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Export horticulture and poverty in Kenya

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Summary

The reduction of absolute poverty has become a central goal of the international community including the governments of many developing countries. However, the appropriate strategy for achieving pro-poor growth in any given country remains an open question. In sub-Saharan Africa, the promotion of export horticulture has often been proposed as a pro-poor development strategy due to its intensive use of land and unskilled labour. However, few studies have examined the linkage between export horticulture and poverty reduction. This paper reports the results of a household survey in Kenya undertaken explicitly to compare the incomes of households involved in export horticulture with those which are not. We find evidence that households involved in export horticulture are better off than those which are not, particularly in rural areas. A simulation exercise shows that enabling more households to participate in the sector could reduce poverty substantially in both urban and rural areas. However, analysis of the determinants of participation in export horticulture suggests that some households may face important constraints to participation in the sector.

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1 Introduction

With the adoption of the International Development Targets, poverty reduction is now at the top of the agenda for international donors.[1] Governments of developing countries across the world have adopted poverty reduction strategies with the explicit aim of achieving substantial reductions in the proportion of their populations falling below nationally set poverty lines. However, the appropriate strategy for achieving pro-poor growth in any given country is still an open question. Nowhere is this truer than in sub-Saharan Africa much of which has suffered from slow or negative per capita growth for two decades. The development strategies of the 1960s based on large-scale capital intensive integrated rural development have been widely criticised, as have the attempts at import substituting industrialisation of the 1970s (Balassa 1980). Equally, many African countries have become disillusioned with the strategy of traditional export led growth because of the secular decline in the price of many of the primary commodities which constitute their main exports. Consequently several African countries have looked to non-traditional exports to provide a platform for growth and development. Inevitably countries have tended to focus on non-traditional exports which reflect their comparative advantage and for many countries this has pointed to the export of non-traditional horticultural crops.

Horticultural exports have grown dramatically in many sub-Saharan African countries[2] while many other agricultural commodities have faced stagnation and declining world prices. In addition, the horticulture industry provides an important source of foreign exchange, generates substantial employment[3] and has contributed to the upgrading of agricultural production skills.[4] But has the growth in export horticulture contributed to significant poverty reduction? A number of studies have raised concerns about the benefits which export horticulture provides to employees and the wider economy. Such studies have shown that workers in the sector often have to work long hours in poor conditions for low pay. Other studies point to gender and other forms of discrimination within the sector.[5] Of course if there were no alternative use of the resources absorbed by the sector then, despite these drawbacks, the sector would contribute to greater poverty reduction than its absence. However, in the long-run resources can clearly be used for more than one purpose. Consequently, whether the sector contributes efficiently to poverty reduction depends upon whether an alternative use of the same resources might reduce poverty by more.

One way to determine whether this is the case is to examine the incomes of both horticultural and non-horticultural workers and to test whether it is true that, holding everything else equal, horticultural

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[1]   See (OECD 1996) for the original statement of the International Development Targets.
[2]   Imports of fresh and chilled leguminous vegetables into the EU rose by 133 per cent between 1989 and 1997 with almost three-quarters of the value of these exports coming from sub-Saharan Africa (Dolan, Humphrey *et al.* 1999).
[3]   Including workers in packhouses, exporters' own and large contact farms, and smallholders, the World Bank estimated that the export horticultural industry provided jobs to 2 million people in Kenya (World Bank 1995) quoted in (Dolan 2001).
[4]   Several authors point to the advantages of export horticulture – see (Schapiro and Wainaina 1991; Dijkstra and Magori 1995; Dunham 1995; Jaffee and Morton 1995; Dolan and Humphrey 2000) among others.
[5]   See (Barrientos, McClenaghan *et al.* 1999) for the case of fruit farmers in South Africa and (Little and Dolan 1993) for the case of workers in the Gambian horticultural industry.

workers are better off. If they are, then this provides at least preliminary evidence that the horticultural sector may be making a greater than proportionate contribution to poverty reduction (and conversely if not). We have therefore undertaken a survey of horticultural and non-horticultural households in urban and rural Kenya. Our survey asked about the demographic and educational characteristics of the household as well as detailed information enabling the calculation of household income. We use this data to give a tentative indication of whether participation in the horticultural sector benefits the poor. To our knowledge, no previous studies have attempted to compare horticultural and non-horticultural workers in a systematic way to determine the relative efficiency of the horticultural sector in poverty reduction.

Our paper is organised as follows. Section 2 reviews the literature on the export horticulture industry in Kenya and the separate literature describing the extent of poverty in Kenya and hypotheses. Section 3 introduces our household survey data explaining the sampling procedure and implementation of the survey. This section also describes the characteristics of the sample households and presents detailed information about their sources of income and a profile of poverty amongst the sample households. Section 4 introduces our econometric analysis of the data, looking at the determinants of income and participation within the sector. Section 5 uses this analysis to simulate the impact on poverty of switching households into the horticulture sector. Section 6 concludes.

2 Literature review

2.1 The export horticulture industry in Kenya

Large scale horticultural production in Kenya started during World War II to supply food to the Allied Forces stationed in East Africa. Since then, Kenya's export horticultural industry, despite being a late-comer in the global market, has rapidly caught up with the market leaders (Dijkstra and Magori 1995; Jaffee 1995). At the time of independence in 1963, horticultural products accounted for only 0.3 per cent of total export value, but from the late 1960s, exports expanded both in volume and in the diversity of crops (Schapiro and Wainaina 1991; Jaffee 1995). Between 1963 and 1991, horticultural exports from Kenya rose by approximately twelve times in terms of tonnage and by forty times in terms of value (Jaffee 1995). By the late 1990s, Kenya supplied some 75 horticultural products to overseas markets not only as raw products but also as pre-packed and pre-prepared vegetables (Jaffee 1995; Dolan and Humphrey 2000).

Leguminous and "Asian" vegetables have increasingly replaced coffee and tea as the major export crops (Jaffee 1995). Horticultural produce (which includes vegetables, flowers and fruit) represents 13 per cent of the value of Kenya's exports and is one of the top four foreign exchange earning industries (Chweya, Kimenye *et al.* 1995). Since 1995 the volume and value of horticultural exports has continued to grow reaching Ksh 14.9 million in 1998 (Government of Kenya 2000). Kenya is now by far the largest exporter of vegetables to the European Union (Dolan and Humphrey 2000). Table 2.1 shows the growth

Table 2.1 Volume and unit price of horticulture, coffee and tea exports 1995–1999

	1995		1996		1997		1998		1999	
	Tonnes	Price	Tonnes	Price	Tonnes	Price	Tonnes	Price	Tonnes	Price
Horti-culture	228,576	46.49	304,461	44.77	192,629	71.39	232,217	64.32	200,624	87.93
Fresh vegeta-bles	37,561	n.a.	46,836	56.30	33,703	80.45	69,392	53.53	43,436	99.64
Prepared vegeta-bles	9,493	91.58	11,733	87.38	13,869	76.92	11,825	76.97	14,506	93.78
Coffee	88,519	163.21	116,371	142.47	70,066	247.00	51,578	252.91	71,581	171.75
Tea	217,937	82.54	262,146	86.61	199,224	121.10	263,771	124.99	245,710	133.44

Source: Government of Kenya (2000), Tables 7.5 and 7.7, and personal communication.
Note: (1) The figures for 1999 are provisional.
(2) Price indicates unit price per kilogram; the price of coffee is for unroasted coffee.
(3) Horticulture includes cut flowers, fruits and vegetables, both fresh and processed.

in the volume and unit price of horticultural exports compared to coffee and tea exports between 1995 and 1999.

The horticultural exporters in Kenya were initially a small number of Kenyan Asians who had expertise in domestic horticultural production and marketing, and had good connections with immigrants in Europe. Large exporters with financial and managerial backgrounds (mainly Kenyan Europeans and expatriates), then entered the business in the 1980s, as did many local entrepreneurs (Jaffee 1995). However, only a few African-owned companies have survived, and a handful of large exporters dominate the industry.[6] Most of these exporters have contracts with large UK and other European retailers and have established processing factories near Nairobi's international airport where vegetables delivered from rural areas are sorted, washed, weighed, processed and packed. The large exporters initially focussed on the export of fresh vegetables, but in recent years there has been a large increase in the export of processed vegetables which have a higher value per weight than raw vegetables.

The production of vegetables for export was initially done primarily by smallholders (Islam 1990; Harris 1992; Dijkstra 1997) report that smallholders represented the majority of the providers of horticultural products by the 1990s.[7] However, by the late 1990s Dolan and Humphrey report that 40 per cent of the products for export came from exporters' own farms or leased land, 42 per cent came from large commercial farms, and 18 per cent from smallholders (Dolan and Humphrey 2000). Thus the tightening of European regulations on pesticide use and the costs of collecting output from multiple

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[6] See (Jaffee 1995; Dolan, Humphrey *et al.* 1999). In 1991, the six largest exporters had nearly 75 per cent of the total trade value (Jaffee 1995).

[7] Indeed one of the reasons policymakers have been supportive of the industry is because of its potential for improving the incomes of rural smallholders who constitute the majority of Kenya's poor. However, the importance of irrigation and the appropriate application of pesticide for export production, has meant that only smallholders with access to water and inputs have been able to produce for export with the vast majority of horticultural production intended for domestic consumption (Chweya, Kimenye *et al.* 1995).

smallholders appears to be leading to greater production on large farms in which growing conditions can be more carefully controlled.

The success of the Kenyan export horticulture industry can be attributed in part to Kenya's natural advantages for the production of horticultural crops. The agro-climatic conditions are ideal and Kenya's location on the equator enables round the year production – a characteristic not shared by competitors such as Egypt and Morocco. In addition production is highly intensive in the use of relatively low skilled labour and therefore in keeping with Sub-Saharan Africa's comparative advantage in the production of land and labour intensive goods.

However, the production and marketing difficulties associated with the horticulture industry are substantial. Horticultural products are perishable and delicate, so it is essential to handle them carefully and to minimise the length of time from harvest to their arrival on the shelves in overseas retail outlets. This requires considerable investment in post-harvest facilities and transport infrastructure as well as immediate access to air-cargo capacity. It also requires managerial and marketing skills to link production planning with marketing and distribution. The nature of the horticulture industry has therefore helped Kenyan exporters to develop the necessary technical and managerial skills and has encouraged the development of suitable infrastructure and financing mechanisms, although exporters do still face constraints due to Kenya's domestic transport infrastructure and the cost of access to air freight (Jaffee 1995; Dolan and Humphrey 2000).

The Kenyan government recognised the potential of export horticulture in the 1960s, and has adopted policies promoting the industry, notably the establishment of the Horticultural Crops Development Authority (HCDA). However, unlike the tea and coffee sectors, the government's interventions have been limited. For example, the government issues export licences, but it does not impose substantial export taxes nor attempt to control the marketing or distribution of the crop.[8] Indeed, some authors have argued that the lack of government intervention is one of the reasons for the success of the industry (Dolan and Humphrey 2000).

2.2 Poverty in Kenya

Poverty in Kenya, as in much of sub-Saharan Africa, is widespread and deep. The latest national household survey, the Welfare Monitoring Survey III (WMS), estimated that 13.4 million Kenyans, just over half of the population, lived below the total poverty line in 1997 (Government of Kenya 2000).[9] Table 2.2 shows the trend in poverty between 1992 and 1997. Poverty in Kenya is predominantly rural,

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[8]   Dijkstra (1997) states that the high risks involved in trading perishable vegetables make it difficult for the government to intervene.

[9]   An individual is defined to be food poor if their (per adult equivalent) expenditure on food is insufficient to meet the FAO/WHO recommended daily allowance of 2,250 calories per adult. This allowance translated into a food poverty line of Ksh 15,047 in urban areas and Ksh 11,125 in rural areas in 1997. Total poverty, which the WMS refers to as overall poverty, implies that per adult equivalent total expenditure (including both food and non-food) does not meet the total poverty line which was Ksh 31,776 in urban areas and Ksh 14,866 in rural areas in 1997. Note that the WMS total poverty line makes a very large allowance for non-food expenditures in urban areas but a much smaller allowance in rural areas. This is likely to inflate the relative size of urban poverty.

Table 2.2 The trend in poverty in Kenya between 1992 and 1997

	% of Food poor			% of Total poverty		
	1992	**1994**	**1997**	**1992**	**1994**	**1997**
Nairobi	41.92	27.26	38.38	26.45	25.90	50.24
Rural	71.78	47.19	50.65	47.89	46.75	52.93
Total	n.a.	n.a.	n.a.	44.78	40.25	42.32

Source: Government of Kenya (2000), Table 4.9.
Note: (1) Food poverty refers to the percentage of individuals whose per adult equivalent expenditure falls below the food poverty line. Total poverty refers to the percentage of individuals whose per adult equivalent expenditure falls below the total poverty line.
(2) n.a. indicates the data are not available.

Table 2.3 Total poverty headcount by socio-economic group

	Urban		Rural	
	Household	**Individual**	**Household**	**Individual**
Household head				
Male	41.07	47.22	45.88	52.66
Female	52.69	62.50	47.42	54.27
Household size				
1–3	33.92	33.92	32.26	32.26
4–6	53.82	53.82	48.26	48.26
7+	53.84	53.84	61.23	61.23
Education				
None	60.75	67.39	57.54	64.28
Primary level	54.90	65.03	47.08	54.13
Secondary level	34.53	39.68	26.52	33.59
Form 5 and above	9.71	13.71	1.94	6.46
Employment				
Public	32.33	38.92	20.57	26.90
Semi–public	27.12	29.42	33.48	42.01
Private formal	32.79	37.32	31.91	41.81
Private informal	53.37	63.47	48.20	54.46

Source: Government of Kenya (2000), Annex Tables 10 and 11.
Note: Household level poverty indicates percentage of households below the poverty line; individual level poverty indicates percentage of individuals below the poverty line.

but urban poverty, which was not regarded as important in the 1970s, is increasing rapidly (Collier and Lal 1980). The percentage of the population with food expenditures below the food poverty line declined between 1992 and 1994 but increased again between 1994 and 1997, both in Nairobi and in rural areas.[10] The total poverty headcount remained between 46 per cent and 53 per cent between 1992 and 1997 in rural areas, but in Nairobi the poverty headcount reported by the WMS surveys increased dramatically between 1994 and 1997 (Government of Kenya 2000).

Table 2.3 shows the socio-economic characteristics of the poor reported by the WMS. The incidence of poverty is high among female-headed households, larger households, households headed by people with no education, and those engaged in private informal sector jobs.

Regionally, the incidence of poverty is particularly high in the arid and semi-arid districts of Northern Kenya as well as in Western Kenya and Eastern and Coastal Provinces (Government of Kenya 2000). However, because of the size of the population in different provinces, the rural areas of Eastern, Nyanza, Rift Valley and Western Provinces contain the highest numbers of poor people.

2.3 The potential impact of the horticulture industry on poverty alleviation

The horticulture industry is likely to affect poverty in different ways in urban and rural areas. In Nairobi, exporters employ workers in packhouses. The majority of these workers are unskilled or semi-skilled women engaged in weighing, grading, cutting and packing vegetables. Most are employed on a casual basis or on short seasonal contracts. Wages are not high, although they are typically well above the government set minimum wage. Work is also highly seasonal with long working hours in the peak season and a much reduced demand for workers in the low season. Given these characteristics one would expect the horticulture industry to reduce poverty in urban areas by providing employment to unskilled women who might have few other job opportunities.

In rural areas, export horticulture contributes to poverty reduction in two ways. Firstly, exporters generate considerable employment both on their own farms and on farms producing for exporters under contract. The working conditions for workers in owned and large contract farms are similar to those in packhouses – employment is mostly casual and earnings are seasonal. The extent to which this employment reduces poverty depends upon both the wage received and the availability of alternative forms of employment in horticultural areas. However, given the lack of job opportunities in rural Kenya and the increase in the number of landless and marginal farmers, it is likely that the industry provides an important source of additional income for unskilled land-poor households.

The second way in which the horticulture industry may benefit the poor is through the purchase of produce from smallholders. Smallholder development is particularly important in redressing rural poverty in Kenya (Collier and Lal 1980). Furthermore, smallholder production of horticultural crops has several advantages: the use of family labour saves supervision costs and the additional care taken by smallholders

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[10]   The figure for poverty in urban areas presented in Table 2.2 is for Nairobi, not for all urban areas, to aid comparability with our urban survey which was conducted only in Nairobi.

can provide high yields of good quality produce from relatively small plots of land (Collier and Lal 1980; Islam 1990).[11] Since, the majority of farmers own less than four acres of land (Government of Kenya 2000) and often have poor access to credit, agricultural inputs and extension services, the opportunity to produce a high-value crop and to obtain assistance with key services and inputs is likely to have a major impact upon the incomes of such smallholders. However, the poverty reduction impact of the industry will be determined by the extent to which the smallholders producing for exporters were initially poor. If exporters choose to buy from relatively well off smallholders, then the poverty impact will be muted.

3 Data

3.1 Data set and sampling

To explore the impact of export horticulture upon poverty in Kenya, data were collected from 263 households in urban and rural Kenya between April and June 2001. The purpose of the survey was to obtain detailed data on the characteristics of these households and their household income, in order to estimate the determinants of income and of participation in the export horticulture industry and to examine the effect of the industry on poverty alleviation.[12]

In the urban area, Nairobi, the households of 40 packhouse workers **(PH)** were selected from those working in three major export horticultural companies, Homegrown, Everest and Vegpro. In order to compare incomes and levels of poverty between households which participate and those who do not participate in export horticulture, non-packhouse worker households **(NPH)** were also interviewed. Since we were primarily interested in the impact of export horticulture on the incomes of otherwise similar households, we selected 42 non-packhouse worker households from the neighbours of the packhouse worker households in the estates where the latter households are concentrated.[13] It was assumed that the characteristics of households living in the same compound or vicinity would be more likely to be similar than those living in much richer areas.

The rural sample was drawn from the region surrounding Mount Kenya which is one of the main growing regions for export horticulture. The sample was drawn from four strata based on the nature of the household's involvement in the horticulture industry. The first strata consisted of workers in the farms owned by Homegrown, Vegpro and Everest in Timau and Nanyuki **(OF)** – 40 households were sampled. A further 20 households were selected from the workers in the large contract farms **(LF)** producing for Homegrown and Everest in Timau. The third component of the sample was drawn from smallholders **(HS)** which produce export horticultural crops in a variety of locations along the Meru-Nairobi road.[14] Finally, again to enable comparison with households not involved in export horticulture, 80 non-

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[11]   For the debate on the relative efficiency of small and large farms see (Collier and Lal 1980; Glover 1984; Dunham 1995) among others.
[12]   To make the survey manageable we focussed on workers and smallholders involved in the production of vegetables for export. The survey did not cover workers or smallholders producing fruit or flowers.
[13]   These were Kayole, Embakasi village, Pipeline/Sinai/Kware, Dandora, Huruma/Mathare North and Mukuru Kwajenga.
[14]   The locations were Kangutu, Girune, Nkubu, Kigene and Michune.

horticultural smallholders **(NHS)** were sampled from the vicinity. Since many households in the survey area were involved in the production of horticultural produce, it was not easy to identify households which did not produce horticultural crops at all. However, with the help of the District Statistical Officer in Timau, the enumerators found non-horticultural smallholders in Timau, Kariene, Moroga and Karima.

The six categories of surveyed households (urban and rural) are shown in Table 3.1.

Table 3.1 Sample households

		Number of households	Number of people
Urban	Pack-house workers (PH)	40	115
(Nairobi)	Non-Pack-house workers (NPH)	42	154
Rural	Owned farm workers (OF)	40	111
(Meru, Timau,	Large contract farm workers (LF)	20	51
Laikipia,	Horticulture smallholders (HS)	41	202
Nanyuki)	Non-horticulture smallholders (NHS)	80	377
Total		263	1,010

Source: Field survey (2001).

A survey questionnaire was administered to each household based on a single visit.[15] The questionnaire was designed to collect detailed information on household income and the characteristics of the household. It consisted of six sections concerning: demographic characteristics, labour participation, farming activities, non-farm enterprises, other income sources, and the possession of durable goods, housing conditions and a subjective classification of wellbeing.

3.2 Characteristics of the sample households

This section describes the characteristics of the sample households according to the six sections mentioned above. The results are disaggregated by the six categories of households.

3.2.1. Demographic and educational characteristics

The sample households are, in general, nuclear families containing few members of the extended family. On average, household size is higher in rural than urban areas, but even in rural areas the average household size in our sample is only 4.1 with a maximum of 9.0 (See Table 3.2).[16] The sample households can be divided into three groups in terms of demographic characteristics, with some variation within each group.

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[15]   The responses were checked each evening and a small number of return visits were made to clarify inconsistencies.

[16]   This is somewhat lower than the average household size found by the Welfare Monitoring Survey in 1997 which reports an average household size of 3.5 for urban areas and 4.9 for rural areas.

Table 3.2 Demographic characteristics of the sample households

	Urban		Rural				Total
	PH	NPH	OF	LF	HS	NHS	
No of households	40	42	40	20	41	80	263
No of female-headed hhs	25	0	20	12	2	13	72
No of married hh heads	17	40	17	7	38	68	187
Average age of hh head	29.7	32.5	30.0	26.5	39.9	45.3	36.2
	(7.60)	(6.90)	(7.35)	(4.90)	(11.04)	(13.0)	(12.04)
Household size	2.88	3.67	2.78	2.55	4.93	4.71	3.84
	(1.49)	(1.46)	(1.42)	(1.64)	(1.78)	(1.97)	(1.92)
Sex ratio (2)	0.70	0.44	0.60	0.61	0.43	0.49	0.53
	(0.31)	(0.22)	(2.89)	(0.36)	(0.19)	(0.21)	(0.27)
Dependency ratio (3)	0.45	0.71	0.72	1.10	0.75	0.69	0.70
	(0.67)	(0.62)	(0.82)	(1.31)	(0.68)	(0.59)	(0.74)
% of children	24.92	35.54	34.40	34.90	36.74	33.71	33.35
(aged 0–15)	(25.75)	(21.46)	(26.47)	(32.16)	(22.00)	(22.77)	(24.37)
% of the elderly	0	0	0	0	3.94	7.65	2.94
(aged 56+)	(0)	(0)	(0)	(0)	(12.47)	(21.88)	(13.41)
% of working-age adults	75.08	64.46	65.60	65.10	59.31	58.64	63.72
(aged 16–55)	(25.75)	(21.46)	(26.47)	(32.16)	(21.93)	(24.32)	(25.16)
Educational standard completed by the hh head (4)	10.58	11.60	8.95	9.15	9.54	7.00	9.13
	(2.73)	(2.55)	(2.66)	(3.05)	(3.40)	(3.91)	(3.60)
Average educational level of the hh (5)	10.49	10.31	8.67	8.85	9.41	7.62	9.02
	(2.35)	(2.68)	(2.31)	(2.44)	(2.36)	(2.88)	(2.78)
% of hh members who were away from home (6)	42.58	27.82	31.63	59.17	18.23	7.10	25.23
	(42.42)	(40.76)	(44.01)	(47.90)	(29.16)	(17.72)	(38.16)

Source: Field survey (2001).
Note: (1) Standard deviations are indicated inside parenthesis.
(2) Sex ratio: no of females divided by no of total household members
(3) Dependency ratio: no of people (aged 0–15 and aged 65+) divided by no of people (aged 16–64).
(4) Educational standard: 0 = no education; 1–8 = Standard 1–8; 9–14 = Form I–VI; 15 = university.
(5) Average educational level of the household: average of educational standard of adult household members (aged 16+).
(6) Average proportion of members of the household who were away from the home where they currently live during the past 12 months.

The first group consists of households with packhouse workers in urban areas (PH) and households with owned farm workers (OF) and large contract farm workers in rural areas (LF). These households are all nuclear families and have small household sizes (between 2.55 and 2.88). More than half of these households are female-headed, and the average age of the household head is low. The main difference in the demographic characteristics between these three categories of households is in their dependency ratios, with households with workers in large contract farms having very high dependency ratios, while packhouse worker households record low ratios.

The second group includes horticultural and non-horticultural smallholder households in rural areas. They have on average larger household sizes (around 4.8) and the average age of the households head is much higher than other categories of household. A "typical" household contains two parents and two to three children, and some households contain members of their extended family. The third group of households consists of non-packhouse worker households in urban areas. This group has demographic characteristics which are in-between those of the other two groups of households. The average household size is 3.7, typically including two adults and one or two children.

Both the educational level of the household head and the average educational level of the households are higher in urban areas than in rural areas. More than half the household heads in urban areas had completed their secondary school certificate – fewer than a third of rural household heads had done so. The educational level of non-horticultural smallholder households is particularly low, with a fifth of household heads in this category having no education.

The data also provide some evidence for rural-urban and rural-rural migration. An average of 43 per cent of the members of packhouse worker households were away from home during the previous 12 months. This is consistent with many packhouse worker household containing rural-urban migrants who maintain frequent contact with their home villages. The relatively high proportion of single household heads among packhouse worker households may also contribute to their high mobility. Non-packhouse worker households may also be migrants but appear to have established their lives in Nairobi given that 95 per cent of such household heads were married and most have families.

In the rural areas, large contract farm worker households are likely to be rural-rural migrants given the high proportion of the members of such households who have been away from the household in the last 12 months and the large number of single household heads. Many of these people will have come to Timau or Nanyuki to seek opportunities for employment. The same is true to a lesser extent of the households of own farm workers.[17] By contrast smallholders, especially non-horticultural smallholder households, appear to be local to the area.

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[17]   In addition, less than a quarter of households with workers on own or contract farms are engaged in farming providing further evidence that many of these households contain migrants.

Table 3.3 Labour participation of the sample households

	Urban		Rural				Total
	PH	**NPH**	**OF**	**LF**	**HS**	**NHS**	
No of hhs engaged in:							
Paid employment	40	32	40	20	12	19	163
	(100%)	(76.19%)	(100%)	(100%)	(29.27%)	(23.75%)	(61.98%)
Farming	4	5	9	5	41	80	144
	(10.00%)	(11.90%)	(22.50%)	(25.00%)	(100%)	(100%)	(54.75%)
Non-farm enterprise	5	23	3	1	3	5	40
	(12.50%)	(54.76%)	(7.50%)	(5.00%)	(7.32%)	(6.25%)	(15.21%)
Total no of hhs	40	42	40	20	41	80	263
Average no of people per hh engaged in:							
Paid employment	1.42	0.95	1.18	1.15	0.29	0.35	0.77
	(0.50)	(0.66)	(0.38)	(0.37)	(0.46)	(0.78)	(0.71)
Farming	0.10	0.19	0.58	0.30	2.41	2.61	0.59
	(0.30)	(0.55)	(1.20)	(0.57)	(1.16)	(1.38)	(0.57)
Non-farm enterprise	0.15	0.74	0.08	0.05	0.07	0.08	0.15
	(0.43)	(0.77)	(0.27)	(0.22)	(0.26)	(0.30)	(0.36)

Source: Field survey (2001)
Note: Numbers in parenthesis indicate standard deviation or the percentage of households in each category of households when percentage is shown.

3.2.2 Labour participation

Labour participation in paid employment, farming and non-farm enterprises is shown in Table 3.3. The intention here is to explore the extent to which household members from each of the six categories of household are involved in activities other than the primary activity which determined their selection into the sample. In the urban area, approximately 10 per cent of both packhouse worker and non-packhouse worker households are engaged in farming. However, far more non-packhouse worker households (55 per cent) run non-farm enterprises than packhouse worker households (12.5 per cent), although the scale of such enterprises tends to be small, focussing on wholesale, retail and other services such as tailoring and shoe repairs.

In the rural areas, only 12 out of 181 households have non-farm enterprises. Given the substantial evidence for the importance of the non-farm sector in sub-Saharan Africa (Haggblade, Hazell *et al.* 1989; Reardon 1997; Government of Kenya 1999) it is surprising that so few households are engaged in non-farm activities. The small household sizes of own and contract farm worker households may preclude significant involvement in other activities, but the lack of non-farm activities undertaken by smallholder households implies that returns to specialisation in horticultural activities may be high or that there may be relatively few other viable forms of economic activity in this area.

The different patterns of labour participation in paid employment, farming and non-farm enterprises are confirmed by the average number of people engaged in each activity per household. Among the packhouse worker households, one or two people have paid employment whereas in non-packhouse worker households one person typically works in a waged job whilst another runs an enterprise. In the rural areas, households with workers in owned and large contract farms tend to have one person in paid employment whilst another may engage in farming. By contrast, in smallholder households an average of 2.5 people are involved in farming. These results imply that the horticulture industry is the most important income source for those involved in the industry.

Table 3.4 Farming activities of the sample households

	Urban		Rural				Total
	PH	NPH	OF	LF	HS	NHS	
No of hhs owning land	6	14	8	2	38	79	147
	(15.00%)	(33.33%)	(21.62%)	(10.00%)	(80.85%)	(90.80%)	(53.85%)
Land-holding size (acres) # (2)	1.89	3.09	2.13	0.94	6.78	2.91	3.73
	(1.55)	(3.09)	(2.19)	(0.72)	(6.79)	(2.32)	(4.30)
Irrigation ratio # (%) (3)	0	0	7.69	25.00	91.68	35.97	42.38
	(0)	(0)	(27.74)	(50.00)	(21.86)	(46.28)	(47.82)
Land quality # (4)	3.26	3.21	3.54	3.75	3.63	3.59	3.55
	(0.95)	(0.80)	(0.78)	(0.50)	(0.68)	(0.75)	(0.74)
No of hhs owning farm equipment (5)	4	16	15	8	41	80	164
	(10.00%)	(38.10%)	(37.50%)	(40.00%)	(100%)	(100%)	(62.36%)
Average no of farm equipment items owned by hh	0.3	1.5	1.5	1.2	6.6	4.6	3.1
	(1.23)	(2.79)	(2.36)	(1.73)	(1.77)	(1.80)	(3.00)
No of hh which purchased inputs	6	10	12	4	41	78	1
	(5.77%)	(9.62%)	(11.54%)	(3.85%)	(39.42%)	(75.00%)	(57.41%)
No of hh which hired labour	4	7	9	1	37	32	90
	(10.00%)	(16.67%)	(22.50%)	(5.00%)	(90.24%)	(40.00%)	(34.22%)
Average person days of hired labour	6.7	144	21.4	38	477	38.3	159
	(8.0)	(419)	(33.0)	(76)	(590)	(112)	(382)
No of hhs owning livestock	6	15	11	6	39	77	154
	(15.00%)	(35.71%)	(27.50%)	(30.00%)	(95.12%)	(96.25%)	(58.56%)
No of hhs selling livestock by-products	1	2	6	2	25	39	75
	(2.50%)	(4.76%)	(15.00%)	(10.00%)	(60.98%)	(48.75%)	(28.52%)

Source: Field survey (2001).
Note: (1) Numbers in parenthesis indicate standard deviation or the percentage of households in each category of households when percentage is shown.
(2) # indicates mean value excluding the households which do not own land.
(3) Irrigation ratio: irrigated land divided by total land
(4) Land quality: mean land quality reported by the household (1=bad, 2=below average, 3=above average, 4=good)
(5) Farm equipment includes large/small tractor, machine/animal pulled plough or harrower, mechanical water pump, sprinkler, motorised/hand thresher, mill, machine to process livestock feed, motorised/hand insecticide pump, ox card, small cart pulled by person, chemical store, hoe, knife/axe, rake, shovel/pick, sickle/reaping hook and wheelbarrow.

3.2.3 Farming activities

Our focus on farming activities was on smallholders in rural areas. However, some urban households reported owning land and livestock in their home villages in rural areas (see Table 3.4). Indeed, the percentage of packhouse worker households owning land (15 per cent) is larger than the percentage of contract farm worker households owning land in rural areas (10 per cent). Similarly the percentage of non-packhouse worker households owning land (33 per cent) is larger than the percentage of owned farm worker households owning land (22 per cent). This provides a further indication that urban households are better off at least than the households of rural farm workers.[18]

Table 3.4 also shows significant differences between horticultural and non-horticultural smallholders. Horticultural smallholders own more than twice as much land as non-horticultural smallholders and their land is of substantially better quality with over 90 per cent being irrigated compared to a little over a third for non-horticultural smallholders. Furthermore, horticultural smallholders are better equipped and spend more on the purchase of agricultural inputs and on hiring labour. The relatively large size of their land-holdings induce more than 90 per cent of horticultural smallholders to hire in labour compared to only 40 per cent of non-horticultural smallholders. As we will see, these differences contribute to the disparity between the household incomes of horticultural and non-horticultural smallholders.

3.2.4 Other income sources

Other income sources cover remittances, transfers (such as pensions) and other miscellaneous sources of income. In our sample over two-thirds of households sent remittances whereas less than a third received them (see Table 3.5); 154 households (59 per cent) were net-remitters. The proportion of households sending remittances was highest for large contract farm worker households, packhouse worker households and horticultural smallholders. The average remittance sent out was Ksh 5,340 per year while the average remittance received was Ksh 2,763. Over 80 per cent of remittances received were transfers rather than loans, usually in the form of cash.

Only three households had income from state pensions, and only 10 households had incomes from renting out housing. However, 97 households from both urban and rural areas participated in "Merry-go-round" savings schemes in which each member of a group contributes a fixed amount per month and one person receives the entire contributions of the group each month. The popularity of this scheme despite the implicit negative interest rates on savings indicates that many people have little or no access to institutional savings.

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[18] It could also indicate that urban migrant households come from better off households in rural areas if urban households reported on the land and assets of the rural household from which they came. However, the enumerators of the urban survey were told to report only on the land and assets owned by members of the urban household rather than those owned by the associated household in rural areas.

Table 3.5 Other income sources of the sample households

	Urban		Rural				Total
	PH	NPH	OF	LF	HS	NHS	
No of hhs which received remittances	13	15	20	9	10	15	82
	(32.50%)	(35.71%)	(50.00%)	(45.00%)	(24.39%)	(18.75%)	(31.18%)
No of hhs which sent remittances	33	31	29	18	34	39	184
	(82.50%)	(73.81%)	(72.50%)	(90.00%)	(82.93%)	(47.56%)	(69.96%)
Average remittances received (Ksh)	2,834	2,803	1,889	2,238	2,409	3,506	2,763
	(0)	(0)	(90)	(0)	(0)	(0)	(0)
Average remittances sent (Ksh)	8,865	11,147	3,322	3,418	7,060	780	5,340
	(2,850)	(5,000)	(800)	(2,925)	(3,950)	(0)	(1,000)
Average income from Merry-go-round	3,213	2,192	1,586	1,225	4,258	1,000	2,142
	(400)	(0)	(0)	(0)	(0)	(0)	(0)
Average income from house rent	3,000	2,341	0	0	7,272	0	1,934
	(0)	(0)	(0)	(0)	(0)	(0)	(0)

Source: Field survey (2001).
Note: Numbers in parenthesis indicate standard deviation or the percentage of households in each category when percentage is shown.

3.2.5 Possession of durable goods, housing conditions and access to facilities

Our survey also investigated the extent of ownership of 18 durable goods.[19] In urban areas the proportion of households owning almost all of the durables listed was higher for non-packhouse worker households than for packhouse worker households. In rural areas the pattern of ownership was more mixed, although in many cases a larger proportion of horticultural smallholders owned the durable than the proportion of other categories of household owning the good. For example, over half of the horticultural smallholder households claimed to own a bicycle compared to around a fifth for non-horticultural smallholders and owned farm worker households, and 5 per cent for large contract farm worker households. The total value of durable goods possessed was much higher for horticultural smallholders than for any other category as shown in Table 3.6.

We also constructed a durable goods index in order to make overall comparisons of wealth between the different categories of household.[20] The method used was to give a score for each durable good possessed by the household. The score was equal to one minus the probability of owning that durable good calculated across all households. Thus if a good is extremely common, the ownership of this good adds only a small score to a household's durable index, whereas if very few households own the good, then its possession is given a high score (see the notes on Table 3.6 for a description of the index). This

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[19]   The items were: stove, cooker, refrigerator, tables, chairs, sofa set, beds, mattress, sewing/knitting machine, kitchen utensils, household tools, dishes, cutlery, radio, television, bicycle, motorcycle/scooter, and car or truck.

[20]   Our durables index is strongly correlated with income; the Spearman's ρ between household income per adult equivalent and the durables index per adult equivalent is 0.5629 which is significantly different from zero at the 1 per cent level.

Table 3.6 Durable goods owned, housing conditions and access to facilities

	Urban		Rural				Total
	PH	NPH	OF	LF	HS	NHS	
No of durable goods owned	9.7	10.8	9.5	8.6	11.0	9.0	9.8
	(2.09)	(1.74)	(1.99)	(1.90)	(2.13	(2.45)	(2.28)
Total value of durable goods (Ksh)	16,650	37,867	8,500	5,061	81,268	18,933	28,686
	(44,654)	(101,808)	(8,847)	(3,537)	(161,813)	(37,306)	(83,371)
Durable goods index (2)	1.90	2.34	1.64	1.33	2.67	1.61	1.92
	(1.01)	(1.13)	(0.82)	(0.51)	(1.19)	(1.03)	(1.09)
No of hhs with piped water into the home or plot	39	40	28	14	40	64	225
	(97.50%)	(95.24%)	(70.00%)	(70.00%)	(97.56%)	(80.00%)	(85.55%)
No of hhs with a pit latrine as their main toilet facility	7	12	34	20	32	73	178
	(17.50%)	(28.57%)	(85.00%)	(100%)	(78.05%)	(91.25%)	(67.68%)
No of hhs with cement floors	38	42	20	3	33	28	164
	(95.00%)	(100%)	(50.00%)	(15.00%)	(80.49%)	(35.00%)	(62.36%)
No of rooms per capita	0.54	0.42	0.60	0.88	1.04	0.82	0.72
	(0.30)	(0.25)	(0.36)	(0.58)	(0.61)	(0.47)	(0.48)
Time to water source (minutes) # (3)	8.8	8.5	29.7	26.9	30	37.4	27.19
	(9.45)	(7.3)	(22.9)	(25.6)	(.)	(30.5)	(26.17)
Facility welfare index (4)	1.27	1.22	0.46	0.47	0.98	0.54	0.81
	(0.33)	(0.36)	(0.36)	(0.41)	(0.50)	(0.46)	(0.53)

Source: Field survey (2001).
Note: (1) Numbers in parenthesis indicate standard deviation or the percentage of households in each category of households when % is shown.
(2) Durable goods index: $D_h = \Sigma d_{ih} (1 - P_i)$
$$P_i = n_i / n$$
Where $d_{ih} = 1$ if household h possesses durable i; P_i is the probability of having durable good i; n_i = no of hhs which have durable i ; and n = total no of hhs.
(3) # indicates mean value excluding the households which report 0 minutes.
(4) Facility welfare index: $F_h = \Sigma f_{ih} (1 - P_i)$
$$P_i = n_i / n$$
Where $f_{ih} = 1$ if household h has access to facility i – the facilities are: access to piped water; being less than 10 minutes to water source; access to flush toilet; and having a cement or concrete floor; P_i = probability of having facility i ; n_i = no of hhs which have a facility i; n = total no of hhs.

approach has been used in the literature on wellbeing ranking in developed countries to account for the different values and qualities of different durables (Bradshaw, Gordon *et al.* 2000). Horticultural smallholder households and non-packhouse worker households in urban areas register the highest values of our durables index, whilst the households of workers on large contract farms and non-horticultural smallholders appear to have the fewest durables.

Housing conditions and access to facilities are, as expected, better in urban than rural areas, with no large differences between packhouse and non-packhouse worker households. However, there are marked differences between household categories in rural areas. For example, a far higher proportion of horticultural smallholders have access to piped water than other rural households and a somewhat lower proportion use traditional pit latrines for sanitation. Only 31 rural households use surface water as their principle source of drinking water, but none of these households are horticultural smallholders. Moreover,

80 per cent of the horticultural smallholders in our sample have houses with cement floors compared with 35 per cent for non-horticultural smallholders and 15 per cent for large contract farm worker households. A facilities welfare index constructed along similar lines to the durables index (see notes in Table 3.6 for details) shows that urban households have substantially better access to facilities than rural households and that horticultural smallholders are substantially better off than other categories of rural household.

3.3 Calculating household income

Overall household income was calculated by aggregating the income obtained from all sources during the twelve months prior to the survey. The construction of income aggregates from household survey data is always fraught with error. To minimise such errors, the questionnaire was designed to ask about income from some sources in a number of different ways and considerable attention was paid to cross-checking the amounts obtained from the responses to different questions to ensure that the final income aggregate for each household was credible.[21]

The income from paid employment includes wages and fringe benefits such as food, housing and transport. Farming income consists of three components: net rental income from land; the sum of sales and own consumption for both horticulture and non-horticulture crops minus the costs of farm capital and input purchases (including agricultural inputs and the hiring of labour); and income from livestock activities. Income from non-farm enterprises was calculated as the estimated value-added of the enterprise net of the depreciation costs of business assets.[22] Income from other sources includes net remittances and transfers and other miscellaneous income.[23] The household income from each source is reported for each household category in Table 3.7. In addition, an adult equivalence scale was employed to enable comparisons between households of different sizes and compositions.[24]

The mean annual income per adult equivalent is Ksh 36,869 in our sample (See Table 3.7). Urban households had an average income of Ksh 57,415 while the average in rural areas was Ksh 26,843.[25] Per adult equivalent income is highest for non-packhouse worker households, followed by horticultural smallholders, packhouse worker, owned farm worker, large contract farm worker, and non-horticultural smallholder households in descending order. As suggested by the description of labour participation above, the main income source is distinctively different among six categories of households. Packhouse worker, owned farm worker and large contract farm worker households obtain the majority of their

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[21]   We are conscious that, notwithstanding our efforts, the income aggregates are still likely to be subject to considerable measurement error. However, we do not believe that there is any systematic bias in the aggregate figures. See (Grosh and Glewwe 2000) for an exposition of the difficulties of obtaining income information from sample surveys in developing countries.

[22]   Value-added is used rather than profits because the employees of these businesses were household members and therefore received an implicit wage from the business.

[23]   Cash flow from merry-go-round saving schemes and clan welfare groups is not included as these are a form of saving.

[24]   The scale was constructed from WHO estimates of the calorific needs of males and females of different ages and is presented in Appendix 1.

[25]   The WMS for 1997 reports mean annual consumption expenditure of Ksh 55,604 in urban areas (in 2001 prices) and Ksh 40,667 in rural areas.

Table 3.7 Disaggregates of household income

		Urban		Rural				Total	Total (excl 0)
		PH	NPH	OF	LF	HS	NHS		
Paid employment									
	Mean	114,512	94,508	51,219	27,409	28,896	12,283	52,281	81,216
	SD	127,337	140,058	36,536	17,246	55,967	30,272	90,637	102,106
	Median	79,079	51,270	47,813	25,480	0	0	26,000	55,740
Farming									
	Mean	256	13,035	1,634	1,529	186,915	29,917	38,430	45,360
	SD	5,037	67,795	8,071	5,609	242,107	57,434	118,150	68,724
	Median	0	0	40	0	124,257	12,757	450	20,775
(Non-horticulture)									
	Mean	941	11,022	1,168	2,944	67,723	31,405	21,303	158,433
	SD	4,950	63,646	4,503	11,025	75,250	50,311	52,177	201,464
	Median	0	0	0	0	41,400	15,450	0	65,000
(Horticulture)									
	Mean	0	134	0	60	169,839	817	25,016	88,400
	SD	0	859	0	268	205,620	6,527	98,085	215,594
	Median	0	0	0	0	86,000	0	0	22,235
Enter-prise									
	Mean	1,984	64,437	1,580	3,868	13,276	2,787	14,316	58,233
	SD	6,374	206,238	6,347	125,554	77,930	19,862	91,836	141,553
	Median	0	7,030	0	0	0	0	0	8,394
Other incomes									
	Mean	-3,031	-5,820	-1,433	-1,180	2,621	2,783	-597	-768
	SD	23,976	23,067	7,591	4,829	21,153	16,020	18,317	20,784
	Median	-1,250	-2,500	-500	-930	-1,775	0	-300	-1,000
Total hh income									
	Mean	113,627	165,292	52,100	31,316	214,650	45,826	101,058	101,058
	SD	125,801	232,886	35,347	17,893	217,289	66,232	154,172	154,172
	Median	82,941	85,113	46,287	30,819	128,588	20,147	48,984	48,984
Adult equivalent income									
	Mean	55,490	59,294	29,886	18,767	55,528	12,902	36,869	36,869
	SD	39,731	83,425	25,358	12,978	54,236	19,695	49,133	49,133
	Median	46,853	28,747	21,330	17,144	32,431	5,658	24,845	24,845

Source: Field survey (2001).

income from paid employment i.e. from earnings from the export horticulture industry. Non-packhouse worker households have two major income sources, namely paid employment and non-farm enterprises. Unsurprisingly, rural smallholders record the highest income from farming. However, the difference in farm income between horticultural and non-horticultural smallholders is very large, reflecting the difference in the size and quality of land owned by these households. In addition to high incomes from horticultural crop production, horticultural smallholders earn more than twice as much from non-horticultural crops as non-horticultural smallholders.

Due to the highly non-symmetric distribution of each source of income (and to minimise potential distortions caused by measurement error) we also report median income from each source. The ranking of household categories by median per adult equivalent income is different from the ranking using the mean, with packhouse worker households having the highest median income per adult equivalent, followed by horticultural smallholders and non-packhouse worker households. The ranking of own farm, large contract farm and non-horticultural smallholders remains unaltered with these three categories having substantially lower incomes than the top three categories.

3.4 Poverty profile of the sample households

Both the descriptive statistics and the income figures presented above suggest that households who participated in the horticulture industry are better off on average in both urban and rural areas. However, this only gives us a partial picture of the extent to which the horticulture industry has reduced poverty since the poor are not usually "average" households. Therefore, to explore the relative levels of poverty in our six household categories we constructed a poverty profile of the sample households based on our income data. To try and ensure comparability we have adopted the same poverty lines used in the WMS, but have inflated these by the change in Consumer Price Index (IMF 2001) to obtain poverty lines in 2001 prices. In addition we have adjusted our poverty lines to take account of the differences between our equivalence scale and that used by the WMS.[26] Table 3.8 shows the poverty lines drawn by the WMS 1997 and our poverty line estimates for 2001.[27]

Table 3.9 shows the poverty headcount, poverty gap and squared poverty gap measures for each of the six household categories using the Foster-Greer-Thorbecke method of calculating poverty measures (Foster, Greer *et al.* 1984). Poverty measures are calculated for households and for individuals (i.e. weighted by the number of members of the household).

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[26]   The adult equivalence scale adopted by the WMS has three age categories (age 0-4: weight 0.24; age 5-14: weight 0.65; and age 15+: weight 1.00), while the scale that we have used has 13 age brackets and is differentiated by gender (see Appendix 1). The mean number of adult equivalents per household is 2.9 for urban households and 3.8 for rural households using the WMS scale, and 2.66 and 3.48 respectively using our scale. The poverty lines for urban and rural areas were therefore adjusted by the ratio of the WMS scale to our scale for urban and rural areas.

[27]   For comparison, US$ 2 per day at the 1992 PPP exchange rate inflated to 2001 prices is Ksh 16,617.

Table 3.8 Food and total poverty lines for urban and rural areas

		WMS 1997 (Ksh)	Our poverty lines for 2001 (Ksh)
Urban	Food poverty	15,047	18,881
	Total poverty	31,776	39,885
Rural	Food poverty	11,125	13,982
	Total poverty	14,866	18,687

Source: Government of Kenya (2000); Field survey (2001).
Note: Poverty lines are the per adult equivalent expenditure/income needed per year.

Table 3.9 Household and individual poverty by category of households

	Urban			Rural				
	PH	NPH	Total	OF	LF	HS	NHS	Total
HOUSEHOLD								
No of hhs	40	41	81	39	20	36	71	166
Food poverty line								
Headcount	15.00	31.71	23.46	30.77	40.00	25.00	73.24	48.80
Poverty gap	3.57	16.39	10.06	13.80	16.94	12.17	49.89	29.30
Squared poverty gap	1.10	10.57	5.89	8.39	9.19	7.80	39.37	21.64
Total poverty line								
Headcount	42.50	63.41	53.09	41.03	55.00	27.78	80.28	56.63
Poverty gap	17.25	33.73	25.59	19.96	24.42	15.68	57.03	35.42
Squared poverty gap	8.96	22.76	15.94	12.22	14.29	10.66	45.72	26.46
INDIVIDUAL								
No of people	115	150	265	108	51	176	334	669
Food poverty line								
Headcount	20.00	34.00	27.92	39.81	52.94	31.25	76.95	57.10
Poverty gap	4.61	18.66	12.56	18.11	21.66	16.12	54.14	35.84
Squared poverty gap	1.42	12.34	7.60	10.78	11.59	10.61	46.10	26.93
Total poverty line								
Headcount	52.17	63.33	58.49	51.85	70.59	34.09	82.63	63.98
Poverty gap	22.37	34.57	29.28	25.92	31.50	20.21	60.91	42.31
Squared poverty gap	11.74	24.17	18.78	15.87	18.28	14.02	49.60	32.41

Source: Field survey (2001).

Overall, more than half of the sample households fall below the total poverty line, but the incidence of food poverty is much higher in the rural areas than in Nairobi. The ranking of the six categories of households by their food poverty headcounts (for individuals) corresponds to their ranking in terms of the median per adult equivalent income. Non-horticultural smallholders have the highest incidence of poverty, with over three-quarters of individuals in such households falling below the poverty line. The households of large contract farm workers have the next highest incidence of poverty, followed by own farm worker households, non-packhouse worker households, horticultural smallholders and packhouse worker households. However, a fifth of individuals in packhouse worker households still fall below the food poverty line.

The ranking of household categories by poverty headcount is radically altered when using the total poverty line, with the poverty headcount of non-packhouse workers and packhouse workers both rising by around 30 percentage points. This is because of the strikingly large allowance for non-food needs in urban areas inflating the urban poverty line as mentioned above. We do not find the urban poverty line credible for this reason and have therefore concentrated our analysis on the food poverty line.The depth and severity of poverty among non-horticultural smallholders is confirmed by the very high figures for the poverty gap and squared poverty gap. The latter measure is more than three times larger than the equivalent measure for any other household category. However, closer examination of the squared poverty gap also shows the impact of income inequality within the household categories. Non-packhouse worker households have the second highest squared poverty gap despite having a relatively low poverty headcount of 34 per cent (and the highest mean per adult equivalent income), indicating considerable income inequality below the poverty line. By contrast large contract farm worker households have a lower squared poverty gap, despite a poverty headcount of over 50 per cent, suggesting a more equitable distribution of (low) incomes among such households. Packhouse worker households have a particularly small squared poverty gap implying that their incomes are reasonably equally distributed.

4 The determinants of household income and participation in the export horticulture sector

4.1 Model of income determination

The descriptive statistics presented in Section 3 provide an initial indication that participation in horticulture, either in the form of working in a packhouse in Nairobi or as an employee or smallholder in rural areas, appears to increase the average per adult equivalent income[28] of the household. However, such descriptive statistics do not take account of other possible differences in the characteristics of households participating in horticulture and those which are not and it may be these differences that are giving rise to the disparities in income rather than their participation in horticulture.

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[28] To avoid repetition the term "income" will always refer to per adult equivalent income; the phrase "household income" will be used when referring to the income of the household rather than per adult equivalent income.

To account for this we constructed a simple model for the determination of income. Households typically distribute their labour and capital resources over a set of productive activities (wage labour, farming, non-farm enterprises etc). If households are assumed to maximise their overall return from all activities then it is possible to characterise their income as being derived from an aggregate production function in which household characteristics and assets are the key factors of production.[29] One may therefore specify a reduced form expression for income, y, as a function of these explanatory variables in a manner similar to a traditional Mincerian wage equation. Therefore we estimate:

$$\ln(y) = \beta_0 + \beta_1.HHCat + \beta_2.Demog + \beta_3.Educ + \beta_4.Ethnic + \beta_5.Employ + \beta_6.Asset + \varepsilon$$

where *HHCat* is a dummy variable indicating the category of the household (packhouse worker, non-packhouse worker, own farm worker, large contract farm workers, horticultural smallholder, and non-horticultural smallholder); *Demog* is a vector of demographic characteristics (household size, age and gender of the household head and dependency ratio); *Educ* is a variable indicating the educational level attained by the household head; *Ethnic* is a dummy variable indicating the ethnic group of the household; *Employ* is a vector of dummy variables indicating whether at least one household member participates in paid employment, farming, and self-employment in their own enterprise; *Asset* is a vector of asset and access variables (ownership of land and livestock and an index of durables and access to facilities as well as variables indicating the ability to purchase inputs and hire in labour); and ε is an error term.

The above model was estimated both nationally and for urban and rural areas separately – the results are shown in Table 4.1.[30]

The aim of this model is to examine whether the differences in income between the six categories of household disappear when one takes into account other differences between these households. Table 4.1 shows clearly that this is not the case. With the exception of horticultural smallholders, each category of household is statistically significantly worse off than the excluded category of urban packhouse worker households in the national model. Furthermore the differences are large. Non-packhouse households have incomes a little over half those of otherwise identical households containing packhouse workers. Similarly, the households of workers on farms owned by the large horticultural companies are also much worse off than packhouse workers, although they are better off than the households of workers on large contract farms. Non-horticultural smallholders are worse off still, with incomes of less than a fifth that of similar urban packhouse workers households. These results confirm that the large disparities in income presented above are not merely a consequence of the different characteristics of the households in each group.

In addition to confirming the relative importance of the different household categories for income, the model also provides useful insights into the determinants of income. Households with older heads and with heads having a higher level of education tend to have higher incomes. The educational effect is large, with each additional Standard/Form completed raising per adult equivalent income by 32 per cent.

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[29]   See (Dercon 2000) for an exposition of the traditional theory.
[30]   Appendix 2 shows the definitions, means and standard deviations of all the variables used.

Conversely, larger household size and a higher dependency ratio have strong and statistically significant negative effects.[31] Furthermore households from the Meru ethnic group appear to be better off than those from other ethnic groups, although this effect is not statistically significant given the small sample and the predominance of Meru households in the rural survey area. There is no statistically significant effect of the gender of the household head on income.

Households engaged in paid employment or non-farm enterprises are likely to have higher incomes, but involvement in farming generally decreases income. This reflects the lower incomes of rural households, many of whom have farming as their major income source. Ownership of land and livestock are positively associated with higher income, although none of these results is statistically significant. Unsurprisingly, the more assets a household has the higher its income, but our index of access to facilities is neither strongly nor statistically significantly associated with higher income.[32]

Turning to the separate estimation for the urban area (Nairobi), Table 4.1 shows that the households of non-packhouse workers have incomes around 26 per cent less than those of packhouse workers holding everything else constant. However, the smaller sample size in the urban area means that this effect is no longer statistically significant.[33] Household size, the dependency ratio and the educational level of the household head remain important, but the lack of variation in the urban sample reduces the statistical significance of these results.

In the urban area households headed by females are likely to have higher incomes. This is consistent with packhouse worker households having a higher median income than non-packhouse worker households; 62.5 per cent of packhouse worker households are female-headed whereas there are no female-headed households among the non-packhouse worker households in our sample. None of the employment dummy variables (indicating participation in paid employment, farming or own enterprise) is statistically significant. Nor does the possession of agricultural assets (land and livestock) have a significant effect although interestingly the effect for land ownership is strong suggesting an association between having more land in rural areas and higher incomes in Nairobi. Only the durables index variable is strongly positive and significant.[34]

In the rural areas, owned farm worker households and contract farm worker households are slightly worse off than horticultural smallholders, but the difference is not statistically significant. However non-horticultural households typically have incomes of less than half those of horticultural smallholders. The

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[31] When the proportion of children and the proportion of elderly were included separately, the proportion of elderly was statistically insignificant, but the impact of a higher proportion of children was large and negative and strongly significant, suggesting that caring for a large number of children poses considerable constraints upon a household's ability to obtain income.

[32] Given the obvious potential endogeneity of the labour participation and asset variables we also estimated the model omitting these variables. The signs and significances of the remaining exogenous variables do not change when excluding these variables.

[33] Using the number of years in which the household has been involved in horticulture rather than a dummy variable for involvement also yielded a positive but statistically insignificant association between years in horticulture and income.

[34] Again the results are qualitatively the same when estimated without the potentially endogenous variables.

Table 4.1 Econometric results for the model of income determination

	National				Urban				Rural			
	Coef.	SE	t		Coef.	SE	t		Coef.	SE	t	
Constant	9.05	0.59	15.38	***	8.90	1.01	8.79	***	8.69	0.74	11.73	***
Hh Category												
PH (base)												
NPH	-0.62	0.23	-2.68	***	-0.26	0.26	-0.99					
OF	-0.69	0.27	-2.52	*					0.01	0.52	0.02	
LF	-0.82	0.32	-2.58	*					-0.08	0.51	-0.16	
SH	-0.31	0.43	-0.71									
NSH	-1.74	0.42	-4.15	***					-0.82	0.32	-2.59	**
Demographic and Educational												
Hhsize	-0.24	0.05	-4.82	***	-0.19	0.10	-1.82	*	-0.21	0.06	-3.30	***
Agehead	0.02	0.01	2.49	**	0.01	0.02	0.37		0.02	0.01	1.71	*
Fhead	0.11	0.18	0.59		0.47	0.28	1.69	*	-0.05	0.24	-0.22	
Depend	-0.27	0.09	-3.16	***	-0.29	0.20	-1.46		-0.25	0.10	-2.57	**
Eduhead	0.32	0.09	3.47	***	0.23	0.16	1.46		0.27	0.11	2.39	**
Ethnicity												
Meru (base)												
Kikuyu	-0.28	0.23	-1.22		0.42	0.50	0.84		-0.32	0.29	-1.08	
Luhya	-0.58	0.30	-1.93	*	0.00	0.45	0.01		-1.26	0.77	-1.64	
Luo	-0.48	0.28	-1.74	*	0.25	0.48	0.51		-0.50	0.40	-1.27	
Kamba	-0.36	0.28	-1.30		0.17	0.42	0.41		-0.18	0.66	-0.27	
Others	-0.05	0.45	-0.11		0.42	0.60	0.70		0.53	0.25	2.12	**
Labour Participation												
Paid employment	0.39	0.23	1.69	*	0.26	0.61	0.43		0.62	0.29	2.16	**
Farming	-0.45	0.25	-1.79	*	0.03	0.40	0.09		-0.50	0.40	-1.26	
Enterprise	0.45	0.23	1.97	**	0.11	0.29	0.37		0.66	0.38	1.73	*
Assets and Access												
Own land	0.38	0.25	1.52		0.52	0.38	1.38		0.46	0.40	1.14	
Own livestock	0.23	0.15	1.49		-0.03	0.25	-0.12					
Irrig ratio									0.77	0.33	2.32	**
Input									-0.60	0.35	-1.72	*
Labour									0.73	0.26	2.78	***
Asset index	0.26	0.09	2.86	**	0.27	0.12	2.21	**	0.16	0.11	1.41	
Facility index	0.06	0.18	0.32		0.14	0.31	0.47		-0.10	0.22	-0.46	
No of obs.			241				81				160	
F			14.27				4.40				.	
Prob > F			0.00				0.00				.	
R-squared			0.54				0.43				0.55	
Root MSE			1.02				0.89				1.07	
Ramsey reset test F			1.62				0.61				1.38	
Prob > F			0.19				0.61				0.25	
Cook-Weisberg test Chi2			7.46				3.85				1.84	
Prob > chi2			0.01				0.05				0.17	

Source: Field survey (2001).
Note: (1) The Cook-Weisberg text for heteroskedasticity rejects the null of constant variance and so robust standard errors were estimated using White's correction method.
(2) * implies significant at the 10 per cent level; ** implies significant at the 5 per cent level; *** implies significant at the 1 per cent level.

age of the household head is more strongly associated with higher incomes in rural areas than in urban areas and female-headed households tend to be worse off in rural areas, although the effect is not statistically significant. The latter effect probably arises because horticultural smallholders, who have the highest median income, are mostly male-headed. High dependency ratios again have a strong negative effect on income and breaking this into the proportion of children and the proportion of elderly in the household again shows a strong and statistically significant negative effect associated with a higher proportion of children, and a positive insignificant effect associated with a higher proportion of elderly in the household.[35] The educational level of the household head again has a strong positive effect on income.

Different work activities also have implications for household income as rural households which have workers engaged in paid employment and non-farm enterprises tend to have substantially higher incomes. Interestingly, although ownership of land is positively associated with higher income, this effect is statistically insignificant on its own. However, the proportion of land irrigated yields a strong and statistically significant effect – households whose land is all irrigated have incomes 50 per cent higher than the "typical" land-owning rural household. Given the importance of good quality land for higher incomes, it is unsurprising that households with the ability to hire in labour also tend to have higher incomes. The only surprise is the statistical insignificance of the durables index which may reflect thinner markets for durables in rural areas.

The results of our model of income determination support the earlier findings from our analysis of the descriptive statistics and the incidence of poverty. In urban areas the households of packhouse employees do appear to be better off than similar non-packhouse employees, although the effect is not significant. Demographic and educational characteristics appear to be key in determining incomes in urban areas. In rural areas the horticultural industry appears to have contributed significantly towards an increase in the incomes of landless and marginal farmers by creating employment opportunities in owned and contract farms. Furthermore, the industry has increased the opportunity for earnings from cash crops for smallholders, although it is not clear whether the much higher land size and quality endowments of horticultural smallholders are a cause or a consequence of their participation in the sector. It is therefore to the determinants of participation in the sector to which we now turn.

4.2 Model of participation in the horticulture industry

To explore the determinants of participation in the horticultural industry, we estimated a Probit model of participation within the sector using the same explanatory variables as in the income determination model above. This model was estimated separately for urban and rural areas, since the way in which households participate in the industry differs considerably. In the urban area we therefore consider the determinants of participation in employment in horticultural packhouses; whereas in rural areas we look at the factors

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[35]   As an example here, the addition of one child to a household with the average demographic composition will lower income by 13 per cent due to the increase in the proportion of children and, separately, by 14 per cent as a result of the increase in the household size.

determining whether a household is involved in horticultural smallholder production. The results are presented in Table 4.2.

Table 4.2 shows a variety of factors affecting participation in packhouse employment in Nairobi. Interestingly, household size, an important determinant of income, is not significantly associated with obtaining employment in horticultural packhouses. Similarly the age of the household head does not appear to determine participation. However, having a high proportion of children (aged 0 and 15) in the household has a strong negative effect on participation, particularly if the children are young. Moreover, if there are more female than male members in a household then this is strongly associated with participation in the sector.[36] Relative to the Luhya, the most prevalent ethnic group in our urban sample, Luo and Kamba workers are much more likely to obtain employment in packhouses, although again this result should be treated with caution given the small sample.

Interestingly, education, another strong determinant of income, appears to be associated with *not* participating in packhouse employment, with workers from households with better-educated heads much less likely to participate. Having a member of the household away from Nairobi also makes it less likely that someone from the household will participate in packhouse employment, as does owning an enterprise. These results simply indicate the time constraints imposed by employment in the sector. Packhouse workers are unlikely to have time to run their own businesses. Compared with other forms of employment in Nairobi, packhouse employees work long hours and have relatively few fringe benefits.[37] Our analysis therefore suggests that horticultural packhouses tend to employ less well educated women unencumbered by child care responsibilities from households with few other economic opportunities.[38]

With regard to smallholders, our Probit model confirms many of the determinants of participation in horticultural crop production suggested by the descriptive statistics. Households are more likely to produce horticultural crops when they have more land, particularly if that land is irrigated.[39] Clearly households with larger amounts of irrigated land are more likely to need to hire-in labour and so this is also strongly associated with horticultural production.

The effects of household demographic characteristics also show some interesting results. As in urban areas, household size is positively associated with participation although the effect is small and not significant. Unlike urban areas, the sex ratio of the household plays no part in determining participation. However, the presence of infants (aged 0–4) significantly decreases and the presence of the elderly (aged 56+) increases the probability of households being involved in horticulture, although the older the

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[36]   The sex ratio is used instead of a dummy for being a female-headed household since there were no female-headed households among non-packhouse workers in our sample.

[37]   The working hours of packhouse workers are the longest among all the workers in our sample (8.35 hours per day on average). In the peak season, they reported that they worked for 12 hours a day.

[38]   This is consistent with qualitative fieldwork conducted in parallel with our work which suggested that people who are better off do not regard working in packhouses as a desirable option.

[39]   The effect of land size on its own is small and not statistically significant.

Table 4.2 Participation regression model

	Urban				Rural			
	Marginal effect	Standard error	z		Marginal effect	Standard error	z	
Demographic and educational								
Hhsize	0.01	0.12	0.05		0.04	0.02	1.67	**
Agehead	-0.02	0.01	-1.16		-0.02	0.01	-2.20	**
Eduhead	-0.38	0.16	-2.39	**	0.01	0.05	0.22	
Sex ratio	1.10	0.43	2.55	**	0.03	0.19	0.13	
% child	-1.71	0.97	-1.76	*				
Ave age child	0.07	0.03	2.09	**				
Infant					-0.19	0.10	-1.98	*
Elderly					0.45	0.33	1.35	
Ethnicity								
Meru								
Kikuyu	0.10	0.30	0.34					
Luhya								
Luo	0.56	0.17	3.35	***				
Kamba	0.60	0.13	4.61	***				
Others	-0.51	0.15	-3.40	***				
Labour Participation								
Away home	-0.59	0.22	-2.66	***				
Paid employment					0.41	0.25	1.64	
Farming								
Enterprise	-0.46	0.18	-2.51	**	0.18	0.20	0.85	
Assets and access								
Land size					0.03	0.02	1.55	
Irrig ratio					0.50	0.18	2.76	***
Labour					0.29	0.12	2.41	**
Own livestock					0.08	0.07	1.16	
Durables index	-0.05	0.10	-0.49		-0.01	0.04	-0.24	
Facility index	-0.08	0.36	-0.23		0.11	0.10	1.10	
No of obs.			80				118	
F			65.65				101.31	
Prob > chi2			0.00				0.00	
Pseudo R2			0.59				0.68	

household head, the less likely the household is to be involved. Taken together these results suggest that younger farmers are more willing to try production of horticultural crops but that their ability to do so is assisted by having access to more family labour, and in particular the presence of older (and perhaps more experienced) household members. This is consistent with the greater labour intensity of horticultural production and may also explain the greater use of outside labour.

Finally, unlike urban areas, the variables indicating participation in other economic activities (rearing livestock, wage employment and the operation of a non-farm enterprise) appear to be positively associated with being a horticultural smallholder. This may reflect the greater ability to diversify income sources associated with larger household sizes in rural areas.

5 Poverty simulations

One of our aims in exploring the determinants of income and participation in horticultural activities, is to estimate the potential change in poverty which might result from policies to encourage greater involvement in the sector. To this end we used the separate urban and rural versions of our income determination model to predict the income of each of the households in our sample and then calculated the poverty headcount for each household category using these predicted incomes. The poverty impact of policies encouraging involvement in the sector were then simulated by "switching" non-horticultural households to be horticultural households and recalculating the predicted levels of poverty.

For example, in urban areas the income of non-packhouse worker households was predicted by putting a zero instead of a one for the value of the dummy for being a non-packhouse worker household. Since the coefficient on this dummy is large and negative, switching a non-packhouse worker household to be a packhouse worker household increases their income and reduces the level of poverty among such households. In rural areas we explored the poverty impact of three possible switches from non-horticultural smallholder to owned farm worker household, large contract farm worker household and horticultural smallholder, respectively. The predicted poverty levels for the urban area before and after switching are shown in Table 5.1; the corresponding poverty levels for rural areas are shown in Table 5.2.

In urban areas, switching households from being non-packhouse worker households to packhouse worker households dramatically reduces poverty among former non-packhouse worker households. Prior to switching, one third of the individuals in non-packhouse worker households were below the food poverty line – after switching only one fifth fall below this line. The reduction in total poverty is much less marked because the urban total poverty line is much higher than the food poverty line and so the additional income associated with the switch still leaves many households below the poverty line.

In rural areas switching non-horticultural smallholders to be any of the other three categories of household substantially reduces the very high levels of poverty among such households. Interestingly, however, the impact on poverty both at the individual and household level is broadly similar regardless of the category to which the non-horticultural household switches. It would appear that any involvement in

horticulture in rural areas appears to reduce poverty and that anti-poverty policy should not have a strong preference towards any particular form of engagement with the sector.

Table 5.1 Simlation of poverty switching household category (urban)

	PH		NPH		Total	
	Household	Individual	Household	Individual	Household	Individual
Poverty Headcount using Predicted income						
Food poverty	12.50	17.39	29.27	33.33	20.99	26.42
Total poverty	37.50	49.57	60.98	66.60	49.38	58.87
Simulation of switching NPH to PH						
Food poverty	19.25	20.67				
Total poverty	54.72	58.67				

Source: Field survey (2001).
Note: Numbers in the PH column indicate the poverty rates among NPH when switched to PH.

Table 5.2 Simulation of poverty switching household category (rural)

	OF		LF		HS		NHS		Total	
	H	I	H	I	H	I	H	I	H	I
Poverty headcount using predicted income										
Food poverty	23.08	30.56	52.63	66.00	17.65	23.67	88.24	90.94	53.13	61.85
Total poverty	46.15	59.26	57.89	72.00	26.47	32.54	95.59	96.98	64.38	72.34
Simulation of switching NHS to category										
Food poverty	63.24	69.18	66.18	72.21	64.71	70.69				
Total poverty	70.59	77.95	72.06	78.55	70.59	77.95				

Source: Field survey (2001).
Note: (1) H indicates household level poverty estimates; I indicates individual level poverty estimates.
         (2) Numbers in the OF, LF and HS columns indicate the poverty rates among NHS when switched to that category.

6 Conclusions

This paper has examined the impact of the export horticulture industry on poverty alleviation in Kenya using data from a survey of urban and rural households. Although Kenya is not the least developed country in Africa, poverty is widespread in rural areas and is increasing in urban areas with more than half of the population estimated as living below the poverty line in 1997. The encouragement of labour and land-intensive industries such as export horticulture has therefore been seen by many as a means of creating employment and reducing poverty.

However, the linkage between export horticulture and poverty reduction has not been clear in previous studies. This paper makes this link explicit by comparing the incomes of households which are involved in the export horticulture industry with those of households which are not involved. It was found that horticultural households are, in general, better off than non-horticultural households in both urban and rural areas.

In Nairobi, the median per adult equivalent income of households with individuals working in packhouses is higher than that of households not involved in the sector living in the same areas. However non-packhouse households have more durable goods and a higher mean per adult equivalent income and the difference between the two categories of household is not significant when one takes into account other household characteristics. Nonetheless, it is clear that the horticulture industry has provided substantial employment, particularly to relatively low-income households and unmarried women. Thus although wages for packhouse workers are not high and their earnings fluctuate due to the seasonality of the demand for labour and the prevalence of casual employment, the substantial reduction in food poverty resulting from switching non-packhouse worker households to be packhouse worker households suggests that the sector is making a contribution to poverty alleviation in urban areas.

Comparing the four categories of households surveyed in the rural areas also shows interesting results. Export horticulture appears to contribute to improvements in the economic situation of rural households in two ways. Firstly employment is generated on farms owned by the major exporters and on independent large farms producing for these exporters under contract. Many of the workers on these farms are landless women who may have few other opportunities for earning an income. It is therefore a source of concern that the recent shift towards greater production on owned farms may reduce overall employment if the labour intensity of production on owned farms is less than it is on large contract farms or in horticultural smallholder households. Secondly, smallholders producing for export horticulture companies benefit from both higher incomes and the access to credit and extension services which exporters provide. By contrast non-horticultural smallholders are much worse off than households involved in export horticulture, even when one takes into account differences in the characteristics between each of the household categories. This is confirmed by the large simulated reductions in poverty resulting from switching non-horticultural smallholders into any form of involvement with the horticulture sector.

We have presented evidence that export horticulture can make a contribution to poverty alleviation in both urban and, particularly, rural areas. However, we would urge some caution in the interpretation of our results for three reasons.

Firstly, the well known difficulties associated with the collection of income data in developing countries suggest that considerable care should be taken in using our aggregate income figures for different household categories. Although we have pursued best practice in the calculation of such measures and have attempted to "triangulate" our results with other measures of welfare, it is likely that the final figures are still subject to substantial measurement error.

Secondly, we have provided evidence on the current differences in economic status of households in and out of the export horticulture industry and have simulated the potential impact upon poverty of switching households from one category to another. However, we cannot be sure whether the higher incomes of horticultural households are as a result of their participation in the industry or whether their participation in the industry is as a result of having characteristics associated with higher incomes. Of course, determining causality is particularly difficult with cross-sectional data –what is needed is panel data which chart the incomes of households before and after their involvement in the sector, but this is currently unavailable.

Thirdly, our sample size is small and potentially unrepresentative at the national level. Although our survey was explicitly designed to try and provide for as representative a sample as possible in both urban and rural areas, it is possible that the failure to participate in export horticulture by households in our survey may be the result of some characteristic not recorded by the survey, but associated with lower incomes, which would clearly introduce bias into our results.

Nonetheless, our results provide the first attempt to quantify the potential impact of export horticulture upon poverty in Kenya and suggest that further growth of the industry could reduce poverty significantly in the areas involved. Growth of the industry is likely to be determined by the increasingly competitive world market for horticultural produce while domestic anti-poverty policy may usefully focus on reducing the barriers to the participation of the poor in the sector.

Appendices

Table A1 Adult equivalence scale

Age	Male weight	Female weight
0	0.33	0.33
1	0.46	0.46
2	0.54	0.54
3–4	0.62	0.62
5–6	0.74	0.70
7–9	0.84	0.72
10–11	0.88	0.78
12–13	0.96	0.84
14–15	1.06	0.86
16–17	1.14	0.86
18–29	1.04	0.80
30–59	1.00	0.82
60+	0.84	0.74

Note: The equivalence scale is based on a World Health Organisation equivalence scale quoted in (Dercon 1998).

Table A2 Definitions of variables for regression models

Name of variable	Definition	No of obs.	Mean	SD
Horti(u)	Dummy for a household which participated in export horticulture (urban)	82	0.49	0.50
Horti(r)	Dummy for a household which produces export horticultural crops (rural)	121	0.34	0.48
PH	Dummy for a packhouse worker household	263	0.15	0.36
NPH	Dummy for a non-packhouse worker household	263	0.16	0.37
OF	Dummy for a owned farm worker household	263	0.15	0.36
LF	Dummy for a large contract farm worker household	263	0.08	0.27
SH	Dummy for a horticultural smallholder household	263	0.16	0.36
NSH	Dummy for a non-horticultural smallholder household	263	0.30	0.46
Hhsize	Household size	263	3.84	1.92
Agehead	Age of household head	263	36.23	12.04
Fhead	Dummy for a female-headed household	263	0.27	0.45
Depend	Dependency ratio: number of people (aged 0–15 and aged 65+) divided by number of people (aged 16–64) in a household	259	0.81	0.80
Eduhead	Years of schooling completed by household head	261	3.21	1.02
Meru	Dummy for ethnic group, Meru	263	0.59	0.49
Kikuyu	Dummy for ethnic group, Kikuyu	263	0.14	0.34
Luhya	Dummy for ethnic group, Luhya	263	0.11	0.31
Luo	Dummy for ethnic group, Luo	263	0.08	0.27
Kamba	Dummy for ethnic group, Kamba	263	0.06	0.24
Others	Dummy for ethnic group, others (Ksii, Taita, Tugen and Nandi)	263	0.03	0.17
Sex ratio	Number of females / number of household members	263	0.53	0.27
% child	% of children (aged 0–15) to total household members	263	0.33	0.24
Ave age child	Average age of children in a household	263	4.98	4.65
Infant	Dummy for a household with an infant	263	0.43	0.50
Elderly	Dummy for a household with an elderly person	263	0.07	0.26
Away home	Dummy for a household with members who were away from home during the past 12 months	263	1.61	0.49
Paid employment	Dummy for a household with members engaged in paid employment	263	0.62	0.49
Farming	Dummy for a household with members engaged in farming	263	0.55	0.50
Enterprise	Dummy for a household with members running a non-farm enterprise	263	0.15	0.36
Own land	Dummy for a household owning land	261	0.56	0.50
Irrig ratio	Irrigation ratio: irrigated land divided by total land	263	0.25	0.42
Input	Dummy for a household which purchased agricultural inputs	261	2.24	3.80
Labour	Dummy for a household which hired-in labour	263	0.57	0.50
Land size	Size of land-holding in acres	263	0.34	0.48
Own livestock	Dummy for a household owning livestock	263	0.59	0.49
Durables index	Durables index (see Table 3.6 Section 3.2.5)	263	1.92	1.09
Facilityindex	Facility index (see Table 3.6 Section 3.2.5)	263	0.81	0.53

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