Development Policy Review, 2012, 30 (4): 473-497

Modern Food Supply Chains and Development: Evidence from Horticulture Export Sectors in Sub-Saharan Africa

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The global food system is undergoing rapid processes of transformation and modernisation. This is causing important changes in developing-country food supply chains, particularly in supermarket-driven and high-value export chains, but the welfare implications of these changes are poorly understood. This article analyses and compares the welfare effects in different horticulture export chains in sub-Saharan Africa, disentangling different types of effects and the channels through which rural households are affected. Its main conclusion is that increased high-value exports and the modernisation of export supply chains can bring about important positive welfare effects, which can occur in various ways through product- or labour-market effects and through direct and indirect effects.

Key words: Modern supply chains, poverty, horticulture, Africa

1 Introduction

The food system is undergoing rapid processes of globalisation and modernisation, with important implications for poor countries (Mergenthaler et al., 2009; Reardon et al, 2009). Global food trade has increased sharply during the past two decades, and has changed considerably in structure with the increased importance of high-value products such as horticulture, dairy and meat products (World Bank, 2008). Investment, including foreign direct investment, in food processing and retail is expanding rapidly – also in low-income countries – leading to consolidation in food markets and the increased dominance of large multinational food companies in global food supply chains (McCullough et al., 2008). Food standards are spreading rapidly and food production and trade are increasingly regulated through stringent public and private requirements on food quality and safety, and ethical and environmental aspects (Jaffee and Henson, 2005; Henson and Reardon, 2005; Maertens and Swinnen, 2009b).

As a consequence of these developments, upgraded and modernised food supply chains are put in place that require different production methods with attention to product quality, the implementation and documentation of testing procedures to

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Published by Blackwell Publishing, Oxford OX4 2DQ, UK and 350 Main Street, Malden, MA 02148, USA.

minimise food safety risks, upgraded processing facilities and investment in better storage systems. Such modern supply chains often also entail institutional innovations such as interlinked market transactions and vertical co-ordination (Swinnen and Maertens, 2007). In poor countries, this process of modernisation is most apparent in supermarket-driven supply chains and high-value export chains. While there is consensus that the process of modernisation in these food chains is causing important changes, the welfare implications of these changes are poorly understood and empirical studies have come to diverse conclusions.

This article focuses on high-value horticulture export chains in sub-Saharan Africa (SSA) and analyses the welfare effects, specifically in terms of income mobility and rural poverty reduction, of these modernising chains. With this focus it covers a specific but essential part of modern food supply chains and addresses an important gap in the literature, as very little evidence is available from least developed countries. A main part of the evidence comes from supermarket-driven supply chains in middle-income countries in Latin America (for example, Reardon and Berdegué, 2002), Asia (Wang et al., 2009) and Central and Eastern Europe (Dries et al., 2004), and SSA countries that are no longer least developed countries, such as Kenya and South Africa (for example. Dolan and Humphrey, 2000; Neven et al., 2009; Weatherspoon and Reardon, 2003). We focus on modernisation in horticulture export chains in poor SSA countries because in these countries horticulture export markets are in general much larger than supermarket sectors, which are almost non-existent.[1]

SSA is the region most lagging in integration in international markets and in poverty reduction. Important changes are ongoing in SSA horticulture export chains, which are growing and modernising rapidly, and the poverty implications of these changes are a pertinent issue. Horticulture exports are recognised as entailing an important potential for raising rural incomes and reducing poverty because of the link with the rural economy, the high intrinsic value of the produce and the labour-intensive production systems (Aksoy and Beghin, 2005; Anderson and Martin, 2005). Many poor countries therefore pursue the development of horticulture export chains as a specific poverty-reduction strategy, as documented in the Poverty Reduction Strategy Papers of many SSA countries. The World Bank and other international donors have invested heavily in increasing poor countries' capacity in horticulture exports, and many development projects have focused on ensuring and enhancing the positive welfare effects of increased trade in high-value horticulture. To guarantee the success of such programmes, it is imperative to understand the welfare implications of the growth and modernisation of horticulture export chains, and the channels through which these effects come about.

This article examines in depth three comparative case studies on high-value horticultural exports from Senegal and Madagascar, and disentangles different welfare effects and the channels through which rural households are affected. The case studies

1. In most SSA countries supermarkets have not spread or their size is still very small in comparison with wet markets and export markets (Humphrey, 2006; Minten, 2008). In Kenya, one of the few countries where supermarkets do account for a substantial share of food retail, the horticulture export sector is much larger than the horticulture supermarket sector (Neven et al., 2009). This is in sharp contrast with middle-income countries in Latin America where it is estimated that the horticulture supermarket sector is two to three times the size of the export market (Reardon and Berdegué, 2002).

selected are particularly interesting since the chains have developed very differently in the modernisation process, which has resulted in varied supply chain structures and in diverging implications for rural households. The comparative approach delivers important new insights. There is a growing number of studies on the welfare effects in high-value export chains, focusing on the participation of smallholder farms and rural households in the chains or the impact on productivity, income and poverty. However, many have analysed only partial effects. It is important to compare welfare effects in different supply chains and the different channels through which these come about. Studies that jointly analyse the question of participation and impact, the comparative effects through different channels, and/or direct and indirect effects are extremely scarce. The case studies presented in this article are among the first to compare differential welfare effects and to integrate participation and impact issues, product- and labour-market effects, and direct and indirect effects. Their combined insights therefore contribute to better understanding the overall welfare effects of the growth and modernisation of high-value export chains, to putting previous empirical evidence in the literature in perspective and to drawing legitimate and sound policy conclusions.

The article is structured as follows. The next section documents the growth in high-value food trade and briefly discusses the aspects that contribute to modernising horticulture export chains. Section 3 conceptualises the different welfare effects of the growth in high-value horticulture exports, and Section 4 reviews the existing empirical evidence of these effects. In Section 5 we analyse and compare three case studies of horticulture exports from SSA; a final section concludes and discusses the strategic implications of our findings.

2 The growth of high-value horticulture exports

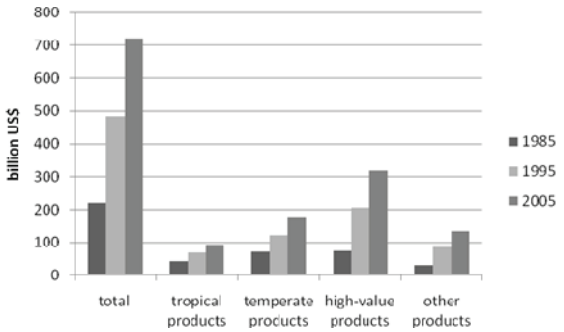
During the past two decades global food and agricultural sectors have experienced rapid changes including (i) a shift from lower-value products towards high-value products, (ii) large investments in retail and increased dominance of multinational companies in global food chains, (iii) proliferation of stringent standards, and (iv) changes in supply chain governance and increasing levels of vertical co-ordination. This applies in particular to horticulture exports, globally and in SSA. In this Section we discuss and document each of these aspects.

2.1 The structure of trade

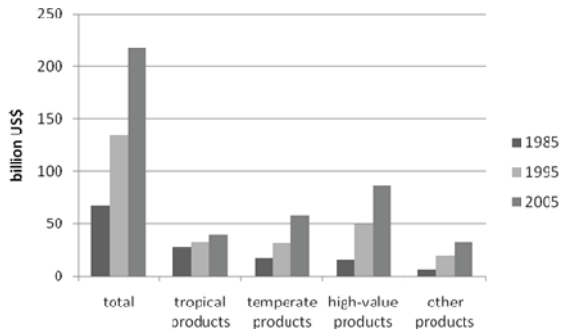
World trade in food and agricultural products has more than tripled during the past two decades: from US$220 billion in 1985 to US$720 bn in 2005 (Figure 1a). Trade in high-value products – defined here as including fruits, vegetables, fish, seafood, meat and dairy products with a relatively high per unit or per weight value as compared to more bulky primary commodities such as cereals, coffee and cocoa – has been increasing even more rapidly; their importance in total global agri-food exports increased by 10 percentage points from 34% in 1985 to 44% in 2005. This shift towards high-value food exports has been most dramatic in developing countries where they increased more than fivefold over the period 1985-2005 (Figure 1b). The share of high-value commodities in

Figure 1: Changes in agri-food exports, 1985-2005

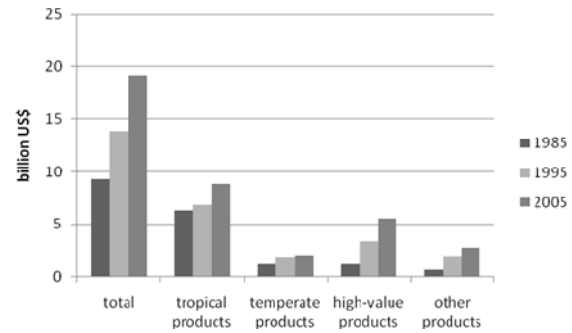
a) World exports[a]



b) Developing country[b] *exports*



c) Sub-Saharan African exports



Notes: a) Tropical products include coffee, cocoa, tea, nuts and spices, textile fibres, sugar and confectionery; temperate products include cereals, animal feed and edible oils; high-value products include fruits, vegetables. b) Developing countries include all low- and middle-income countries in Africa, Central America, South America and the Caribbean; East Asia, South Asia, South-East Asia and Central Asia. , fish, seafood, meat and meat products, milk and dairy products; other products include tobacco and cigarettes, beverages, rubber, and other processed food products.

total developing countries' agri-food exports increased from 23% in 1985 to 40% in 2005. This has been accompanied by a significant loss in importance of traditional tropical exports – defined here as including coffee, cocoa, tea, sugar, cotton, nuts and spices – for which the share in total exports decreased from 41% in 1985 to 18% in 2005. High-value commodities actually constitute the main component of developing countries' agri-food exports.

The shift from traditional tropical exports to non-traditional, high-value exports is apparent in all developing regions, but there are some slight differences between them. In Latin America and developing Asia high-value products have become the main export sector, constituting respectively 43% and 38% of total food exports in these regions (Table 1). In SSA, high-value exports constitute 35% of total exports, but traditional tropical exports still make up the largest part of SSA agri-food exports (39%). The shift in the past decades has been most dramatic in SSA. The importance of traditional tropical exports in total agri-food exports has decreased from 68% in 1985 to 39% in 2005, while the share of high-value exports more than doubled, from 14% in 1985 to 35% in 2005 (Figure 1c). Horticulture products have played a key role in this. Horticulture exports from SSA to high-income regions tripled in the period 1990-2005, from less than 2 million tons to 6 million tons (FAOstat, 2008). From the early 1990s onwards the export of fruits and vegetables from SSA grew sharply and continuously, while the export growth of other, more traditional agricultural commodities, such as coffee, sugar and cotton, was much smaller and less persistent (Figure 2). These are important changes for a region where many countries have been heavily dependent for decades on one or just a few traditional export commodities. The European Union (EU) is the main destination market for these sharply increased SSA horticulture exports. Several SSA countries, including very poor countries such as Burkina Faso, Cameroon, Kenya, Uganda, Senegal and Madagascar, have become important suppliers of fresh fruits and vegetables to the EU.

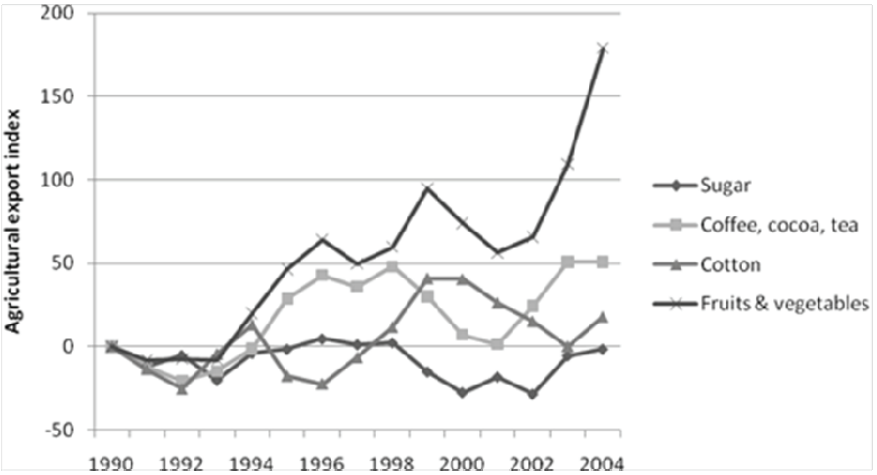
Table 1: Share of different types of products in total agri-food exports for different developing regions, 2005 (%)

	Developing countries	Asia	Latin-America	Africa
Tropical products	18.3	14.5	17.0	38.7
Temperate products	26.7	28.1	29.0	12.3
High-value products	39.9	38.2	42.9	35.5
Other products	15.1	19.2	11.1	13.5

Note: Products classified as for Figure 1.

Source: Calculations based on FAOstat statistics (2011).

Figure 2: Index of agricultural exports from Sub-Saharan Africa, 1990–2005



Source: Calculations based on FAOstat statistics (2011).

2.2. Consolidation

In past decades global food supply chains have become increasingly concentrated, with large food companies and multinational firms dominating the chains. This is most apparent in the food retail sector which is concentrated around a few large super- and hypermarket chains. In EU countries, the five-firm concentration ratio in food retail is particularly high, above 60% in many countries, reflecting the dominance of large retail chains (Henson, 2006). In addition, these large retailers have sharply increased their share in fresh produce sales and account for the majority of fresh fruit and vegetable sales in many EU countries (Grant Thornton, 2005).

This consolidation at the retail level in high-income countries affects horticulture export chains in SSA and elsewhere. It has led to further consolidation upstream in the food chains, as supermarkets increasingly rely on direct trading relations with a limited number of specialised importers, thereby bypassing wholesale markets (Dolan and Humphrey, 2004). Also packing and processing is often taken on by these specialised importers. In the UK for example, the supply of fruits to retailers is largely organised by only four major marketing agents who arrange the supply of domestic as well as imported produce (Grant Thornton, 2005). Consolidation at the import and retail nodes of fresh produce supply chains affects overseas exporters and producers who increasingly have to deal with large and powerful multinational companies.

2.3 Standards

During the past decade food standards, including public regulations as well as private corporate standards, have risen sharply. Fresh food exports to the EU have to satisfy a series of stringent public requirements, including marketing standards, labelling requirements, conditions concerning contamination in food, general hygiene rules and traceability requirements. Also private standards, established by large food companies, supermarket chains and non-governmental organisations, play an increasingly important role in agri-food trade (Henson and Reardon, 2005). Such standards increasingly go beyond food quality and safety specifications and include ethical and environmental concerns as well. Although private standards are not legally mandatory, they have become *de facto* mandatory, as a large share of buyers in international food markets are requiring compliance with such standards, for example GlobalGAP standards (Henson and Humphrey, 2008).

A number of factors contribute to explaining the increased importance of standards in global food trade (Maertens and Swinnen, 2007). A series of major food safety hazards in high-income countries has increased consumer and public concern about food-borne health risks and created a growing demand for food safety. In addition, rising income levels and changing dietary habits have stimulated the demand for high-quality food. Consumers are also increasingly (made) aware of ethical and environmental aspects related to food production and trade, which has increased the need for specific standards regarding these aspects. But also the growing trade in fresh food products such as fruits, vegetables, fish, and meat – which are prone to food-safety risks and subject to specific quality demands by consumers – have increased the need to regulate trade through standards. The growing dominance of supermarkets in food chains also contributes to explaining the increased importance of food standards. Large retail chains put great emphasis on freshness, product quality and food safety as a product differentiation strategy or in order to reduce food-safety risks and the costs related to the risk of selling unsafe food (Henson and Humphrey, 2008).

2.4 Governance

Global food supply chains are increasingly dominated by large multinational food companies, while trade is increasingly regulated through standards set by these private companies or by national, regional and international authorities. This has led to changes in the structure and organisation of high-value export chains (Humphrey and Schmitz, 2001). There has been a move from arm's-length market relations and spot-market transactions towards more explicit forms of co-ordination in the chains (Gereffi et al., 2005). High-standards export chains now entail varying levels of vertical co-ordination at different nodes in the chains. This is apparent in vertical relationships between supermarkets and their specialised suppliers or food importers (Dolan and Humphrey, 2004), but also in increased vertical co-ordination between developing-country producers, on the one hand, and exporters, food processors and supermarkets, on the other. This is mostly in the form of contract-farming between agro-industrial firms or retail companies and local primary producers (Swinnen, 2007). In the most extreme

case, primary production is completely vertically integrated in the ownership structure of downstream processing and trading companies.

As we shall document in the next Sections, the governance and organisation of horticulture export chains is crucial in understanding the welfare implications of the emergence of such chains for rural households in developing countries.

3 Welfare implications: disentangling the effects

The growth in high-value horticulture exports, the increasing consolidation in export chains, rising standards, and increasing levels of vertical co-ordination in horticulture export chains have induced a sharp debate among academics, policy-makers and the development-aid community on the overall welfare implications. Some authors see this process as an engine for rural income mobility and poverty reduction (Aksoy and Beghin, 2005; Mithoefer and Waibel, 2011; Swinnen, 2007; Weinberger and Lumpkin, 2005), while others argue that it exacerbates existing inequalities and fails to create direct gains for the rural poor (Farina and Reardon, 2000; Dolan and Humphrey, 2000; Garcia-Martinez and Poole, 2004). A problem with comparing the conclusions of different studies is that they often look only at partial effects of the growth in high-value export chains. However, in order to understand the overall welfare implications of the growth of modern horticulture export chains for rural households, it is necessary to take account of, and distinguish between, several different effects.

Table 2 summarises some of the key effects to be taken into account. [2] First, rural households are affected by the emergence of high-value export supply chains through product markets, more specifically through the participation (or not) in the production and marketing of produce for export. Second, rural households can be affected through labour markets if the emergence and growth of modern supply chains are associated with increased rural employment in emerging modern agro-industries. This can include employment in the fields of large-scale industrial farms or in post-harvest handling and processing, including labour-intensive activities such as sorting, grading, washing and labelling.

Participation of rural households and smallholder farmers in high-value export supply chains – through either product or labour markets – does not necessarily say much about the impact of such participation on household welfare. The welfare implications depend on the gains rural households can derive from participating in high-value export chains in terms of improved productivity, increased household incomes, and reduced food insecurity and poverty – and on the effects on their incomes if they cannot participate.

To fully capture household effects one needs to take account of both direct and indirect effects. Direct effects are most straightforward. As prices and product requirements in export markets differ, suppliers are affected. They may also be affected, since contract-farming schemes usually entail the provision of inputs, credit and farm assistance to suppliers by the contractor company in return for the supply of high-

2. Note that there may be other effects, such as dynamic investment effects, human capital accumulation, and bargaining, which we do not consider here.

quality and consistent produce. [3] This enhances access to inputs and working capital for farmers, reduces their production and marketing risk, improves their access to technology and typically results in higher productivity. The wages earned by workers in agro-industrial companies add directly to household income. The welfare effect may depend on whether other off-farm employment opportunities are scarce or not. In addition, indirect household-level effects are possible,[4] through technology and managerial spillovers from export crops to non-export crops and plots, and through investment of incomes from export production and wages in other farm and non-farm activities.

Table 2: Development implications of the emergence and growth of modern food supply chains – distinction of different types of effects

	Product-market effects	Labour-market effects
Participation		
	- Possibilities for rural households and smallholder farmers to supply MSC, e.g. through VC schemes - Type of farmers supplying MSC, type of farmers with access to VC schemes	- Access to employment in MSC for rural households - Type of households with access to employment in MSC
Impact		
Direct effects	- Impact of smallholder participation in production for MSC on farm productivity, household income and poverty reduction	- Impact of employment in MSC on household income and poverty reduction
Indirect effects	- Spill-over effects from smallholder participation in production for MSC (technology & managerial spill-over effects, investment linkages, consumption linkages)	- Spill-over effects from employment in MSC (investment linkages, consumption linkages)

VC: Vertical co-ordination; MSC: modern supply chains.

3. Also more complicated forms of contract-farming with the involvement of a third party are observed in high-value food supply chains, such as the provision of bank loan guarantees, warehouse receipt payments, etc. (Swinnen, 2005).
4. Also indirect effects in the broader economy might exist through increased incomes from export production and wage employment leading to increased consumption of locally produced goods and services.

4 Welfare implications: empirical evidence from recent literature

4.1 Participation through product markets

Empirical studies have mostly focused on the participation of rural households in high-value export chains through product markets. Table 3 summarises some findings from the literature on smallholder participation in horticulture export chains in several SSA countries. A comparison across countries and sectors is not straightforward since studies define 'smallholders' differently (or not at all), but the figures generally indicate that there is a wide variation in the share of horticulture export produce that is procured from smallholders. This variation might be related to the nature of the product, the skills and resources of local smallholder farmers, and the land ownership patterns (Gulati et al., 2007).

Some horticulture sectors in SSA are almost completely based on smallholder supply, for example the pineapple sector in Côte d'Ivoire and the vegetable sectors in Ghana and Madagascar. In other sectors about half of the export produce is sourced from smallholders, for example the pineapple sector in Ghana, the mango sector in Côte d'Ivoire, the bean sector in Senegal and the fruit and vegetable sector in Kenya (Table 3). In many cases, procurement from smallholders is based on contract-farming arrangements. Smallholders in the bean sector in Senegal, the vegetable sector in Madagascar and the fruit and vegetable sector in Kenya work (almost) entirely on the basis of individual contracts with exporters (Maertens and Swinnen, 2009a); Minten et al., 2009; Jaffee, 2003; Asfaw et al., 2007). The pineapple sector in Ghana is mixed, with smallholders supplying the export chain through individual contracts or contracts buyers have with smallholder co-operatives as well as through intermediary traders and spot-market transactions (Lambert, 2002). The vegetable sector in Ghana is an exception, with very little vertical co-ordination in the export chain and exchange entirely organised around intermediary traders (Legge et al., 2006).

Only a couple of studies have differentiated among smallholders and specifically looked at the type of farm-households which supply high-value export chains. For example, McCulloch and Ota (2002) find that smallholders' access to horticulture export chains in Kenya is importantly determined by farm size and access to irrigation. They indicate that poorer households face important constraints to participating in contract schemes for export production. Other studies indicate that gender also matters, and that female farmers are largely excluded from supplying high-value export chains and contract-farming schemes in these chains (Dolan, 2001; Maertens and Swinnen, 2012).

In some sectors the participation of smallholder producers is relatively low or zero because export companies rely on procurement from large commercial farms or own integrated estate production. For example, this is the case in the papaya chain in Ghana, the banana chain in Côte d'Ivoire, the tomato chain in Senegal and horticulture export chains in Zimbabwe (Table 3). Some studies have documented that the share of smallholders in export horticulture supply chains in SSA is decreasing as a result of

increasing food quality and safety standards (Dolan and Humphrey, 2000; Danielou and Ravry, 2005).

Table 3: Smallholder[a] procurement in Sub-Saharan African horticulture export chains

Country	Commodity (group)	Year of survey	Share of produce sourced from smallholders	No. of smallholder producers
Ghana[b]	Vegetables	2002	95%	3,300
	Pineapples	2006	45%	600
	Papaya	2006	10-15%	
Cote d'Ivoire	Pineapple	1997	70%	
	Mango	2002	> 50%	
	Banana	2002	0%	
Senegal	French beans	2005	52%	600 - 900
	Tomatoes	2006	0%	0
Kenya	Fresh fruit and vegetables	2002	± 50%	12,000 - 80,000
Madagascar	Fresh vegetables	2004	90-100%	9,000
Zambia	Vegetables	2003		300
Zimbabwe	Fruits & vegetables	1998	6%	10

Notes: a) The definition of 'smallholders' varies over the different studies: in the pineapple sector in Ghana smallholders have on average 1 ha of land, in the pineapple sector in Côte d'Ivoire up to 10 ha of land, in the bean sector in Senegal up to 20 ha of land, in the vegetable sector in Madagascar on average less than 1 ha of land. Other studies do not give an explicit definition of smallholders.
b) Only exports to the UK.

Sources: Legge et al. (2006) for Ghana; Minot and Ngigi (2004) for pineapple in Côte d'Ivoire; Lambert (2002) for mango and banana in Côte d'Ivoire; own calculations for Senegal and Madagascar; Jaffee (2003) and Asfaw et al. (2007) for Kenya; Smith et al. (2004) for Zambia; and Dolan and Humphrey (2000) and Legge et al. (2006) for Zimbabwe.

4.2 Impact through product markets

Empirical studies have also analysed the direct impact of participation in modern supply chains through contract-farming. Most of the available evidence, from horticulture

export chains in SSA as well as from other high-value export chains, points to positive effects on farm productivity and household income. Farmers generally gain from participation in high-value contract-farming schemes through enhanced access to inputs, reduced production and marketing risk, improved technology and productivity, and ultimately higher incomes. For example, McCulloch and Ota (2002) show that contract-farming in Kenyan horticulture export chains significantly increases farmers' incomes.

Potential indirect effects, such as technology and investment spillovers and investment and consumption linkages, have received hardly any attention so far. Exceptions are a study by Govereh and Jayne (2003) that indicates that contracting for export production has important technological and managerial spillovers on food production, resulting in increased grain yields, and a study by Asfaw, Mithoefer and Waibel (2009) that shows how managerial spillover effects from contracting with certified horticulture exporters led to less hazardous use of pesticides and improved health conditions of farmers.

4.3 Participation and impact through labour markets

The labour-market effects of the emergence and growth of modern food supply chains in developing countries have received much less attention in the empirical literature than product-market effects. Several authors indicate that modern supply chains are associated with increased use of hired labour on farms and in processing plants (for example, Barrientos et al., 2001; Jaffee, 2003; Neven et al. 2009; Weinberger and Lumpkin, 2005), but very few studies have actually analysed the participation of poor rural households through labour markets and the impact on household income and other welfare indicators. McCulloch and Ota (2002) show that employment in the Kenyan horticulture export industry is especially important for the poor. Barron and Rello (2000) find that the tomato agro-industry in Mexico provides jobs for poor migrant workers, thereby contributing to rises in income in poverty-stricken regions of the country.

Involvement through labour markets is indeed important in horticulture export chains in SSA. Table 4 gives the figures of employees in horticulture export sectors in several countries, showing that in many poor SSA countries, thousands of people are employed in the fruit and vegetable export industry. Part of this employment might concern urban jobs in processing units and packing houses, but the lion's share is rural employment. Moreover, a major share of the thousands of employees in the SSA horticulture agro-industry is female. This gender aspect might well be important, because off-farm wage-employment opportunities for women are generally limited in rural areas, while such employment is often associated with positive development effects such as female empowerment and improved child nutrition (Quisumbing and McClafferty, 2006; Maertens and Swinnen, 2012).

The employment figures in Table 4 can be compared with the figures on the number of farm-households involved in export horticulture through product markets in Table 3 for some sectors (for fruits and vegetables in Ghana and Kenya, beans and tomatoes in Senegal, bananas and pineapples in Côte d'Ivoire, and vegetables in Zambia). This comparison suggests that in all these sectors a much larger number of households is affected through labour markets than through product markets.

Table 4: Employment[a] in Sub-Saharan African horticulture export chains

Country	Commodity (group)	Year of survey	No. of employees in the export industry	Share of female employees
Ghana[b]	Vegetables	2002	2,260	
	Fruits	2006	8,800	
Cameroon	Banana	2003	10,000	
Côte d'Ivoire	Banana & pineapple	2002	35,000	
Kenya	Fruits & vegetables	2002	40,000 - 50,000	
	Flowers	2001	50,000	75%
Senegal	French beans	2005	12,000	90%
	Tomatoes	2006	3,000	60%
Ethiopia	Flowers	2009	50,000	70%
Zambia	Vegetables	2002	7,500	65%
	Flowers	2002	2,500	35%
South Africa	Deciduous fruit	1994	283,000	53%

Notes: a) Employment figures only include employment in exporting companies and large-scale vertically integrated estates and do not include employment on smaller contracted farms. b) Only exports to the UK.

Sources: Legge et al. (2006) for Ghana; Arias et al. (2003) for Cameroon; Minot and Ngigi (2004) for Côte d'Ivoire; own calculations for Senegal; Taylor (2010) for Ethiopia; Smith et al. (2004) and Barrientos et al. (2001) for Zambia and flowers in Kenya; Jaffee (2003) for fruits and vegetables in Kenya; and Barrientos et al. (2000) for South Africa.

5 Comparative case studies[5]

To complement the literature, we present a comparative analysis of three case studies on high-value horticulture exports in SSA countries: the vegetable export sector in Madagascar and the bean and the tomato export sectors in Senegal. Each of these sectors concerns high-value horticultural exports to the EU with strong growth in the past decade(s). Yet, at the same time, the three studies document very different supply chain structures (Table 5). Because of these variations, a comparative analysis is particularly interesting since it allows light to be shed on the welfare effects identified in

5. This Section draws on evidence described in Minten et al. (2007, 2009) for the Madagascar case study, in Maertens and Swinnen (2009a, 2012), Maertens (2009) and Maertens and Verhofstadt (2011) for the Senegal bean case study, and in Maertens et al. (2011) and Maertens and Swinnen (2012) for the Senegal tomato case study.

Table 2 and assessment of how the effects are influenced by the structure of supply chains.[6]

Table 5: Summary of three comparative case studies

Case study		Destination of exports	Industry structure at export level	Procurement from contracted smallholders
Country	Sector			
Madagascar	Green beans	EU (France, Belgium, the Netherlands)	Monopoly	100%
Senegal	Green beans	EU (France, Belgium, the Netherlands)	Competition	52% (and decreasing)
Senegal	Tomatoes	EU (France, Belgium, the Netherlands)	Monopoly	0 %

Source: Authors' information.

Product-market effects prevail in the vegetable export sector in Madagascar, labour-market effects prevail in the tomato export sector in Senegal, and both types of effects are important in the bean export sector in Senegal. In addition, all three studies allow to some extent an integrated assessment of both participation and impact, and both direct and indirect effects. The case of bean exports from Senegal is in this respect the most interesting, as all the issues identified in Table 2 can be integrated in one study and the survey data collected allow such an integrated analysis. The study of the tomato export sector in Senegal analyses labour-market effects with survey data that are well suited to examining participation and impact effects, and the study on the vegetable export sector in Madagascar analyses product-market effects with survey data that are very well suited to disentangling direct and indirect effects.

For all three export sectors, background information was gathered at the national level, qualitative information was collected through semi-structured interviews with different supply chain actors and stakeholders (including exporters, exporters' organisations, processors, farmers' organisations, etc.), and representative farm-household surveys were conducted. These include surveys in 2004 of 200 farm-households producing vegetables for export in the Highlands of Madagascar, in 2005 a survey of 450 rural households in the Niayes region in Senegal where the large majority of exported beans originates from, and in 2006 of 300 rural households in the Senegal River Delta Region in Senegal where exported tomatoes originate from.

5.1 Export growth

The three sectors have all witnessed tremendous growth. Beans are the main vegetable export from Madagascar. Over the past decade bean exports have more than doubled; from 1,900 tons in1998 to 5,300 tons in 2008 (FAOstat, 2011). Also the export of peas,

6. This question (how supply chain structure affects the distribution of rents in the chain) has been addressed theoretically by Swinnen and Vandeplas (2010).

the second most important export crop in Madagascar, increased but at a slower rate: from 3,600 tons in 1998 to 5,300 tons in 2008 (ibid.). The large majority of these exports go to France, with smaller volumes exported to neighbouring countries, mainly Mauritius, and other EU countries. The export of beans from Senegal quadrupled over the past decade, from slightly more than 1,000 tons in 1998 to almost 5,500 tons in 2008 (ibid.). Beans are mostly exported to France, the Netherlands and Belgium. The sharpest export growth is observed in the Senegal tomato sector: exports increased from slightly more than 500 tons in 1998 to almost 10,000 tons in 2008 (FAOstat, 2011). The main destination countries are France, the Netherlands, Belgium and the UK.

5.2 Supply-chain structure and governance

There are sharp differences in the structure of the export supply chains in the three sectors. These differences importantly determine the channels through which welfare effects emerge. First, the vegetable export sector in Madagascar is dominated by one domestic exporting company that relies 100% on contracting with smallholders for the procurement of primary produce, mainly beans and peas. In response to increasing standards in overseas markets, the company has intensified its contract-farming schemes with smallholders. This has led to a vertical co-ordination scheme including almost 10,000 smallholders, often very small farms of less than one ha, on the hillsides of Madagascar. The company relies on an intensive on-farm monitoring system including 300 company agents who regularly visit the contracted farms to provide extension services and technical advice, to monitor adherence to contractual agreements and to avoid side-selling. Moreover, inputs are supplied on credit by the company at the beginning of the growing season. Since 2007 (which is after the implementation of the farm-household survey on which this analysis draws) almost 1,200 contracted smallholder producers have become GlobalGAP certified with the support of the export company and donor programmes.

Second, in the Senegalese bean export sector there are some 25 exporting companies, a mixture of smaller and larger exporters. As a result of increasing standards and as part of a corporate strategy to become GlobalGAP certified, the largest exporters have changed their sourcing strategies from relying on contract-farming with smallholders to own vertically integrated estate production. This has substantially changed the structure of the bean export supply chain. It is estimated that the share of export produce that is sourced from smallholder contract schemes decreased from 95% in 1999 to 52% in 2005. Companies that do rely on smallholder contract-farming usually provide inputs, credit and management assistance to their contracted suppliers. At the time of the survey, two of the large producer-exporters were GlobalGAP certified for their own fields and some others were in the process of applying for GlobalGAP certification, but none of the smallholder producers in the contract-farming schemes were certified.

Third, the Senegalese tomato export sector is dominated by one multinational company that was established and started exporting tomatoes from Senegal to the EU in 2003. The tomato export supply chain is completely vertically integrated. There is no procurement from smallholders, and production, processing, trade and distribution are completely integrated within the subsidiaries of the multinational company. The

multinational holding aims at high-standards production through certification by different schemes, including GlobalGAP, BRC (British Retail Consortium) and Tesco's Nature Choice.

5.3 Participation through product and labour markets

The three case studies represent an interesting variation in supply-chain structure with 100%, 50% and 0% procurement from smallholder farmers. This has important consequences for the way rural households participate in export supply chains. While much of the literature has focused on participation through product markets, our case studies document that participation through labour markets is also important and often concerns the poorest households. First, in the vegetable export sector in Madagascar where 100% of the produce is supplied by contracted smallholders, rural households mainly participate through product-market channels. Almost 10,000 smallholder producers participate in the contract-farming schemes of the export company. Survey data reveal that these are often very small farms with on average less than one ha of land, which is the national average farm size. However, the level of education is relatively high among these producers: only 1% of contracted farmers have no education and 64% have finished at least primary school, compared with almost half the national population being illiterate. This indicates that education might be an important determinant for participation in contract-farming and export production. Participation of rural households through labour markets is very limited in the vegetable export sector in Madagascar. In addition to the 300 field agents managing the contract schemes, the export company employs some 200 workers in the processing and packing unit in Antananarivo.

Second, both product- and labour-market effects are important in the bean export supply chain in Senegal, where there is a mixed strategy of procurement from contracted smallholders and vertically integrated estate farming. From interviews with a selection of exporters we estimate that, at the time of the data collection in 2005, around 750 smallholder farmers and 12,000 workers were participating in the bean export chain; the former as suppliers of produce in contract-farming schemes and the latter as workers on the estate farms and in the processing centres of the exporters. As a result of increasing standards and subsequent restructuring of the supply chains, participation through labour markets is increasing while that through product markets is decreasing. Survey data indicate that the share of households in the region that participate in the export chain through labour markets rose from less than 20% in 2000 (when companies started to change their sourcing strategies) to 40% in 2005, while the share of households that participate as contract-farmers fell from 23% in 2000 to 10% in 2005. Survey data further reveal that households participating in contract-farming have significantly more land and non-land assets, while those participating in employment in the bean export industry have fewer livestock and other non-land assets. This indicates that there are important constraints on participation in export chains through product markets but not on participation through labour markets.

Third, the tomato export supply chain in Senegal is completely vertically integrated and the export company relies completely on own estate production. Hence, rural households in the Senegal River Delta region only participate in the export chain

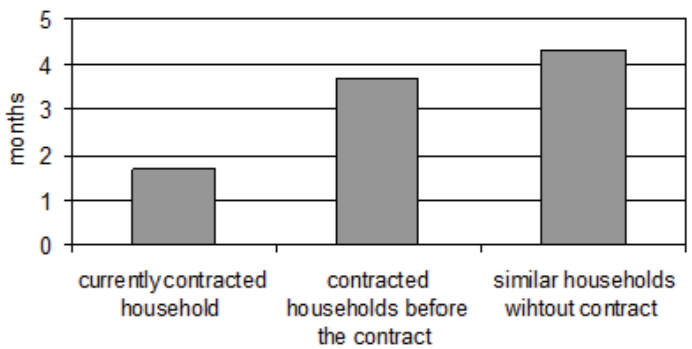
through labour markets. At the time of data collection in 2006, the export company employed slightly more than 3,000 workers on their fields and in the processing unit. These are mainly seasonal workers and day labourers who are recruited from nearby villages. These labour-market effects are important as an estimated 40% of households in the survey region participate in the export chain as labourers. Survey data further reveal that households participating in employment in the export sector are larger and poorer households with less land and non-land assets, while there are no differences in education between participating and non-participating households. In addition, a large share of the workers is female. Access to employment in the export chain is based on geographic location, and no constraints appear to exist in terms of wealth, gender or education.

5.4. Impact through product- and labour-market effects

A main insight from the comparative analysis in this article is that there are important positive welfare effects for rural households through both product- and labour-market channels. Our results document that product-market effects have a higher impact on household income than labour-market effects. Yet, labour-market effects also create important positive effects on income and have a greater impact on poverty reduction because poorer households mainly benefit through labour-market channels.

First, in the case of vegetable exports in Madagascar rural households mainly benefit through contract-farming with the export industry. The farmers surveyed indicate that contracting with the vegetable export industry leads to higher and more stable incomes. These descriptive results could not be corroborated by a causal analysis as only contracted farmers were surveyed. However, an analysis of the length of the 'hungry' season – the period during which households face difficulties in obtaining enough food – with recall data reveals that participation in vegetable contract-farming has led to significant reductions from almost four months to less than two months a year (Figure 3).

Figure 3: Impact of vegetable contract-farming on the length of the 'hungry' season in Madagascar



Source: Authors' data.

Second, in the bean export supply chains in Senegal rural households benefit through both product- and labour-market effects. The survey data – including contract farmers, employees in the export industry and control households – reveal that participation in both contract-farming and in agro-industrial employment has resulted in significantly higher incomes (Table 6). With a causal analysis,[7] it is estimated that contracting with the export sector leads to incomes that are 110% higher than the average income in the region, while for employment in the export industry this is 60%. The observed shift in supply-chain structure from smallholder contract-farming to large-scale vertically integrated estate production has resulted in a stronger poverty-alleviating effect (Table 7). This is the case because the poorest households mainly participate and benefit through labour markets, while participation in contract-farming is biased towards relatively better-off households.

Table 6: Income effects of green bean and tomato exports in Senegal (1000 FCFA)

		Income from different sources			
	Total income	Farming	Wages export industry	Other wages	Other sources
Green bean export sector, Les Niayes region					
Total sample	3,055	2,080	392	69	514
Non-participants	1,835	1,420	0	75	340
Employees	4,700	2,344	1,448	255	653
Contract farmers	6,392	4,372	722	127	1,172
Tomato export sector, Senegal River Delta region					
Total sample	1,324	282	448	141	453
Non-participants	802	190	0	137	474
Employees	2,179	433	1,180	146	419

Source: Authors' calculations.

Third, in the tomato export sector in Senegal rural households only benefit through labour-market effects, as there is no contract-farming and procurement from smallholder farms. The survey data indicate that households employed in the tomato export industry have incomes more than double those of other households in the region (Table 6) – both types of households are included in the sample. A causal analysis[8] reveals that employment in the tomato export industry leads to incomes that are about 50% higher than the average income. As participation in employment includes poorer households as well, these effects on income ultimately result in reduced rates of poverty and extreme poverty (Table 7).

7. The causal analysis is based on a propensity score matching method. More details can be found in Maertens and Swinnen (2009a).
8. The causal analysis is based on a propensity score matching method and an instrumental variable estimation. More details can be found in Maertens et al. (2011).

Table 7: Poverty effects of green bean and tomato exports in Senegal (share of households below the poverty line[a])

	Poverty	Extreme poverty
Green bean export sector, Les Niayes region		
Non-participants	47%	17%
Employees	40%	5%
Contract farmers	13%	2%
Tomato export sector, Senegal River Delta region		
Non-participants	46%	18%
Employees	35%	6%

Note: a) National rural poverty lines are used; calculated from national household surveys and updated to the survey period using consumer price indices.

Source: Authors' calculations.

5.5. Impact through direct and indirect effects

Our case studies allow disentangling some direct and indirect effects. The intention is not to give a complete list of possible indirect effects – many potentially important issues remain unaddressed – but to point to some important mechanisms through which a welfare impact is created. Our results indicate that indirect effects, coming about through different mechanisms, are quite important in generating positive welfare effects for rural households and for creating spill-over effects in the rural economy.

First, the positive impact of vegetable contract-farming in Madagascar on farmers' income and food-security situation results from a combination of direct and indirect effects. Vegetables produced under contract with the export company contribute directly to household income and account on average for 47% of that income. There are important indirect effects through technological and managerial spill-over effects from contract-farming on rice production. Contract-farmers were assisted by the extension agents of the export company to use compost on contracted vegetable plots. Regression analysis[9] reveals that, owing to positive spill-overs of this fertiliser practice, rice productivity on the same plot in the subsequent season increased by 64%, which further adds to households' income and improved food security.

Second, employment in the bean export agro-industry in Senegal benefits rural households directly through increased income from wages, contributing on average 30% of their income, and also indirectly through investment linkages at the household level. Wages earned in the export industry are partially invested in the households' own farm business, leading to higher outputs and farm incomes (Table 6). An econometric

9. More details can be found in Minten et al. (2007).

analysis[10] shows that households with access to wages from the agro-industry cultivate their land more intensively and use 75% more agricultural inputs.

Third, employment in the bean and tomato export industries in Senegal has important indirect gender consequences. A large proportion of the employees in these sectors is female, 90% in the bean and 60% in the tomato sector. The development of the export supply chains has led to a feminisation of the rural labour market in the case-study areas and to a reduction (albeit not an elimination) of direct and indirect gender discrimination in these markets. Survey data reveal that the gender wage gap in export industries is 3 to 6 times lower in comparison with other employment sectors.[11] Moreover, it was observed that wages earned by women in the export industries contribute importantly to female empowerment within rural households, resulting in increased schooling of children. In an econometric analysis[12] we find that female employment in the export industry increases primary school enrolment by 9 percentage points.

6 Conclusion and implications

The main conclusion of this article is that the increased trade in high-value agricultural products and the modernisation of export supply chains in developing countries can produce important positive effects for rural development and poverty reduction, and that these effects can come in various ways through product- or labour-market effects and through direct and indirect effects.

This implies a need for supporting the development of modern and high-value export supply chains in poor countries. This requires a recognition of the importance of private investment in agri-food supply chains and of the development of vertical co-ordination mechanisms in policy thinking and programme strategies. In this respect some specific policy issues can be identified. First, enabling and stimulating supply-chain development and modernisation of agri-food supply systems entails institutional changes to stimulate innovative vertical co-ordination schemes and put in place the right juridical systems and supporting contract-enforcement mechanisms. Second, probably one of the most essential elements for the integration in, and the development of, high-value food supply chains and vertical co-ordination in those chains, is to encourage private investment – domestic as well as foreign investment – in the agro-food industry by creating the right conditions for investment. Third, this involves ensuring macroeconomic stability, attracting FDI in the agro-industry, etc. In addition, enhancing efficiency and equity in high-value agricultural supply chains is a key point. Participation of poor farmers and an equitable distribution of the rents in the chains require several key elements. There is need for policies to focus on reducing transaction costs through, for example, investments in intermediary institutions, infrastructure, and

10. The analysis is based on a combination of econometric methods, including seemingly unrelated regression, instrumental variable regression and simultaneous regression. More details can be found in Maertens (2009).
11. These results are based on a descriptive analysis. More details can be found in Maertens and Swinnen (2012).
12. The analysis is based on instrumental variable estimation. More details can be found in Maertens and Verhofstadt (2011).

farmers' associations. Better empowerment of farmers can also improve their bargaining position in vertically co-ordinated food-supply chains.

In addition, this implies that strategies to improve the welfare effects of the growth in modern supply chains need to include strategies for creating inclusive food-supply chains as well as strategies for the development and improved performance of rural labour markets. The insights from this article that the poorest households tend to benefit from export-market development through labour rather than product markets imply pro-poor export development strategies to pay attention to labour-market and employment conditions. These insights have largely been ignored and the analogy with insights from the Green Revolution of the 1960s could be drawn. The Green Revolution triggered major productivity growth and rural income rises in Asian countries, but was at first believed to benefit richer farmers while marginalising poorer farmers because of the specific constraints they face in accessing and using Green Revolution inputs. However, David and Otsuka (1994) showed that poorer households did benefit from this technology-driven agricultural development because of labour-market effects. This article suggests that the same might hold for supply chain-driven agricultural development. At the same time, Carter et al. (1996) has argued, with regard to exports from Latin America, that poverty effects might depend strongly on the nature of the commodities, with poverty-reducing benefits being more likely in labour-intensive than in land-intensive production systems. Horticulture is in general a labour-intensive sector, and the findings discussed in this article validate the argument that labour-intensive export sectors strongly benefit poverty alleviation.

In this article we have presented evidence from specific case studies related to success stories of high-value horticulture export chain development in SSA. However, we should mention that there is a large variation between countries in both the integration in high-value international food markets and the progress of modernisation of food-supply chains. As documented, participation in high-value agri-food trade can be an engine of pro-poor growth for developing countries, but many countries face challenges in bringing about such export growth. International competition, especially in high-value food markets, is moving beyond the capacity to supply products at market prices, since produce has to comply with stringent quality and safety requirements. Many developing countries have substantial weaknesses in food-safety enforcement capacity. Increasing the capacity to supply high-quality and safe fresh food and creating the capacity to respond quickly to emerging food-safety issues and complying with changing legislation and a variety of private standards demand attention to key issues such as improvement in the administrative, technical and scientific capacity for food safety; public-private sector co-operation; farm and business assistance programmes; attracting foreign direct investment; and demonstrating capacity for producing high-standard food through labelling and certification.

first submitted April 2010
final revision accepted December 2011

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