR_border_{ij}	-	-2.590* [1.510]		-0.711 [0.662]	
MR_FTA_{ij}	-	-0.474 [0.349]		0.399 [0.355]	
$MR_comm_lang_{ij}$	-	0.214 [0.357]		0.539 [0.365]	
$\ln(TTRI_agric_j)$	-	-0.523*** [0.042]	-0.523	-0.367*** [0.058]	-0.367
$\ln(NTMRI_agric_j)$	-	0.325*** [0.035]	0.325	0.221*** [0.043]	0.221
$landlocked_i$	-	-0.273 [0.285]	-0.269	-1.092*** [0.356]	-0.685
$landlocked_j$	-	-0.551*** [0.099]	-0.426	-0.584*** [0.164]	-0.450
$\ln(primary_enrolment_rate)_i$	+	1.107 [0.955]	1.107	0.794 [0.934]	0.794
$\ln(secondary_enrolment_rate)_i$	+	0.0523 [0.256]	0.052	0.722* [0.391]	0.722
$political_stability_i$	+	0.376* [0.199]	0.809	0.280* [0.143]	0.858
$\ln(agricultural_land_i)$	+	0.145 [0.107]	0.145	0.241 [0.159]	0.241
$\ln(freshwater_availability_i)$	+	0.288*** [0.092]	0.288	0.399*** [0.093]	0.399
$fertiliser_consumption_i$	+	0.00157** [0.001]	0.214	-0.000211 [0.001]	-0.029
$infrastructure_quality_i$	+	0.920** [0.407]	2.225	1.272*** [0.458]	3.077
$\ln(electricity_consumption)_i$	+	0.0433 [0.157]	0.043	-0.223 [0.173]	-0.223
Constant		-10.13** [4.604]		-3.527 [4.475]	
Observations		4171		4171	
R-squared		0.545		0.754	
n_cluster		64		64	

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

Note: Since some of the regressors are indices or shares, they were not introduced as logs.

Table A5.2. Regression outputs for the "full sample"

Dependent variable: bilateral import value	OLS		Poisson	
Variables	***Coefficient***	***Elasticity***	***Coefficient***	***Elasticity***
$\ln(Exp_j)$ (importer)	0.879***	0.879	0.794***	0.794
	[0.019]		[0.035]	
$\ln(Prod_i)$ (exporter)	0.527***	0.527	0.417***	0.417
	[0.150]		[0.119]	
$\ln(distance_{ij})$	-1.113***	-1.113	-0.708***	-0.708
	[0.079]		[0.061]	
FTA_{ij}	0.642***	0.884	0.666***	0.935
	[0.133]		[0.110]	
$contig_{ij}$	0.950***	1.559	0.579***	0.77
	[0.144]		[0.126]	
$comm_lang_{ij}$	0.832***	1.281	0.377**	0.439
	[0.120]		[0.158]	
$MR_distance_{ij}$	0.471***		-0.0613	
	[0.157]		[0.098]	
MR_border_{ij}	-1.648*		-0.519	
	[0.871]		[0.632]	
MR_FTA_{ij}	-0.0311		0.302	
	[0.276]		[0.376]	
$MR_comm_lang_{ij}$	0.281		0.132	
	[0.280]		[0.269]	
$\ln(TTRI_agric_j)$	-0.007		0.209*	
	[0.054]		[0.110]	
$DC_\ln(TTRI_agric_j)$	-0.375***	-0.382	-0.617***	-0.408
	[0.065]		[0.0983]	
$\ln(NTMRI_agric_j)$	0.059		-0.0949	
	[0.071]		[0.0705]	
$DC_\ln(NTMRI_agric_j)$	0.141*	0.2	0.246***	0.151
	[0.079]		[0.0822]	
$landlocked_i$	-0.205	-0.202	-0.706***	-0.522
	[0.206]		[0.251]	
$landlocked_j$	-0.803***	-0.553	-0.643***	-0.479
	[0.074]		[0.134]	
$developing_i$	20.58	-1	-4.940	-1
	[16.45]		[10.16]	
$developing_j$	-1.913***	-0.857	-2.032***	-0.872
	[0.250]		[0.222]	
$\ln(primary_enrolment_rate)_i$	3.765		-3.085	
	[2.840]		[1.999]	
$DC_\ln(primary_enrolment_rate)_i$	-2.668	1.097	3.762*	0.677
	[3.044]		[2.271]	
$\ln(secondary_enrolment_rate)_i$	2.009		2.101**	
	[1.659]		[1.025]	
$DC_\ln(secondary_enrolment_rate)_i$	-1.830	0.179	-1.069	1.032
	[1.687]		[1.108]	
$political_stability_i$	-0.694***		-0.343	
	[0.252]		[0.324]	
$DC_political_stability_i$	1.187***	0.068	0.686*	0.084
	[0.296]		[0.353]	
$\ln(agricultural_land_i)$	0.163		0.247**	
	[0.164]		[0.105]	
$DC_\ln(agricultural_land_i)$	-0.0749	0.088	-0.0934	0.154
	[0.179]		[0.191]	
$\ln(freshwater_availability_i)$	0.225*		0.035	
	[0.125]		[0.084]	
$DC_\ln(freshwater_availability_i)$	0.048	0.225	0.422***	0.035
	[0.144]		[0.131]	

Table A5.2. Regression outputs for the "full sample" *(cont.)*

Dependent variable: bilateral import value	**OLS**		**Poisson**	
Variables	***Coefficient***	***Elasticity***	***Coefficient***	***Elasticity***
fertiliser_consumption$_i$	0.000443***		0.000508***	
	[0.0001]		[0.0001]	
DC_fertiliser_consumption$_i$	0.000991	0.089	-0.000807	0.102
	[0.0006]		[0.0007]	
infrastructure_quality$_i$	1.550***		1.200***	
	[0.334]		[0.379]	
DC_infrastructure_quality$_i$	-0.726	4.399	0.021	3.406
	[0.508]		[0.587]	
ln(electricity_consumption)$_i$	-0.162		-0.090	
	[0.181]		[0.187]	
DC_ln(electricity_consumption)$_i$	0.112	-0.05	-0.315	-0.405
	[0.201]		[0.213]	
Constant	-28.12*		6.568	
	[15.79]		[9.347]	
Observations	6.663		6.663	
R-squared	0.655		0.863	
n_cluster	97		97	
F test / WaldTest chi2	11474		5993	
F test / WaldTest p-value	0		0	
Chow Test p-value	0		0	

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

Note: Since some of the regressors are indices or shares, they were not introduced as logs.

Source: Authors' calculations.

Annex 6.

Robustness checks

Table A6.1. Regression outputs for the "developing countries only" sample (with constraints on the MR terms)

Dependent variable: bilateral import value	OLS	Poisson
Variables	***Coefficient***	***Coefficient***
ln(Exp_j) (importer)	0.977***	0.940***
	[0.024]	[0.0596]
ln($Prod_i$) (exporter)	0.308	0.383**
	[0.205]	[0.16)]
ln(distance_MR_{ij})	-0.824***	-0.280***
	[0.108]	[0.078]
FTA_MR_{ij}	0.876***	0.462***
	[0.183]	[0.141]
contig_MR_{ij}	1.401***	0.667*
	[0.255]	[0.353]
comm_lang_MR_{ij}	0.312**	0.131
	[0.127]	[0.098]
ln($TTRI_agric_j$)	-0.511***	-0.456***
	[0.0438]	[0.049]
ln($NTMRI_agric_j$)	0.343***	0.235***
	[0.0319]	[0.034]
$landlocked_i$	-0.00492	-0.596*
	[0.264]	[0.325]
$landlocked_j$	-0.359***	-0.389**
	[0.0911]	[0.169]
ln($primary_enrolment\ _rate)_i$	0.722	0.838
	[0.852]	[0.993]
ln($secondary_enrolment\ _rate)_i$	0.143	0.814*
	[0.235]	[0.443]
$political_stability_i$	0.391**	0.297**
	[0.179]	[0.126]
ln($agricultural_land_i$)	0.0680	0.0535
	[0.092]	[0.173]
ln($freshwater_availability_i$)	0.262***	0.328***
	[0.083]	[0.072]
$fertiliser_consumption_i$	0.00105*	-0.000176
	[0.001]	[0.001)]
$infrastructure_quality_i$	0.617*	0.722*
	[0.356]	[0.436]
ln($electricity_consumption)_i$	0.119	-0.164
	[0.144]	[0.191]
Constant	-15.41***	-10.65**
	[3.863]	[4.853]
Observations	4,171	4,171
R-squared	0.528	0.719
n_clusters	64	64

Table A6.2. Regression outputs for the "developing countries only" sample (with MR terms for other trade costs variables)

Dependent variable: bilateral import value	OLS	Poisson
Variables	***Coefficient***	***Coefficient***
ln(Exp_j) (importer)	0.817***	0.806***
	[0.027]	[0.043]
ln($Prod_i$) (exporter)	0.477**	0.516***
	[0.215]	[0.157]
ln($distance_{ij}$)_MR	-0.882***	-0.428***
	[0.119]	[0.079]
FTA_{ij}_MR	0.779***	0.292**
	[0.17)]	[0.135]
$contig_{ij}$_MR	1.317***	0.893***
	[0.246]	[0.310]
$comm_lang_{ij}$_MR	0.315**	0.138
	[0.130]	[0.090]
ln_TTRI_agric_MR	-0.245***	-0.273***
	[0.071]	[0.058]
ln_NTMRI_agric_MR	0.157***	0.0262
	[0.045]	[0.057]
$landlocked_i$	0.0127	-0.619*
	[0.257]	[0.320]
$landlocked_j$	-0.387***	-0.478***
	[0.094]	[0.180]
ln(primary_enrolment _rate)$_i$	0.992	0.936
	[0.895]	[0.863]
ln(secondary_enrolment _rate)$_i$	0.191	0.854***
	[0.238]	[0.326]
$political_stability_i$	0.471**	0.323**
	[0.184]	[0.128]
ln($agricultural_land_i$)	0.015	0.036
	[0.010]	[0.160]
ln($freshwater_availability_i$)	0.245***	0.280***
	[0.082]	[0.0684]
$fertiliser_consumption_i$	0.000790	-0.000690
	[0.001]	[0.001]
infrastructure_quality _MR	0.624***	0.874***
	[0.067]	[(0.157)]
ln(electricity_consumption)$_i$	0.041	-0.243
	[0.150]	[0.150]
Constant	-15.99***	-12.35***
	[3.933]	[4.329]
Observations	4,171	4,171
R-squared	0.542	0.766
n_clusters	64	64

Table A6.3. Regression outputs for the two steps gravity

	OLS	Poisson
First step gravity **Dependent variable: bilateral import value**		
Variables	***Coefficient***	***Coefficient***
$\ln(distance_{ij})$	-0.644***	-0.850***
	[0.217]	[0.092]
FTA_{ij}	1.619***	0.516***
	[0.301]	[0.132]
$contig_{ij}$	1.495***	0.433*
	[0.301]	[0.232]
$comm_lang_{ij}$	1.090***	0.645***
	[0.129]	[0.090]
$\ln(tariffs)_{ij}$	-0.134***	-0.177***
	[0.046]	[0.040]
Exporter and importer country fixed effects are included in the first step		
Second step gravity **Dependent variable: exporter fixed effects**		
$landlocked_i$	-0.390	-0.253
	[0.428]	[0.440]
$\ln(primary_enrolment\ _rate)_i$	-1.176	-1.666
	[1.707]	[1.891]
$\ln(secondary_enrolment\ _rate)_i$	0.275	0.699
	[0.453]	[0.495]
$political_stability_i$	0.354*	0.337
	[0.208]	[0.253]
$\ln(agricultural_land_i)$	0.114	0.184
	[0.163]	[0.167]
$\ln(freshwater_availability_i)$	0.512***	0.739***
	[0.152]	[0.267]
$fertiliser_consumption_i$	-0.000429	-0.00222
	[0.002]	[0.004]
$infrastructure_quality_i$	1.613**	1.962*
	[0.634]	[1.085]
$\ln(electricity_consumption)_i$	0.172	-0.226
	[0.224]	[0.330]
Constant	0.0466	13.60
	[8.061]	[8.680]
Observations	71	71
R-squared	0.672	0.576