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# Horticultural exports and food security in developing countries

Goedele VAN DEN BROECK <sup>1</sup> and Miet MAERTENS <sup>1</sup>

## Abstract

This article reviews the channels through which horticultural exports affect food security in developing countries. We describe the trends in horticultural export chains and investigate the macro- and micro-level effects on the different components of food security, including availability, access, utilization and stability. The available evidence suggests that horticultural exports contribute to food security in developing countries, particularly through the development of rural labor markets and female wage employment in companies. Important challenges remain; most notably the provision of secure employment at remunerative conditions and the sustainable use of water resources. Private food standards may contribute to overcoming these challenges. Empirical evidence that directly measures the implications of horticultural exports on food security is highly needed.

**Key Words:** high-value food exports, food security, poverty reduction, agri-food system transformation, contract-farming, labor markets

**JEL classification:** F1, F6, I3

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## **Horticultural exports and food security in developing countries**

### **1 Introduction**

In the past two decades, exports of horticultural products (including fruits, vegetables and cut-flowers) from developing countries have increased tremendously. Horticultural exports from Latin-America more than tripled in the past 20 years, and horticultural exports from Africa and Asia more than quadrupled. This tremendous growth has resulted in horticulture being the most important product category in total agri-food exports for all developing regions.

Horticultural exports received a lot of attention from policy-makers and researchers. Many developing country governments prioritize the development and modernization of the horticultural sector as an export diversification and poverty reduction strategy. Horticultural exports entail a high potential for poverty reduction because of the intensive use of low-skilled labor in production and post-harvest activities, and the high intrinsic value of produce (Aksoy and Beghin, 2005). Horticultural exports are often referred to as high-value exports, resulting in higher and less variable foreign exchange earnings than coffee, cocoa and other more traditional commodity exports (Carter et al., 1996).

Trade and welfare implications of horticultural exports have been debated intensively by researchers. Various studies document positive welfare effects of increased horticultural exports for rural households. Other authors have questioned specific issues such as the exclusion of smallholder farmers from horticultural export chains (e.g. Dolan and Humphrey, 2000; Reardon et al., 2009); the exploitation of workers in the horticultural export industries (e.g. Barrientos et al., 2003; Schuster and Maertens, 2016); land-grabbing by multinational export companies (e.g. Baglioni and Gibbon, 2013; Deininger and Byerlee, 2012); the (over-)exploitation of water resources (e.g. Schwarz et al., 2015); and the environmental burden of overseas transport of off-season vegetables (e.g. Brenton et al., 2009).

In the scientific debate on horticultural exports, food security has received very little attention. In a related field on modern food supply chains, there are some recent studies investigating the food security implications of increased supermarket retail; i.e. the work by Chege et al. (2015), Rischke et al. (2015), and Umberger et al. (2015). While the latter two studies focus on urban consumers, the first study shows that the participation of Kenyan farm-households in supermarket channels improves their food and nutrition security. Likewise, Negash and Swinnen (2013) find that smallholder participation in biofuel production through

contract-farming increases food security in Ethiopia. Yet, there are no studies that investigate the direct impact of horticultural exports on food security.

In this article we assess the channels through which horticultural exports can affect food security at the macro- and micro-economic level by reviewing the empirical literature on the implications of horticultural exports. We first describe the trends in horticultural export chains in developing countries in more detail. We then review the different components of food security, including availability, access, utilization and stability. For each of these components we investigate the macro- and micro-level effects and review the existing empirical evidence.

## **2 Trends in horticultural exports**

In all developing regions exports of fruits, vegetables and cut-flowers have increased sharply during the past two decades (Figure 1). In Africa, horticultural exports increased from 3.75 billion USD in 1995 to 16 billion USD in 2014, which comes down to an average annual growth of 7.54%. In developing Asia (including China and India), horticultural exports increased from 14.75 billion USD in 1995 to 66.5 billion USD in 2014, coming down to an average annual growth of 7.82%. In developing America, horticultural exports grew on average 6.32% annually; from 11.75 billion USD in 1995 to 40 billion USD in 2014. For all regions, the sharpest growth has been realized since the turn of the millennium. Horticultural exports in Africa and developing Asia reached double digit annual growth rates during the past 15 years. As a result, horticultural exports are currently the most important agri-food export category in all developing regions, constituting respectively 32.8%, 26.8% and 24% of total agri-food exports in Africa, developing Asia and developing America. Some developing countries, e.g. South-Africa, Kenya, Ethiopia, Peru, Chile, Thailand and China have become important suppliers of fruits, vegetables and cut-flowers in the international market. The largest share of horticultural produce exported from developing countries is destined for high-income countries.

*[Insert Figure 1 here]*

This increased trade in horticultural produce between developing and high-income countries has been associated with: 1/ increased foreign direct investment in developing country horticultural sectors; 2/ increased consolidation and vertical coordination in horticultural export chains; and 3/ an increase in public food safety regulations and the spread of private food standards (Maertens and Swinnen, 2007; McCullough et al., 2008; Mergenthaler et al., 2009; Reardon, 2015; Swinnen, 2007; Weinberger and Lumpkin, 2007). Foreign direct investment in horticultural production, processing and trade has expanded

rapidly in developing countries. This sometimes includes large land-lease deals with multinational companies for horticultural export production. The degree of vertical coordination in horticultural export chains is usually high; arm's-length market relations and spot-market transactions hardly exist. The chains are usually dominated by a limited number of export companies and organized based on contract-farming with local (smallholder) farmers or on vertically-integrated estate production by companies, or a combination of both. In several countries, a shift has been observed in the organization of horticultural export chains with decreased importance of smallholder contract-farming and increased importance of vertically integrated estate farming – e.g. in Kenya (Gibbon, 2003; Humphrey et al., 2004; Jaffee and Masakure, 2005; Ouma, 2010), Senegal (Maertens and Swinnen, 2009), and Peru (Schuster and Maertens, 2013). In destination countries, public food safety regulations for trade in fruits and vegetables have become more stringent (Beghin et al., 2015). In addition, private food standards focusing on food quality and safety, or ethical and environmental aspects of food production and trade have spread in horticultural sectors, with GlobalGAP as one of the most important ones.

Rural households in developing countries are connected to horticultural export chains and affected by horticultural export growth in two main ways (Maertens et al., 2012). First, rural households are affected through product markets, i.e. through the participation in contract-farming with export companies for the production and supply of produce. Second, rural households are affected through labor markets, i.e. through participation in wage employment on the fields and the conditioning centers of export companies. Specific export sectors include a large number of workers, e.g. an estimated 35,000 in the fruit sector in Ghana; 50,000 in the Kenyan horticultural sector; 85,000 in Ethiopian flower industry; and 100,000 in the Peruvian horticultural sector (Jaffee, 2003; Schuster and Maertens, 2016; Staelens et al., 2014). The number of contract-farmers is usually much smaller, e.g. 12,000 in the Kenyan horticultural sector; 9,000 in the Malagasy vegetable sector; and 3,000 in the vegetable sector in Ghana (Legge et al., 2006; Jaffee, 2003; Minten et al., 2009). On the other hand, in some countries horticultural exports remain largely or partially smallholder-based. This is the case e.g. for vegetable exports from Madagascar and Ghana, and fruit exports from Cote d'Ivoire (Maertens et al., 2012; Minten et al., 2009), and for fruit and vegetable exports from China, Vietnam and the Philippines (Verhofstadt et al., 2014; Miyata et al., 2009; Wang et al., 2009).

Due to the shift from smallholder contract-farming to vertically integrated estate farming, and the need for labor-intensive post-harvest handling, participation in horticultural export

chains through labor markets has become particularly important. Empirical studies have demonstrated that especially the poorest households are included in export chains through wage employment while contract-farming with horticultural companies is often biased to relatively better-off households with more land and capital and a higher level of education (Afari-Sefa, 2007; Asfaw et al., 2010; Ashraf et al., 2009; Kersting and Wollni, 2012; Maertens and Swinnen, 2009; Masakure and Henson, 2005; Narrod et al., 2009; Okello and Swinton, 2007). However, some studies do not observe this bias (Roy and Thorat, 2008; Minten et al., 2009; Kleemann et al., 2014). In addition, a large share of the workers in horticultural export companies is female (in some sectors up to 90%), while the majority of contract-farmers are men (Maertens and Swinnen, 2012).

### **3 Horticultural exports and food security**

In this paper we follow the widely used definition of food security that resulted from the 1996 World Food Summit. It relates food security to four main pillars: 1) food availability, which entails a sufficient supply of food (both in terms of quantity and quality) in a specific area, 2) food access, which entails the ability to obtain food and which relates to available resources, markets and policies, 3) food utilization, which entails appropriate use of food in order to absorb nutrients and which relates to nutrition, safety and adequate sanitation, and 4) stability, which entails sustained food availability and access, and which relates to food resilience and environmental sustainability. In this section, we highlight each of these pillars in turn. We explain how horticultural exports affect food availability, access, utilization and stability based on existing empirical evidence and some new evidence from macro-economic statistics. This allows us to draw some conclusions on the overall contribution of horticultural exports to food security in developing countries, despite the lack of evidence on the direct impact of horticultural exports on food security.

#### **3.1 Food availability**

Food availability entails that there is a sufficient supply of food, in terms of quantity and quality, in a certain area. At the macro-economic level the supply of food is determined by food production within a country's boundaries, food stock levels and net food imports. Quantitative evidence on the implications of increased horticultural exports for national food availability is lacking. Therefore, we investigate the correlation between horticultural exports and food availability for a number of individual countries that are most intensively referred to in the scientific literature on horticultural exports.

Figure 2 depicts the evolution of horticultural export values and of food supply measured in kcal per capita per day for selected countries in Africa (Ethiopia, Ghana, Kenya, South-Africa, Senegal and Madagascar), Latin-America (Peru, Argentina, Colombia and Chile) and Asia (China, India and Thailand). In all these countries horticultural exports have increased sharply during the last two decades while also food availability improved. Some countries experienced quite large increases in food availability – most notably Ghana, Senegal, Ethiopia, Peru, China and Thailand – while for other countries food availability improved only slightly – e.g. Madagascar, Colombia and Argentina. Despite these recent improvements, the food availability in some countries remains below the food security threshold of 2,500 kcal per day per person – e.g. Ethiopia, Madagascar and Kenya. The figures do not depict a negative correlation between horticultural export growth and food availability improvements. South-Africa, Chile and China experienced sharp growth in horticultural exports throughout the years 2000s while also food availability steadily increased in that period. In Senegal, Ghana and Peru horticultural exports boomed especially from 2005 onwards and also increases in food availability accelerated in that period. These figures do not reveal a causal relation between horticultural exports and national food supply but nevertheless suggest that there is no negative correlation between horticultural export growth and food availability at the macro-economic level.

*[Insert Figure 2 here]*

Horticultural exports contribute positively to foreign exchange earnings and a country's trade balance, thereby increasing a country's capacity to import food. Especially because of the high intrinsic value of horticultural produce, the effect on a country's trade balance may be important. There are nevertheless concerns that increased agricultural exports are associated with increased dependency on global food trade and reduced availability of food (Khoury et al., 2014; Otero et al., 2013; Pingali, 2007; Winters et al., 2004). Especially in the aftermath of the food price crisis in 2008/2009, heavy dependence on food imports and volatile international market prices was considered to be detrimental to food security in developing countries (De Hoyos and Medvedev, 2011). Yet, Verpoorten et al. (2013) show for a large number of African countries that food security improves with increasing agricultural exports, and that with rising food prices in the period 2005-2008 food security remained remarkably stable.

Horticultural exports may reduce food availability in a country because there is competition for resources between export production and food production for the domestic



market. If more land and labor resources are allocated to horticultural export production, food production and domestic food supply may decrease. Shepard (2011) argues that especially because horticultural export sectors are dominated by large multinational companies, competition for resources is uneven and reduces national food availability. Patel-Campillo (2010) illustrates how expansion of the cut-flower sector in Colombia reduced production of staple food crops such as sorghum, wheat and barley for the domestic market. In other cases, the competition over land resources is less harsh – likely because of higher land availability. Pieters et al. (2016) document that the expansion of the horticultural export sector in Senegal and the land-lease deals with large multinational companies did not reduce smallholders' farm size or the availability of farm land for rural households. In addition, complementarities have been observed between horticultural export production and food production. Minten et al. (2007) show that smallholder contract-farming with the vegetable industry in Madagascar increases the productivity on rice plots of the contract-farmers. The increase in rice yields is attributed to an improvement of soil fertility due to the application of fertilizer and compost, which farmers were taught in the contract-farming scheme. Maertens (2009) shows that workers in the horticultural sector in Senegal use their wages to alleviate liquidity constraints in the household farm, resulting in larger farm sizes, higher farm expenditures and increased farm incomes. In these cases, expansion of horticultural export production results in increased food production for the domestic market through technology and investment spillover effects.

In summary, the available evidence indicates that horticultural export growth does not necessarily jeopardize food availability at the macro-economic level. Competition over resources between horticultural export production and food production might exist but whether this reduces a country's food availability depends on whether reduction in domestic food production is compensated for by increased food imports. There is not necessarily a trade-off between horticultural export production and domestic food production; both may grow at the same time.

### **3.2 Access**

Access to food implies that an individual, a household, a community or society has the ability to obtain a sufficient quantity of sufficiently nutritious food. Access to food is determined by the resources or endowments one has, to make claims over food that is available in a certain area. Access to food can be direct, i.e. access through own food production, or indirect, i.e. access through the market. Access to productive resources and purchasing power are important determinants of respectively direct and indirect access to food. Very few studies

have analyzed the direct link between households' participation in contract-farming with the horticultural export industry or wage employment in the sector and households' food security. Participation in horticultural export chains, either through contract-farming or through wage employment, may affect households' indirect and direct access to food.

First, *indirect access to food* may increase if contract-farmers and employees in the horticultural export sector benefit in terms of higher incomes, leading to increased purchasing power and reduced poverty. Many empirical studies in various countries and sectors, have documented positive income and poverty-reducing effects of participation in contract-farming for horticultural export production: Minten et al. (2009) show that smallholder vegetable farmers in Madagascar benefit in terms of higher incomes and a reduced length of the hungry season; Wang et al. (2014) and Miyata et al. (2009) document positive income effects for smallholder horticultural farmers in China; Roy and Thorat (2008) and Narayanan (2014) for horticultural export farmers in India; Carletto et al. (2011) for smallholder horticultural farmers in Guatemala; Maertens and Swinnen (2009) for bean and mango exports in Senegal; and Muriithi and Matz (2015) for vegetable exports in Kenya. Measured income effects are sometimes quite large; up to a doubling or tripling of incomes (e.g. Maertens and Swinnen, 2009; Wang et al., 2014). In other cases, effects are more modest and need to be nuanced: Carletto et al. (2011) indicate that especially early entrants in contract-farming experienced substantial income benefits while later entrants hardly benefited in Guatemala; Narayanan (2014) indicates that income effects vary widely across horticultural products and are even negative for some products in India.

Some authors have shown that the adoption of private standards in horticultural export sectors leads to additional benefits for smallholder contract-farmers: e.g. Becchetti and Costantino (2008) demonstrate that Fair Trade certification of Kenyan vegetable export farms improves households' income, food consumption and dietary quality; Asfaw et al. (2010) show that GlobalGAP adoption leads to higher incomes for smallholder vegetable producers in Kenya; Kleeman et al. (2014) show that pineapple export farms in Ghana benefit from GlobalGAP and organic certification; Handschuch et al. (2013) find that certification to GlobalGAP or USGAP among Chilean raspberry farmers doubles their incomes; Holzapfel and Wollni (2014) find that GlobalGAP certification among horticultural farmers in Thailand has significant positive income effects but not for the smallest farms.

In addition, households may benefit from participation in horticultural export sectors through wage employment in terms of higher incomes, reduced poverty, increased purchasing

power, and ultimately increased food security. This is however a more contentious issue. Maertens and Swinnen (2009) and Maertens et al. (2011) find substantial positive income effects of employment in the horticultural export sector in Senegal. For the same sector, Maertens et al. (2012) report that wages in the sector are substantially higher than in other rural employment sectors, and Colen et al. (2013) show that GlobalGAP certification of export companies leads to higher wages. Mano et al. (2011) indicate that employment in the cut-flower industry in Ethiopia results in higher wages. On the other hand, studies by Barron and Rello (2000) for the tomato export industry in Mexico, Ortiz and Aparicio (2007) for the lemon export sector in Argentina, and Patel-Campillo (2010) for the cut-flower export sector in Colombia report that wages in these sectors are particularly low and do not result in substantial income gains. The latter study indicates that real wage rates in the Colombian cut-flower industry did not increase over time while real food prices did, resulting in decreasing purchasing power for workers. Comparing the size of the income effects, contract-farming usually results in higher income contributions than wage employment – this is most apparent for Senegal, where these income effects have been explicitly compared (Maertens and Swinnen, 2009). Yet, given that employees in a particular export sector are usually more numerous and come from a poorer segment of the population (see section 2), it is especially through labor market channels that horticultural exports may contribute to increased access to food at the micro-economic level. In certain cases – most notably in horticultural export sectors in Latin-America where wages in the sector are rather low – this may require improvements in employment conditions .

Second, *direct access to food* may be affected by participation in horticultural export chains. If households re-allocate land, labor and capital resources from food production for own consumption to horticultural production for the export market, their direct access to food may decline. Dolan (2001) reports that smallholder contract-farming in the vegetable export sector in Kenya, which is dominated by male farmers, results in female farmers losing their access to land for the cultivation of food crops for household consumption. On the other hand, technology, managerial and investment spillovers from contract-farming with export companies or wage employment in these companies may result in increased food production at the household level. As documented in the previous section, such spillover effects at the household level have been observed in Madagascar, where rice production increased as a result of technology spillovers from vegetable contract-farming (Minten et al., 2007); and in

Senegal where wages earned in the export industry are partially invested in the household's own farm (Maertens, 2009).

Expansion of horticultural exports in developing countries entails a shift for rural households from direct access to food from own farm production to indirect access to food through the market. This is not necessarily bad for food security. If the increase in purchasing power from participation in export supply chains is large enough – which is likely, given the magnitude of estimated income effects – the increase in indirect access to food will offset the reduction in direct access. In addition, relying on the market for access to food instead of on own production may increase access to more nutritious food. Sibhatu et al. (2015) demonstrate in a cross-country analysis that indirect access through markets increases households' dietary diversity in comparison with direct access from production on the household farm where nutrition diversity is small.

The expansion of horticultural export sectors in various countries has been associated with the development of rural labor markets, and with increased employment opportunities for women in areas where these were scarce before (see section 2). Female wage employment in horticultural export sectors results in a higher share of income being controlled by women (Maertens and Swinnen, 2012), which might be conducive for food security at the household level. It is often argued that women are more likely than men to spend money on food, and more nutritious food in particular (Fisher and Qaim, 2012; Malapit et al., 2015). While other gender specific effects resulting from female employment in horticultural export sectors have been observed – specifically reduced fertility (Van den Broeck and Maertens, 2015) and increased child education (Maertens and Verhofstadt, 2013) – the direct impact on food and nutrition security has not been studied.

To summarize, the available evidence suggests that participation of rural households in horticultural export chains, either through contract-farming or through wage employment, improves households' indirect access to food. Especially female employment in horticultural export sectors may be conducive for food and nutrition security. Reallocation of land and labor resources to export production, may reduce household's direct access to food – although technology and investment spillover effect may increase food production as well – but this is likely compensated by higher incomes and purchasing power.

### 3.3 Utilization

The utilization component of food security refers to aspects of nutritional quality and to safety and sanitation of food consumption. We discuss these two issues in turn. We need to note that our arguments in this section are hardly underpinned with empirical evidence and need to be interpreted as hypothesized effects for which evidence is largely lacking.

First, the development of a horticultural export sector may stimulate the domestic fruit and vegetable sector and induce a shift in the diet of people towards more fresh horticultural produce (Gómez and Ricketts, 2013). Export companies and contract-farmers may sell a share of their produce on the domestic market if international market conditions are not good, if supply exceeds the demand from their buyers or if produce does not meet the stringent criteria of export markets. Suzuki et al. (2011) report that Ghanaian pineapple farmers sell domestically when international market prices are low. On the other hand, employment of women in horticultural export sectors may negatively affect food utilization. As women are most often responsible for food preparation in the household, their increased workload as wage employees may reduce the time spent on food preparation. This could lead to more convenient, ready-made and less nutritious food in households' diet but evidence on this is lacking. However, as discussed in the previous section, wage employment in horticultural export sectors contributes to household income and female control over income, which is likely to improve diet diversity and nutrition.

Second, horticultural export sectors have to comply with stringent food safety and (phyto-)sanitary regulations and increasingly comply with even more stringent private standards. Good agricultural and (phyto-)sanitary practices in export sectors may influence practices in domestic food sectors and improve safety and sanitary conditions of domestic food production and distribution (Unnevehr, 2015). GlobalGAP, as one of the most widespread private standards in global horticultural supply chains, has given rise to domestic standards that are benchmarked against it, such as ChileGAP and KenyaGAP, and that are increasingly used in domestic horticultural sectors. In addition, contract-farmers who apply good agricultural practices on their contracted fields for export production may use these practices also on other fields or in other seasons for domestic food production. Besides these rather indirect effects, wage employment in horticultural export sectors can entail a more direct effect on sanitation and food utilization. Workers in horticultural export companies (especially female workers responsible for food preparation in the household) who have to

comply with specific sanitary practices at the workplace, such as washing hands, may use these practices at home; resulting in improved sanitary conditions of food preparation.

To summarize, horticultural exports may increase households' nutritional intake and the use of stringent standards in these sectors may contribute to improved food safety and sanitation of domestic food consumption. Empirical evidence on these effects is lacking.

### **3.4 Stability**

The stability component of food security refers to continued availability and access to food at the macro- and micro-economic level. We identify three ways in which horticultural exports can affect stability of food security. First, at macro-economic level, the stability/volatility in horticultural export earnings determines the long-term capacity of countries to import food to guarantee food availability in the country in the long run. Export earnings from horticultural produce might be more stable than export earnings from traditional tropical commodities such as coffee, tea and cocoa. Horticultural export prices are generally more stable than commodity prices (English et al., 2004) and horticultural export produce is more varied than exports dominated by one or two commodities. Horticultural produce constitutes not only perennial crops (most fruits) but also annual crops (most vegetables), which allows a faster reaction to price and other shocks. Hence, horticultural exports make countries less vulnerable to price shocks. In addition, horticultural export chains are demand-driven and characterized by tight vertical coordination at different nodes in the chain (Dolan and Humphrey, 2004; Gereffi et al., 2005; Swinnen and Maertens, 2007). This includes more direct, personal and long-term commercial relations between exporters and overseas buyers, and reliance on custom-made transactions; which is conducive for stability in exports.

Second, at the micro-economic level, the stability of farmers' and workers' participation in horticultural export supply chains – and how this is guaranteed in contractual agreements – matters as this determines their purchasing power and access to food in the long run. Farmers and workers in horticultural export chains often derive a large share of their income from the horticultural export sector, resulting in increased income, purchasing power and food security (see section 3.2). Yet, the stability of their food security depends on the risk in production and employment contracts with horticultural export companies and the long-term access to these contracts. For suppliers, contract-farming entails lower production and marketing risk than spot-market transactions because of input delivery on credit and guaranteed market access, often at a guaranteed price (Swinnen and Maertens, 2007; Swinnen, 2007). Dedehouanou et al. (2013) demonstrate for the Senegalese horticultural export sector that contracting entails

non-monetary benefits, such as reduced marketing risk, better access to inputs and credit, and better access to improved technologies. Yet, in several countries the growth in horticultural exports has been realized through vertically integrated estate-farming, leading to smallholder suppliers being excluded from export chains. In addition, it has been observed that exporters straddle between sourcing from smallholder producers and own vertically-integrated estate production as a strategy to compete in the market and satisfy buyers' demand – e.g. documented for the Senegalese horticultural export sector by Baglioni (2015). These observations put some doubt on the continued and stable involvement of smallholder suppliers in horticultural export chains and associated beneficial income and food security effects. On the other hand, in many countries horticultural export growth has not been associated with decreasing smallholder involvement and exports remain largely or partially smallholder-based.

For workers, horticultural export sectors provide an increasingly important source of rural employment and growth in the sector may contribute to securing jobs in the long run. Yet, permanent and secure employment contracts are often lacking in export industries. Selwyn (2009) reports a high labor flexibility in the Brazilian grape export sector; Barrientos et al. (2003) report similar conditions in the Chilean and South African deciduous fruit sectors; and Schuster and Maertens (2016) in the horticultural export sector in Peru. High seasonality in employment and casual and unsecure employment contracts may result in volatility in wage earnings and jeopardize stability in access to food for those households with a high dependency on wage employment. On the other hand, it has been documented that private standards in horticultural export sectors can result in longer employment periods and more secure labor contracts, and improved working conditions in general (e.g. Aparicio et al., 2008; Ehlert et al., 2014; Nelson et al., 2007). Colen et al. (2012) document that the adoption of GlobalGAP among Senegalese export companies leads to longer employment periods and higher wages for workers; but not to more secure labor contracts. Schuster and Maertens (2016) show that private food standards in the Peruvian horticultural export sector increase contract security and the likelihood of receiving the minimum wage; but have no impact on the length of employment, nor on the level of the wage. This implies that employment conditions in horticultural export sector need to improve in order to guarantee more stable and secure employment, and that private standards may play a role in achieving this. However, some authors have argued that private standards are very unlikely to improve employment conditions of workers in horticultural export sectors, as the majority of workers have

informal, casual labor contracts (Barrientos et al., 2003; Riisgaard, 2009; Tallontire et al., 2005).

Third, future food production and income-generating capacity of countries and communities hinges on the continued availability of resources. Hence, the sustainability of natural resources exploitation in horticultural export sectors matters for stability in food security. Agricultural export production in general and large export companies in particular are often blamed for overexploitation of water and soil nutrient resources, and for pollution of soils and the environment through overuse of chemical fertilizer and pesticides. The existing evidence for horticultural export sectors largely refutes the concerns related to fertilizer and pesticide use, and soil nutrient overexploitation. Sierra et al. (2015) find that horticultural exports lead to higher soil organic carbon stocks in Guadeloupe. Galt (2008) indicates that horticultural farmers in Costa Rica do not intensify pesticide use when switching to export production. In addition, Okello and Okello (2010) and Asfaw et al. (2009) show that the spread of EU public and private food standards have reduced pesticide use, and particularly the use of hazardous pesticides, on Kenyan horticultural export farms. The evidence with respect to concerns of water overexploitation are more mixed. Ulrich (2014) indicates that local farmers perceive the expansion of horticultural export production to be associated with increased water scarcity in the Laikipia area in Kenya. Vera (2015) and Schwarz et al. (2016) expressed concerns about unsustainable water use in the asparagus export sector in the arid coastal zone of Peru. Yet, in a cross-country study on virtual water trade, Schwarz et al. (2015) point out that the growth in horticultural exports is beneficial for developing countries from a water efficiency perspective.

To summarize, the available evidence indicates that horticultural exports can contribute to the stability of food security in developing countries but that there are particular challenges, most importantly stable and secure employment in export sectors and the sustainable use of water resources. The evidence suggests that public and private food standards may contribute to overcoming these challenges and guaranteeing the contribution of horticultural exports to food security in the long run.

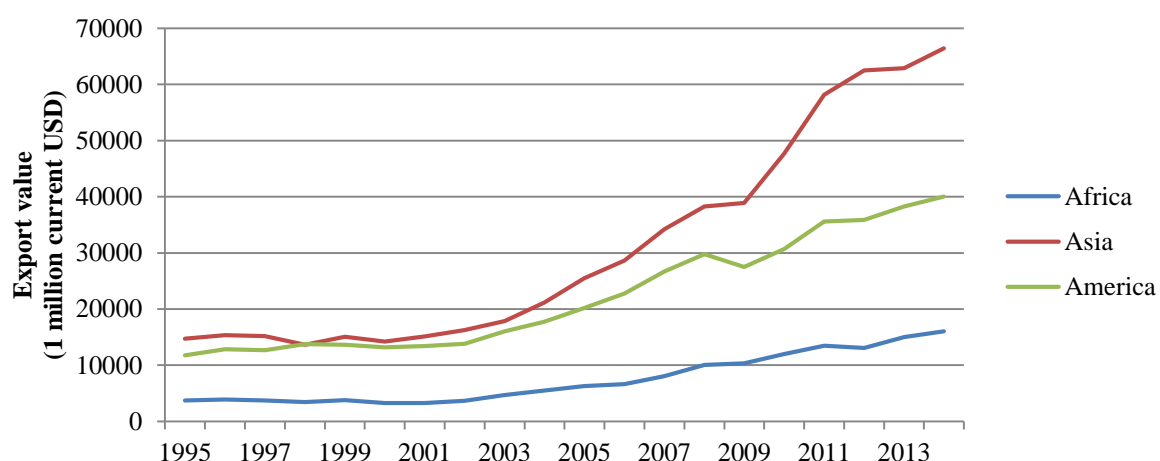
#### **4 Conclusion**

In this article we assess the channels through which horticultural exports can affect food security by reviewing the empirical literature. The available evidence suggests that in many developing countries horticultural exports contribute to food security. At the macro-economic



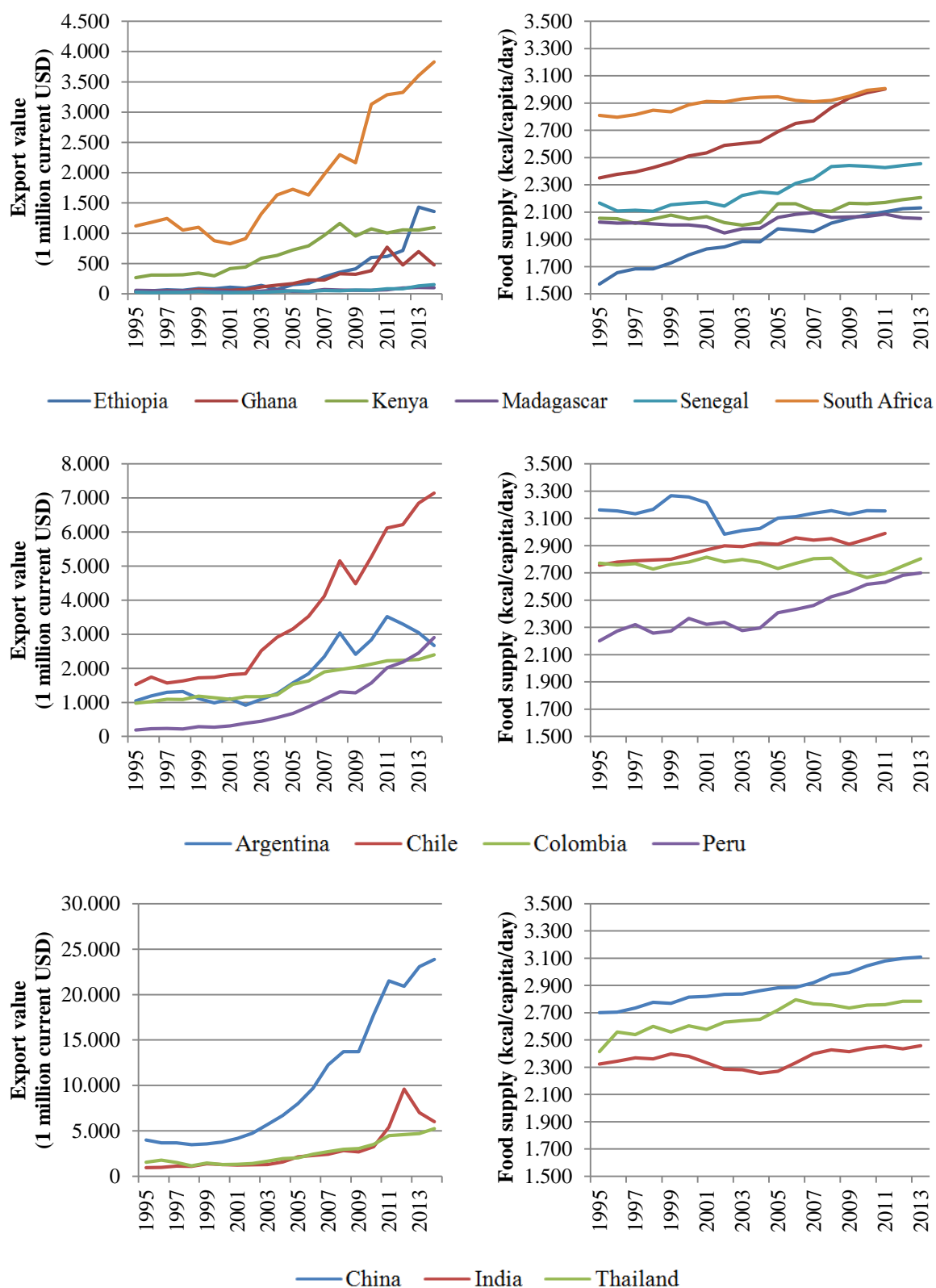
level, horticultural export growth does not necessarily jeopardize food availability; horticultural exports do not necessarily reduce food production for the domestic market and have a positive effect on a country's trade balance. At the micro-economic level, horticultural exports contribute to improved access to food, mainly by increasing the income and purchasing power of contract-farmers and workers in the export chains. Especially the development of rural labor markets and participation of women in wage employment in horticultural export companies is conducive for improved food security. Particular challenges for horticultural export companies are to provide secure employment at remunerative conditions – especially in Latin-America this is a challenge – and the sustainable use of water resources. The evidence suggests that private food standards may contribute to overcoming these challenges and guaranteeing the contribution of horticultural exports to food security in the long run.

Empirical evidence that directly measures the implications of increased horticultural exports for food availability at the macro-economic level is very scarce – if not completely absent. The same holds for empirical evidence on the direct impact of contract-farming and (female) wage employment in horticultural export chains on food and nutrition security at the household level. Such evidence is needed to corroborate our findings derived from reviewing the literature that only deals with food security in indirect ways. Ideally, such evidence comes from panel data, which allows to more accurately estimate causal effects and to assess dynamic and long-term effects.



**Figure 1.** Evolution of the export value of horticultural products for developing countries in Africa, Asia and America over the period 1995 – 2014. Horticultural products include the following SITC classification codes: 054 vegetables, 056 vegetables, roots, tubers, prepared or preserved, 057 fruits and nuts (excluding oil nuts), fresh or dried; 058 fruit, preserved and fruit preparations (no juices); 059 fruit and vegetable juices, unfermented, no spirit; 292 Crude vegetable materials (including 292.7 cut-flowers and foliage).

SOURCE: Authors' calculation based on UNCTADstat data.



**Figure 2.** Evolution of the export value of horticultural products (in USD) and national food availability (in kcal per day per capita) for selected countries in Africa, Latin-America and Asia over the period 1995 – 2014. Horticultural products include the following SITC classification codes: 054 vegetables, 056 vegetables, roots, tubers, prepared or preserved, 057 fruits and nuts (excluding oil nuts), fresh or dried; 058 fruit, preserved and fruit preparations (no juices); 059 fruit and vegetable juices, unfermented, no spirit; 292 Crude vegetable

materials (including 292.7 cut-flowers and foliage). SOURCE: Authors' calculation based on UNCTADstat and FAOstat data.

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