AGRICULTURAL PRODUCTIVITY, DIVERSIFICATION AND GENDER

Background report to Sri Lanka Poverty Assessment

WORLD BANK GROUP

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Abbreviations

ISIC International Standard Industrial Classification of All Economic Activities
NE Northern and Eastern Provinces
OLS ordinary least squares
SID Simpson Index of Diversification

Executive summary

Identifying opportunities to increase agricultural productivity and incomes is an important priority for rural development. Progress toward poverty reduction continued in recent years, but the contribution of the agriculture sector was weak, mainly because productivity improvements were relatively limited. Using detailed individual-level data on agricultural activities, this paper analyzes agricultural production patterns and associated productivity of farm households. Particular attention is paid to (i) diversification toward higher-value, export-oriented crops as a means to increase productivity and earnings; and (ii) gender differences in farming activities and outcomes. The role of structural factors such as access to land is also considered.

There are three key findings in this paper. First, diversified farmers, especially those with a crop mix that is focused on export crops or other high-value crops have higher productivity and earnings. The productivity of paddy cultivation is significantly lower than that of other crops, leading to low earnings. Second, production patterns and productivity levels differ distinctively between men and women farmers. Female farmers have higher productivity, as measured by output value per acre, which is mainly explained by their smaller plot size and a crop mix that consists of higher-value crops. However, despite higher productivity, overall farm incomes are lower among female farmers, mainly due to lower access to land. Third, once land size and crop mix are accounted for, unequal access to resources eventually leads to a male productivity advantage—referred to as conditional advantage, after differential access to resources is controlled for via multivariate analysis. Policies to increase the crop mix toward higher-value, export-oriented crops and to equalize access to resources, including land and agricultural inputs, could help improve productivity and income, and reduce gender disparities.

1.

Introduction

Sri Lanka has been steadily transitioning from a predominantly rural, agrarian economy toward a modern economy structured around industries and services. The primary sector's contribution to gross domestic product (GDP) was low, at 7.4 percent in 2019. Between 2002 and 2016, the share of employed engaged in agriculture dropped from around 30 percent to 25.8 percent. The majority shifted away from agriculture toward services, and the change was marked after 2012. While the production sector alone contributes a small share toward Sri Lanka's total GDP, the broader agriculture and food sector is significantly larger due to the sector's strong backward and forward linkages. Food and beverage manufacturing alone accounted for about 6 percent of GDP and slightly over 5 percent of employment.[1]

With a large share of the poor engaged in agriculture, identifying opportunities to increase productivity and incomes in the sector is an important priority for poverty reduction and shared prosperity. While poverty decreased between 2012 and 2016, agricultural earnings showed weak improvements, in stark contrast to the preceding period (2009–2012), which saw strong progress in the sector primarily owing to favorable prices (World Bank 2021a). Sustained progress in the sector can be brought about by increases in productivity, particularly among household-based enterprises that comprise the majority of smallholder farmers.

This paper analyzes agricultural production patterns and associated productivity of farm households. It offers an overview of historical trends and patterns in agricultural production systems, crop choices, and productivity, and them more deeply analyzes the determinants of productivity and earnings. In addition to structural factors such as access to land, it focuses on diversification as a key means to increasing productivity and earnings, where diversification is understood to encompass (i) "a shift of resources from farm to nonfarm activities, (ii) use of resources in a larger mix of diverse and complementary activities within agriculture, and (iii) a movement of resources from low value agriculture to high value agriculture" (Joshi et al. 2004). The focus of this paper will be on the latter two types of diversification strategies.[2]

Particular attention is paid to gender differentials in farming activities and outcomes. While many women engaged in the sector work as unpaid family workers (Hirimuthugodage et al 2014; World Bank 2021b)., an increasing number of women farmers have been successful at earning a living from crop- or livestock-related activities. Future poverty reduction hinges on strong and sustained improvements in rural livelihoods in the agricultural sector, especially among those groups and in areas where the productivity and earnings gaps are the widest. As described in further detail below, there are large disparities between men and women farmers, and narrowing these disparities could help address these challenges.

1. Estimated share of GDP is from national accounts data for 2019; share of employment is based on HIES 2016.

2. The first strategy—a shift in resources from farm to nonfarm activities—is examined in a separate background paper titled "The Rural Nonfarm Sector and Livelihoods Strategies in Sri Lanka" (World Bank 2021).

Gendered roles in agricultural activities have been documented for Sri Lanka in the past. For example, focus group discussions found that although both men and women participate in field production, men tend to dominate the later stages of the value chain, whereas women tend to participate in the most time-consuming activities at earlier stages. This arrangement could be due to the constraints on women's access to transportation; it allows women to work close to home while offering flexibility to also perform household chores. It could also arise because men are more familiar with productive technologies, have more information about markets, and have more connections, influential networks and access to capital (FAO, 2018). These disadvantages may all be related to biases against women. Spice-based industries (cinnamon and pepper) and tea and rubber crops in Sri Lanka have a high rate of female participation, although the activities within these industries are also gendered (FAO 2018). Another important example of social norms in Sri Lanka agriculture is that although women participate in planting, most of them are considered unpaid family workers (Ratnayake 2009).

The analysis relies on detailed individual-level data on agricultural activities that can also be disaggregated by gender. The main data source is the Household Income and Expenditure Survey (HIES) 2016. The survey was conducted by the Department of Census and Statistics of Sri Lanka and the data are representative at the national and district levels. The survey includes questionnaires on demographic and socioeconomic characteristics of individuals and households as well as relatively detailed income modules. As part of the income module, detailed information is gathered on wage employment and on agricultural and nonagricultural self-employment. Data on agricultural activities include information on the type of crops, cultivated area, value and quantity of output, agricultural inputs, own-consumption, and use of subsidies. While not all crops are individually listed, information is collected on paddy, other seasonal crops (chilies, onions, vegetables, cereals, yams, tobacco), and annual crops (tea, rubber, coconuts, coffee/pepper/betel, banana/fruits); information is also collected on livestock (meat, eggs, milk), fish, horticulture, and other crops and livestock. A key advantage of the data is that all this information is available for each individual farmer, allowing gender-disaggregated analysis.[3]

There are three key findings in this paper. First, diversification within agriculture plays a key role in improving productivity and income. Diversification includes diversifying the set of activities undertaken as well more broadly shifting from food crops toward high-value crops with higher export orientation.

3. While the survey aimed to collect individual data on production, it is possible that households manage farm plots jointly, where males may contribute to the work on a female-managed plot. The relevant question is understood as reporting the household member with the largest contribution to the plot, while contribution by others is difficult to know. Certain other data limitations should be acknowledged as well. As described above, information is available for most major crops but not all are listed separately (e.g., information on "vegetables" is collected in the aggregate). Agricultural inputs consist of seeds, fertilizers, chemicals, hired labor, agricultural equipment/rental, and others, but only the aggregated value is available in the data. This makes it difficult to know whether production practices changed and how they would have affected productivity. The absence of information on hours worked makes it difficult to construct detailed measures of labor input. There is also no information on technology use, cropping intensity, or actual use of extension services (the survey only asks about the availability of a community extension center).

Paddy productivity is particularly low, constraining productivity growth among farmers who devote a large share of their land to paddy. Second, agricultural production patterns and productivity levels differ distinctively between men and women farmers. Female farmers have higher productivity, as measured by output value per acre, which is mainly explained by their smaller plot size and a crop mix that consists of higher-value crops.[4] However, despite higher productivity, overall farm incomes are lower among female farmers, mainly due to lower access to land. Third, once land size and crop mix are accounted for, unequal access to resources eventually leads to a male productivity advantage—referred to as conditional advantage, after differential access to resources is controlled for via multivariate analysis. Policies to increase the crop mix toward higher-value, export-oriented crops and to equalize access to resources, including land and agricultural inputs, could help improve productivity and income, and reduce gender disparities.

4. Farmers are defined as those who reported a positive gross crop output value in the survey.

2.

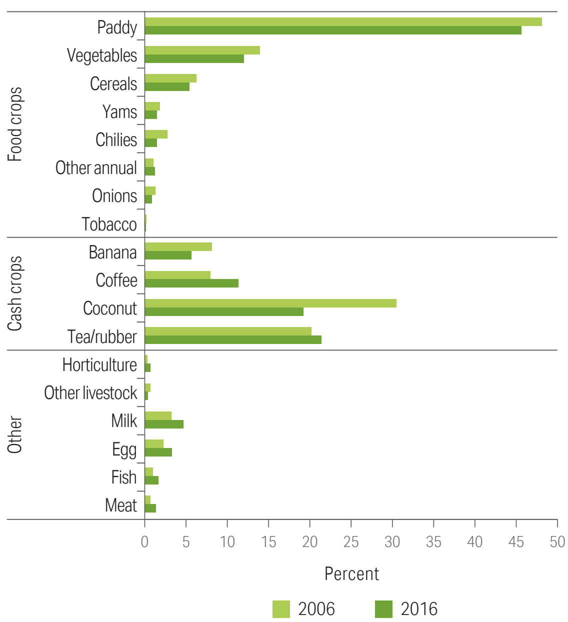
Agricultural Production of Farm Households, 2006–16

Agricultural production decisions are influenced by a variety of factors, including agroecology and climate. Sri Lanka's agricultural land is broadly divided along three climatic zones, i.e., dry, intermediate and wet zones. Two thirds of the agricultural area is located in the dry zone, which covers the northern, eastern and south-eastern parts of the country. This is also where the bulk of the irrigation infrastructure is located. The variation in rainfall and altitude creates diverse agroecological regions that offer opportunities for diversified production. There are two distinct growing seasons that fall in line with seasonal rainfall patterns: these are the Yala (April–June) and Maha (October–June) seasons. The tea, rubber and coconut plantations have traditionally been the basis for export agriculture, with many of them located in the Southwest and highland areas. Extreme weather events have impacted productivity in recent years: for example, the prolonged drought that started in 2016 and lasted through a good part of 2017 was arguably the worst drought in 40 years, affecting almost 4 million people, and leading to widespread crop failure and large income drops. Sri Lanka has been identified as a hot spot in future climate change scenarios (Mani et al. 2018).

In Sri Lanka, the primary form of agriculture among farm households is crop production, with a large number of farmers engaged in rice cultivation. As of 2016, over 88 percent of farm households maintained a crop-only production scheme; about 7 percent produced livestock only and about 5 percent engaged in mixed production. Production systems have overall not changed much, apart from a slight decrease in mixed crop-livestock schemes. There is marked variation across districts, with livestock activities concentrated in the Northern and Eastern Provinces and crop production dominating in the Southern, Sabaragamuwa, and Uva Provinces (annex table A.1).

The trend has been mixed for some higher-value crops, while participation in livestock and other activities has increased. Nearly half of all farm households cultivate paddy, and this share has remained almost unchanged in the decade after 2006. The popularity of some higher-value crops—such as coffee, pepper, betel, tea, and rubber—increased, while it decreased for banana/fruits and coconut (figure 1), the latter a major ingredient in Sri Lanka food and an increasingly important export product. Vegetables are grown by 12 percent of farmers. The focus in this paper is on smallholder farmers since the analysis is based on household

FIGURE 1 Share of farm households engaged in different types of products



Source: World Bank staff calculation using HIES.

surveys. Figure 1 may not fully reflect the production generated by large plantations, for example. Box 1 explores the different profiles and earning opportunities of smallholders and agricultural wage workers, including those in the estate sector.

BOX 1 Are Self-employed Farmers and Wage Workers Different?

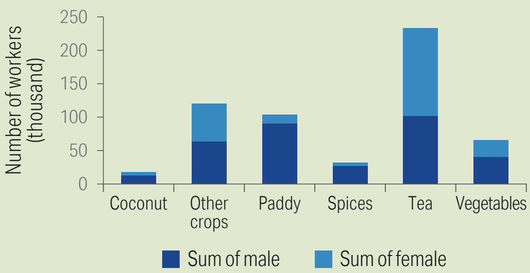
According to the HIES 2016, there were 0.57 million agricultural wage workers involved in crop activities in 2016. Figure B1.1 shows the number of wage workers by crop type and wage worker's gender.

Tea production was the leading agricultural wage sector, employing 41 percent of wage workers, of whom 56 percent were women. Tea is the top agricultural export commodity in Sri Lanka: out of 300 million kg of tea produced, 293 million kg were exported in 2019 (Central Bank of Sri Lanka 2020). Smallholdings account for over 70 percent of the country's tea production, and the remaining share is produced in plantations (ILO 2018). The paddy sector is the second largest employer of agricultural wage workers (87 percent of whom are male), and most paddy output is sold domestically. Spices (e.g., cinnamon) and coconuts are export-oriented sectors and appear to hire more male wage workers.

The summary statistics reported in appendix table A.2 reveal somewhat different personal profiles for Sri Lanka agricultural wage workers and self-employed farmers. Wage workers are younger (45 years old on average) than self-employed farmers (52 years old on average); they are less educated (6.1 years of education, compared to 8.5 years of education for self-employed farmers) and less likely to be ethnic majority Sinhala (54 percent versus 91 percent). A disproportionately large share—33 percent—of wage workers work in the estate sector (43 percent for women and 27 percent for men), while only 2 percent of self-employed farmers work in the estate sector.

Figure B1.2 and the accompanying table show average wages per crop and by gender. The figure clearly reveals different patterns of earnings for self-employed and wage workers. In particular, tea is the sector that pays the lowest wages. This finding contrasts with the pattern among self-employed farmers, whose export-oriented crops such as tea generate higher productivity and income. Spices appear to be the highest paid crop, while paddy is in the middle.

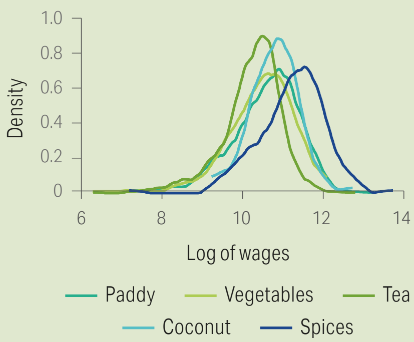
FIGURE B1.1 Number of wage workers, by crop and gender



Source: HIES 2016.

Note: Under ISIC (International Standard Industrial Classification of All Economic Activities) categorization, the crops that have more than 50 observations are reported as separate categories, including paddy (ISIC 112), vegetables (ISIC 113), coconut (ISIC 126), tea (ISIC 127), and spices (ISIC 128). The activities that are not crop specific and the crops that have fewer than 50 observations are aggregated as "other crop activities."

FIGURE B1.2 Kernel density estimates of the log of wages, by crop



	Monthly wages (Rs)			Log of monthly wages (Rs)			
	Total	Male	Female	Total	Male	Female	t-test (p-value)
Paddy	14,575	15,414	8,794	9.39	9.48	8.81	0.000 ***
Vegetables	13,183	15,052	10,203	9.30	9.45	9.06	0.000 ***
Tea	10,972	12,832	9,536	9.16	9.33	9.03	0.000 ***
Coconuts	15,801	17,204	12,422	9.57	9.65	9.35	0.0098 **
Spices	24,695	25,459	20,597	9.92	10.00	9.49	0.001 ***
Other crop activities	13,541	15,428	11,435	9.32	9.45	9.19	0.000 ***
Total	13,330	15,460	10,319	9.3090	9.4718	9.0789	0.000 ***

Source: HIES 2016

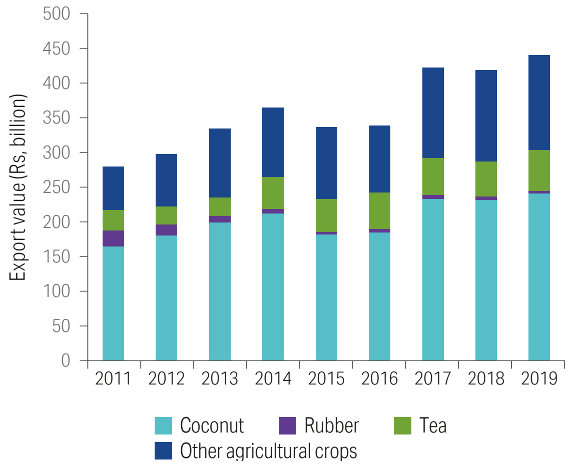
Note: Significance level: * = 10 percent, ** = 5 percent, *** = 1 percent.

The results of Mincerian earnings regressions (not reported here) reveal that the spice and coconut sectors pay higher wages than the paddy sector, while wages in the tea and paddy sectors are not statistically different. These results differ from those for self-employed farmers; their earnings from all the other crops (except other cereals) are higher than from paddy. The result of Oaxaca-Blinder decomposition suggests that wage workers in spices contribute to widening the wage gender gap in favor of men, as spice wage workers are relatively well paid and represented disproportionately by males.

This suggests that farmers can be heterogenous even within the same sector. For instance, tea pluckers in the estate sector and smallholder entrepreneurs cultivating tea appear to face different constraints and opportunities and to show different gender gap patterns.

The most important higher-value crops include tea, rubber, spices and coconut, and a large share of their production is aimed toward export markets. Key export crops have exhibited positive export performance in recent years (Figure 2). Sri Lanka is among the world's leading tea producers as the climate in the central highlands and in some low-elevation areas is favorable for the production of high-quality tea. Today about 70 percent of tea production is accounted for by smallholders, with plantations accounting for the rest (ILO 2018). In the HIES data, about 17 percent of farm households report growing tea and/or rubber in 2016.[5] Coconut production was reported by about 20 percent of farm households in 2016, which is a notable decline from 31 percent in 2006. Given the recent boost in coconut production and exports, it is possible that this change reflects a consolidated shift toward production at scale.

FIGURE 2 Trend in agricultural export value, 2011 – 2019 (Rs, billions)



Source: Central Bank of Sri Lanka, Economic and Social Statistics (various years).

While paddy is cultivated across the country, the production of tea/rubber tends to be concentrated in certain provinces. Table 1 shows by district the shares of farm households that produced paddy, vegetables, tea/rubber, coconut, and coffee/pepper/betel in 2016. Production patterns vary widely across the country. For instance, paddy is planted throughout Sri Lanka, possibly because of relatively high levels of self-consumption. The share of paddy-cultivating farmers was particularly high in districts such as Ampara in the Eastern Province (87 percent) and Polonnaruwa in the North Central Province (86 percent). Between 40 percent and 55 percent of farm households in the Kurunegala, Puttalam, and Gampaha districts (which form the so-called coconut triangle) engaged in coconut production, a much higher share

5. Prior to 2016, the HIES response option for tea and rubber was lumped together in one category as "tea/rubber." It is thus difficult to ascertain the trends for tea and rubber separately. The extent to which these trends can be generalized to the overall sub-sector depends on the sector's farm size composition: that is, if the sub-sector is dominated by smaller farms, the trends captured in household surveys are more likely to reflect changes in the whole sector.

than elsewhere in the country. In comparison, farm households in the Sabaragamuwa, Southern, and Western Provinces were more likely to be engaged in tea/rubber production, with the highest shares, at about 70 percent, recorded in Kalutara and Ratnapura districts.

TABLE 1 Shares of farm households engaged in selected crop activities by district

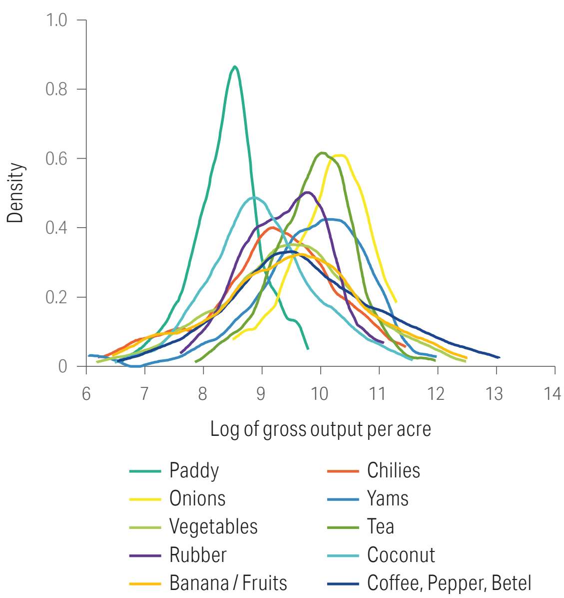
Province	District	Paddy	Vegetables	Tea/rubber	Coconut	Coffee, pepper, betel
Western	Colombo	0.30 (0.05)	0.14 (0.04)	0.17 (0.04)	0.23 (0.05)	0.10 (0.03)
Western	Gampaha	0.23 (0.03)	0.04 (0.01)	0.03 (0.01)	0.55 (0.03)	0.07 (0.02)
Western	Kalutara	0.28 (0.03)	0.03 (0.01)	0.71 (0.03)	0.10 (0.02)	0.03 (0.01)
Central	Kandy	0.27 (0.02)	0.18 (0.02)	0.17 (0.02)	0.15 (0.02)	0.40 (0.02)
Central	Matale	0.63 (0.03)	0.14 (0.02)	0.01 (0.01)	0.13 (0.02)	0.28 (0.03)
Central	Nuwara Eliya	0.11 (0.02)	0.60 (0.03)	0.14 (0.02)	0.00 (0.00)	0.05 (0.01)
Southern	Galle	0.13 (0.02)	0.03 (0.01)	0.64 (0.02)	0.22 (0.02)	0.12 (0.02)
Southern	Matara	0.26 (0.02)	0.02 (0.01)	0.62 (0.02)	0.18 (0.02)	0.17 (0.02)
Southern	Hambantota	0.52 (0.03)	0.18 (0.02)	0.01 (0.00)	0.20 (0.02)	0.12 (0.02)
Northern	Jaffna	0.29 (0.04)	0.09 (0.03)	0.00 (0.00)	0.06 (0.02)	0.02 (0.01)
Northern	Mannar	0.62 (0.06)	0.06 (0.03)	0.01 (0.01)	0.09 (0.03)	0.00 (0.00)
Northern	Vavuniya	0.67 (0.04)	0.18 (0.03)	0.01 (0.01)	0.06 (0.02)	0.00 (0.00)
Northern	Mullaitivu	0.73 (0.04)	0.01 (0.01)	0.01 (0.01)	0.03 (0.01)	0.00 (0.00)
Northern	Kilinochchi	0.51 (0.07)	0.07 (0.04)	0.00 (0.00)	0.08 (0.04)	0.06 (0.03)
Eastern	Batticaloa	0.43 (0.05)	0.12 (0.03)	0.00 (0.00)	0.01 (0.01)	0.00 (0.00)
Eastern	Ampara	0.87 (0.03)	0.03 (0.01)	0.01 (0.01)	0.02 (0.01)	0.02 (0.01)
Eastern	Trincomalee	0.70 (0.04)	0.08 (0.02)	0.01 (0.01)	0.02 (0.01)	0.01 (0.01)
North-Western	Kurunegala	0.67 (0.02)	0.04 (0.01)	0.02 (0.01)	0.42 (0.02)	0.09 (0.01)
North-Western	Puttalam	0.32 (0.03)	0.10 (0.02)	0.00 (0.00)	0.52 (0.03)	0.00 (0.00)
North Central	Anuradhapura	0.77 (0.02)	0.15 (0.02)	0.00 (0.00)	0.14 (0.02)	0.00 (0.00)

Province	District	Paddy	Vegetables	Tea/rubber	Coconut	Coffee, pepper, betel
North Central	Polonnaruwa	0.86 (0.02)	0.04 (0.01)	0.00 (0.00)	0.09 (0.02)	0.00 (0.00)
Uva	Badulla	0.45 (0.03)	0.34 (0.02)	0.22 (0.02)	0.02 (0.01)	0.13 (0.02)
Uva	Monaragala	0.61 (0.03)	0.07 (0.01)	0.04 (0.01)	0.11 (0.02)	0.25 (0.02)
Sabaragamuwa	Ratnapura	0.17 (0.02)	0.05 (0.01)	0.70 (0.02)	0.10 (0.01)	0.12 (0.02)
Sabaragamuwa	Kegalle	0.31 (0.03)	0.03 (0.01)	0.51 (0.03)	0.21 (0.03)	0.06 (0.01)
Total		0.44 (0.01)	0.12 (0.00)	0.21 (0.01)	0.19 (0.01)	0.11 (0.00)

Source: World Bank staff calculation using HIES.
Notes: Standard errors are in parentheses.

The level of productivity varies widely depending on the crop. Figure 3 shows kernel density estimates of the log of gross output per acre by crop, our measure of productivity. While paddy farmers devote a relatively large land area to the crop (1.9 acres on average), both their productivity and earnings are the lowest among all crops. Export-oriented crops such as tea appear to be significantly more productive.

FIGURE 3 Kernel density estimates of the log of gross output per acre, by crop

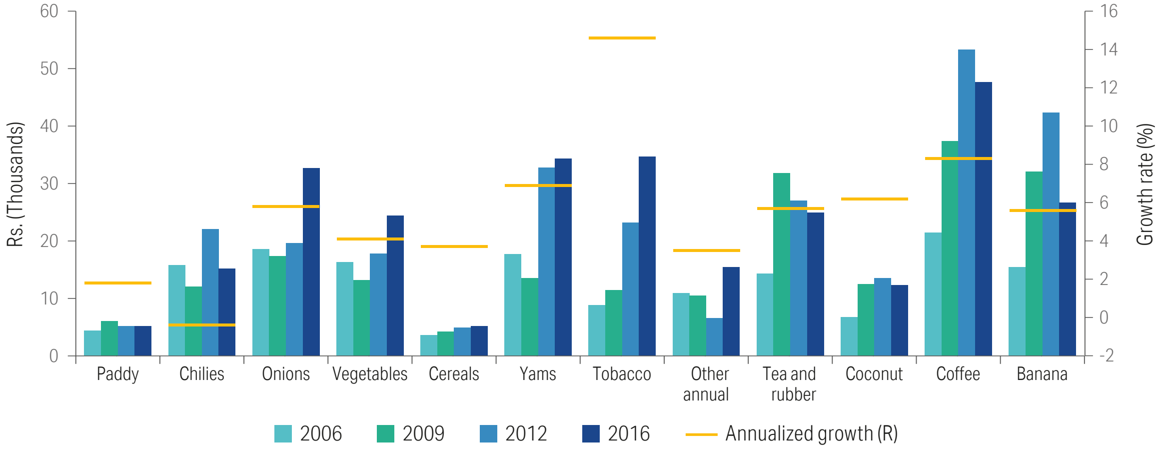


Source: World Bank staff calculation using HIES 2016.

The productivity of paddy production is not only the lowest among food crops, it has also improved little in the last decade. A vast amount of land area is devoted to paddy cultivation, but productivity and earnings are low. Figure 4 shows the average productivity of different crops, measured as yield per acre (in annual terms).[6] Among the different crops, paddy stands out for its low earnings per acre of land as well as the low levels of productivity growth experienced between 2006 and 2016. In fact, productivity remained almost stagnant during these years, in contrast to most other crops, which experienced an annualized productivity growth rate of around 4 percent or more.

6. Productivity is measured as the real annual gross output value, divided by the total cultivated area.

FIGURE 4 Crop productivity (Gross value of output/acre, Rs), 2006-2016



Source: World Bank staff calculation using HIES.
Note: HIES combines tea and rubber as one category for 2006, 2009 and 2012. In 2016 tea and rubber are included as separate categories but are aggregated for this table. Gross value of output is temporally and spatially adjusted using the Colombo Consumer Price Index (CCPI). 1 percent and 99 percent tails are trimmed.

While the majority of cultivation is marketed, paddy farmers keep a large share of output for their own consumption. The share of own-consumption among farm households has fallen across nearly all food crops over time, likely as a result of increased market access and commercialization. However, paddy is an exception to this trend, as paddy farmers still use more than 40 percent of paddy output to meet their own consumption needs. Somewhat surprisingly, the figure does not vary much across farmers in different income quintiles. The share of self-consumption of vegetables has decreased significantly, which likely implies a diversification strategy toward market crops (table 2).

TABLE 2 Share of crop output kept for farm household's own consumption (percent)

Year	Paddy	Chilies	Onions	Vegetables	Cereals	Yams	Tobacco	Other annual
2006	49.6	25.5	4.8	19.6	20.1	16.9	0.3	10.0
2009	50.6	20.1	3.2	14.2	8.1	28.6	0.0	21.0
2012	40.7	6.9	2.2	6.8	1.5	3.3	0.0	5.0
2016	41.8	4.9	0.2	7.4	3.4	5.8	0.0	1.8
Q1	41.49	1.95	0.18	5.77	4.26	9.23	0.00	1.56
Q2	41.86	11.60	0.48	5.26	3.18	20.93	0.00	0.19
Q3	42.66	1.34	0.13	11.63	4.30	2.35	0.36	0.78
Q4	41.67	16.61	0.02	6.97	3.22	3.21	0.00	5.69
Q5	41.33	1.52	0.18	8.42	1.05	1.58	0.00	0.58

Source: Staff calculation using HIES.
Note: Some large fluctuations in values are due to relatively small number of observations.

Poor farmers rely much more on paddy cultivation for their income than better-off farmers. Table 3 below shows the share of paddy output out of total gross income (left) and out of total farm output value (right). Consistent with the low productivity of paddy, the poorest farmers—in the bottom 20 percent of the income distribution—are most reliant on paddy farming; over 40 percent of their farm output value comes from paddy, while the contribution of higher-value crops is low. In contrast, farmers in the top 20 percent receive only about 26 percent of their farm output value from paddy. The relative importance of paddy income has not changed much over time.

TABLE 3 Paddy output value as share of gross income and farm output value, by household income quintile (percent)

	Paddy output value as share of gross income (percent)				Paddy output value as share of farm output value (percent)			
Quintile	2006	2009	2012	2016	2006	2009	2012	2016
Bottom 20%	9.4	9.5	9.0	8.4	39.7	44.4	43.7	41.3
Second quintile	4.0	5.5	3.8	3.5	32.5	36.8	35.2	32.2
Third quintile	2.9	4.1	2.9	2.9	30.6	34.2	32.5	31.2
Fourth quintile	2.3	3.5	2.3	2.2	27.4	34.0	29.9	29.4
Top 20%	1.4	2.8	1.8	1.4	19.0	26.0	23.2	25.7
Total	3.9	5.0	3.9	3.6	29.6	34.6	32.7	31.8

Source: Staff calculation using HIES.
Note: Income quintiles are estimated based on per capita total household income.

Most farmers who benefit from fertilizer subsidies apply them in paddy cultivation, and larger subsidies are associated with higher productivity. A larger share of male farmers receives crop subsidies than female farmers (38.9 percent versus 18 percent)[7], though this gap likely reflects the greater tendency of paddy farmers to be male. Most of the subsidy (90 percent) is accounted for by paddy, followed by tea (4 percent) and vegetables (2 percent). Regression results in section 3 show that the incidence of subsidy is negatively associated with productivity as well as earnings—i.e., poor farmers are more likely to be recipients of subsidies. However, among those that receive subsidies, larger subsidies are associated with higher productivity, which appears to support the long-held belief that fertilizer subsidies lead to increased land productivity, the goal of the subsidy support scheme (Weerahewa, Kodithuwakku, and Ariyawardana 2010).

Fertilizer subsidies come at a fiscal and opportunity cost, and may need careful consideration in the broader context of spending to support the agriculture sector and rural development. Fertilizer subsidies constitute a major expenditure in the government's agricultural budget and could result in a suboptimal composition of agricultural spending when interventions to incentivize farmers to adopt climate-smart technologies, help them access value chains or invest in better agro-logistics could have

7. Most of the subsidies consist of fertilizers.

greater payoffs. More generally, there have been concerns that they might take away resources from other spending on roads, health, and education, which could contribute to rural development more broadly. Fertilizer subsidies have been primarily used to meet production and therefore food security objectives, and were deemed less effective than direct income transfers from the perspective of providing support to low-income paddy farmers. Furthermore, these subsidies appear to have impacted market decisions by encouraging the cultivation of paddy and disincentivizing movements to other types of agriculture that have more potential for value addition (World Bank, 2013).

3.

Determinants of Higher Agricultural Productivity and Earnings

Diversification to Improve Productivity

The analysis in this section focuses on key determinants of productivity and earnings. Since detailed input data to measure total factor productivity are not available, we use land productivity as a proxy for productivity, defined as gross income divided by cultivated area. A farmer's real monthly income from crop production is proxied by the sum of the gross output value for each crop.[8] For the purpose of our analysis, "farmers" are defined as those who reported a positive gross crop output value in the HIES. By this definition, there were 1.7 million farmers in 2016 and about a quarter of them were female.[9] Detailed summary statistics are reported in appendix table A.2. On average, farmers were 51.7 years old, had 8.5 years of schooling, cultivated 1.7 acres of land and grew 1.3 types of crops. Their average crop income and productivity in 2016 were estimated respectively at Rs. 15,487 and Rs. 16,905 per acre.

Diversification is generally considered a key channel to increase productivity and incomes. Joshi et al (2004) describe diversification as threefold, entailing "(i) a shift of resources from farm to nonfarm activities, (ii) use of resources in a larger mix of diverse and complementary activities within agriculture, and (iii) a movement of resources from low value agriculture to high value agriculture." The first channel could be considered diversification at the external margin. Our findings below suggest that Sri Lanka farmers may be using nonfarm incomes to move out of agriculture.

We focus on diversification within agriculture and allocation of resources between low-value and high-value activities and their roles for productivity and incomes. To operationalize these concepts, we construct an index to capture each. Following common practice in the literature, we measure a farmer's level of crop diversification using the Simpson Index of Diversification (SID):

$$\text{SID}_i = 1 - \Sigma_k P_{ik}^2 ,$$

where SID_i is the Simpson Index of Diversification for farmer i, and P_{ik} is the proportionate cultivated area dedicated to the k^{th} crop.[10] A lower index would indicate high concentration (or low diversification). This measure considers crop farming only, excluding earnings from livestock activities. There are many reasons why farm households might benefit from increased diversification. These include strategies to reduce risks or to realize complementarities between different activities.

8. Beginning in this section, the analysis moves to the individual farmer level except in table 4.

9. Following the definition used, there were an estimated 1.7 million farmers in 2016, of which 1.3 million were male and 0.4 million female. These numbers should not be interpreted as representing the gender breakdown of the workforce in the agricultural sector. Because the definition considers only those with a positive output as farmers, most unpaid family workers are not included, and it is well known that in Sri Lanka this group includes a large number of female workers. Another caveat is that the sample includes those individuals whose farm activities are secondary. In the 2016 HIES, 38.5 percent of farmers had some income from nonfarm activities such as nonfarm self-employment or wage work, while 47.0 percent of them had some non-labor income.

10. Calculating the index with the share of output value leads to similar results.

Further, an export-orientation index is constructed to capture the relative weight of domestic-oriented and export-oriented crops in a farmer's portfolio. Specifically, the index is calculated as follows:

$$XIND_i = \Sigma_k [ShX_k * ShX_{ik}],$$

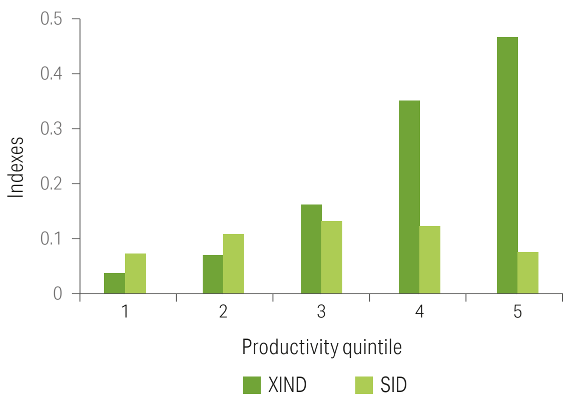
where $XIND_i$ is the Export Orientation Index for farmer i, and ShX_k is the export intensity of crop k—i.e., the share of exports of the overall production quantity at the national level taken from FAOSTAT (2014–17 average). Export-related information is not available at the farm level. Paddy and most other food crops are geared toward serving the domestic market, whereas higher-value crops tend to have a higher share of exports. ShS_{ik} is the share of cultivated area for agricultural item *k* in individual i's total cultivated area and is intended to compute a weight for the overall export intensity of the production mix.[11] $XIND_i$ intends to capture the extent to which the crop mix consists of export-oriented crops, which tend to be of high-value, e.g., tea, coffee, pepper, betel, and rubber.

There is a positive relationship between productivity and the export-orientation of the crop mix (figure 5). It should be noted that this index captures export shares at the aggregate national level and there is likely significant heterogeneity across farmers. Unfortunately, the household survey data do not provide further information on the export share of farmers' agricultural output. The relationship between productivity and the level of diversification in the portfolio appears to be less linear. Productivity increases with the level of diversification, measured with the SID, but peaks in the middle quintile of the productivity distribution. In comparison, productivity increases monotonically with the weighted export intensity of the crop portfolio (figure 6).

FIGURE 5 Correlation between the Export Orientation Index and productivity

Source: World Bank staff calculation using HIES 2016.

FIGURE 6 Simpson Index of Diversification and Export Orientation Index, by productivity quintile



Source: World Bank staff calculation using HIES 2016.

Note: XIND = Export Orientation Index; SID = Simpson Index of Diversification. The x axis displays the productivity quintile of the farmers (1=lowest 20%, 5=highest 20%)..

11. ShX_k, or crop-level export shares, are computed as: paddy (0.0039), chilies (0.012), onions (0.0), vegetables (0.023), cereals (0.044), yams (0.0), tobacco (1.0), tea (0.87), rubber (0.18), coconuts (0.09), coffee, pepper, betel etc (0.399), banana/fruits (0.052) and horticulture (0.037) (average of vegetables and banana/fruits).

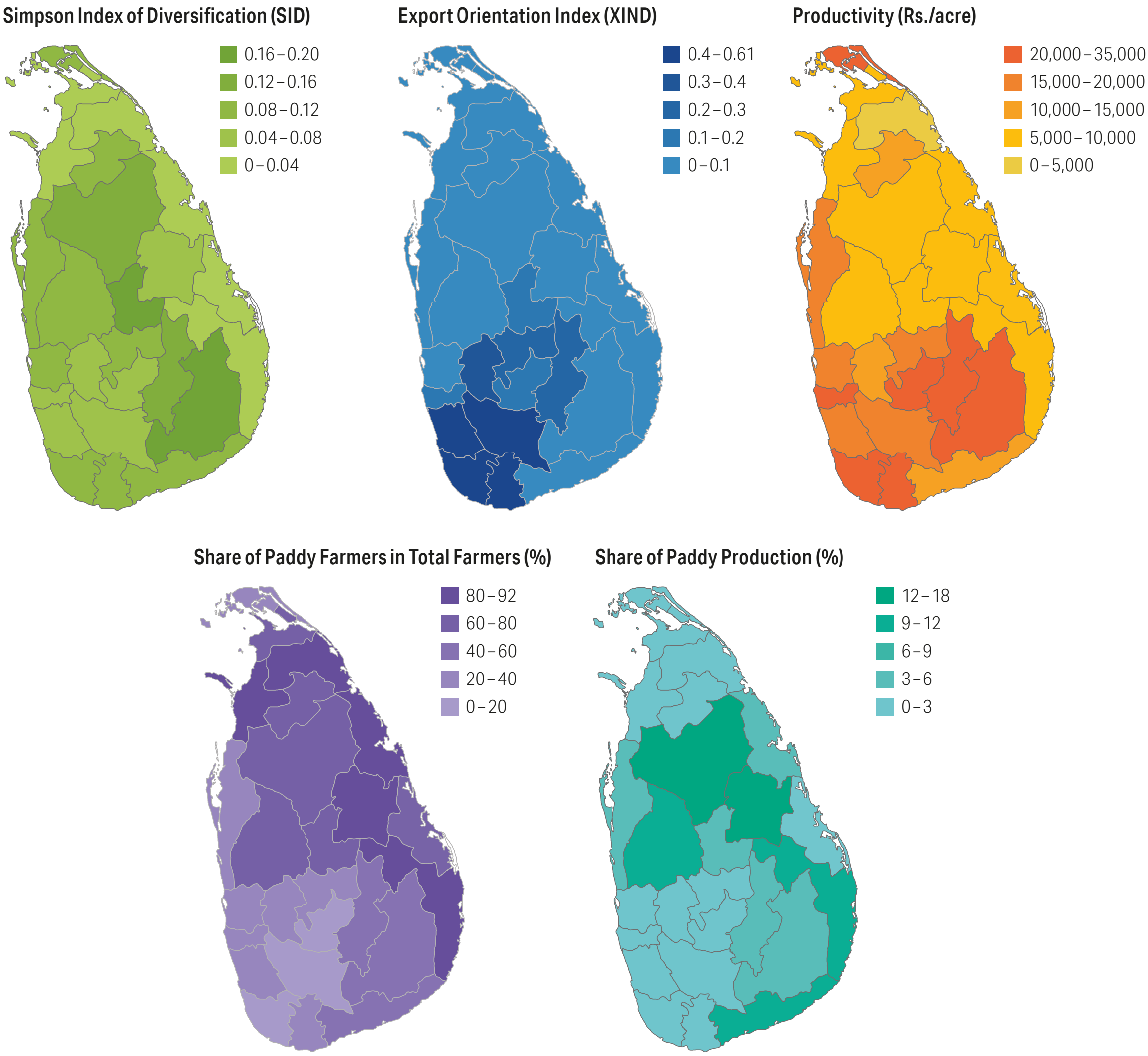
Crop diversification has also been adopted in Sri Lanka to increase the resilience of agricultural production. A case study in the dry zone of Sri Lanka found that although farmers in the area have been cultivating paddy for many decades, its cultivation has increasingly suffered pressure from high costs of production and the decrease in paddy market prices. To cope with such constraints, farmers have increasingly relied on crop diversification, changing cropping patterns and methods for cultivating, especially during seasons with a deficit of water supply (Dharmasiri, 2008) and likely between seasons as well.

The nature of agricultural livelihoods differs significantly across the country. The variation could be the result of a combination of factors, including differences in agroclimatic conditions and natural endowments—for example, smallholder tea farmers are concentrated in the Southern and Sabaragamuwa Provinces; vegetable production mainly takes place in the Central and Uva Provinces; many small coconut producers are located in the North-Western and Western Provinces; and finally, the North-Central Province accounts for the largest share of smallholder paddy production.

Wide regional variation exists in the export-orientation and diversification of crops and productivity levels. Figure 7 shows the district-level variation in the average Simpson Index of Diversification, Export Orientation Index, productivity (Rs/acre), share of paddy farmers in total crop farmers in the district and the district's share in total paddy production. Some clear patterns emerge: first, there are wide differences in productivity across districts; and second, productivity is significantly higher in districts where export-oriented crops are cultivated and lower in districts where a large share of farmers cultivate paddy. However, while a high share of farmers in the NE produce at least some paddy, the majority of paddy output (as measured by output value) is accounted for by the districts of Anuradhapura (North-Central Province), Polonnaruwa (North-Central Province), Kurunegala (North-Western Province), Ampara (Eastern Province), and Hambantota (Southern Province). The spatial production patterns reflect the farmers' choice as well as the local agro-ecological and climatic conditions.

Meanwhile, farm households in the Northern and Eastern Provinces (NE) rely more on livestock activities and exhibit lower average crop productivity, measured by output value per acre of land. Table 4 compares household characteristics in the NE to others, disaggregated by the gender of the household head. Households in the NE rely more on livestock activities (table 4; see also annex Table A.1.)—for instance, 40 percent of farm households in Batticaloa were engaged in livestock-only activities in 2016. The civil war has exerted lasting impacts on livelihoods in the NE. Post-conflict livelihood support, especially for female-headed households, tended to be focused on small livestock activities (Silva et al. 2018), which may explain the high share of chicken and goat ownership among this group. Crop productivity among NE farm households is lower than in the rest of the country, which could be due to several factors, including (i) larger agricultural land area, as the average land size owned by NE households is 1.7 acres, compared to 1.0 acre for non-NE households; there is a commonly found inverse relationship between land size and productivity (as further described below); and (ii) the crop

FIGURE 7 District level variation in diversification, export orientation, productivity, share of paddy farmers and share of paddy production in national production



Source: World Bank staff estimation using HIES 2016.

choice, with NE farm households devoting a large area of land—around 80 percent on average in most districts—to the cultivation of paddy, which is a low-productivity crop. It should be emphasized that available data on livestock activities are either limited or difficult to measure—for example, land productivity is only measured against crop production. Hence, the focus on the crop sector may not accurately reflect the overall productivity and incomes of farmers in the NE where livestock activities are much more widespread.

TABLE 4 Characteristics of farm households in Northern and Eastern Provinces (NE) vs. other provinces and by gender of household head

	All Farm HHs			Farm HHs in NE			Farm HHs in other provinces			t-test to show if HHs in NE are different from others		
	Total	Male headed	Female headed	Total	Male headed	Female headed	Total	Male headed	Female headed	Total	Male headed	Female headed
Gender of HH head (=1 if female)	16.8			0.097			0.176			0.000		
Education of HH head (years)	8.1	8.1	7.6	7.5	7.5	7.5	8.1	8.2	7.6	0.000	0.000	0.161
Monthly income (Rs)												
Total income	87,153	90,886	68,663	70,296	71,812	56,224	88,966	93,132	69,404	0.006	0.008	0.077
Per capita income	17,234	17,488	15,982	14,067	14,160	13,211	17,576	17,882	16,148	0.000	0.000	0.008
Crop productivity at HH levela (Rs/acre)	16,376	16,332	16,600	9,911	9,782	11,301	16,981	17,009	16,844	0.000	0.000	0.003
Land owned by HH (acres)	1.1	1.1	0.8	1.7	1.8	1.4	1.0	1.1	0.8	0.000	0.000	0.008
Paddy land owned by HH (acres)	0.6	0.6	0.5	1.4	1.4	1.0	0.5	0.5	0.4	0.000	0.000	0.000
Livestock ownership												
% HHs that own a cow	9.1	9.7	5.6	20.7	21.1	16.8	7.8	8.4	5	0.000	0.000	0.000
% HHs that own a goat	1.9	2.1	1.3	10.3	10.1	11.6	1	1.1	0.7	0.000	0.000	0.000
% HHs that own a chicken	10.2	10.2	10.3	32.5	31	46.5	7.8	7.8	8.2	0.000	0.000	0.000

Source: World Bank staff calculation using HIES 2016.
Note: NE = Northern and Eastern Provinces; HH = household. a. Productivity is calculated as gross crop output divided by cultivated areas at the household level.

There is a strong and positive association between productivity and the level of diversification, and between productivity and the export orientation of the crop mix; the association is confirmed after controlling for other factors that could determine productivity. Table 5 reports regression results relating the log of productivity (regression (1)) or the log of earnings from crops (regression (2)) to a series of personal, household, location, and agricultural characteristics. The main results are presented in regression (1) and (2), and suggest that higher export orientation of farmers' production mix, captured by the coefficient for the Export Orientation Index,[12] and diversification of crop mix, reflected in the coefficient for the Simpson Diversification Index, are positively associated with higher productivity and earnings (with statistical significance at the 1 percent level).

12. Alternatively, we include a series of the share of cultivated area for each crop in total cultivated area, with the share of paddy as the omitted category. The coefficients for the shares of all the other crops except "other cereals" turn out to be positively significant, suggesting higher productivity of cash crops relative to staples.

TABLE 5 Determinants of crop productivity and earnings

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent variable	Log of productivity	Log of crop income	Log of productivity	Log of productivity	Log of productivity	Log of productivity	Log of productivity
Gender (=1 if female)	-0.072 *** (0.025)	-0.084 *** (0.025)	0.254 *** (0.036)	0.129 *** (0.036)	-0.065 * (0.035)	0.013 (0.034)	-0.155 *** (0.033)
Age	0.009 ** (0.005)	0.008* (0.005)		0.013 * (0.007)	0.015 ** (0.007)	0.014 ** (0.006)	0.016 ** (0.006)
Age squared	-0.000 ** (0.000)	-0.000 ** (0.000)		-0.000 ** (0.000)	-0.000 *** (0.000)	-0.000 *** (0.000)	-0.000 *** (0.000)
Years of education	0.006 ** (0.003)	0.007 ** (0.003)		0.013 *** (0.004)	0.026 *** (0.004)	0.012 *** (0.004)	0.024 *** (0.003)
Household head	0.068 ** (0.027)	0.071 ** (0.028)		0.052 (0.041)	0.152 *** (0.038)	0.052 (0.038)	0.143 *** (0.035)
Share of nonfarm labor income in total income (%)	-0.509 *** (0.031)	-0.537 *** (0.032)		-0.607 *** (0.040)	-0.934 *** (0.041)	-0.500 *** (0.037)	-0.808 *** (0.039)
Share of nonlabor income in total income (%)	-0.579 *** (0.041)	-0.588 *** (0.042)		-0.723 *** (0.054)	-1.043 *** (0.051)	-0.544 *** (0.052)	-0.853 *** (0.049)
Incidence of livestock activity	-0.036 (0.045)	-0.044 (0.045)		-0.137 ** (0.068)	-0.181 *** (0.064)	-0.065 (0.062)	-0.111 * (0.058)
Household size	0.003 (0.006)	0.002 (0.006)		0.009 (0.009)	0.018 ** (0.008)	0.012 (0.009)	0.020 ** (0.008)
Child dependency ratio	-0.004 (0.032)	-0.010 (0.033)		0.056 (0.049)	0.016 (0.044)	0.030 (0.045)	-0.005 (0.041)
Log of cultivated land (acres)	-0.720 *** (0.014)	0.202 *** (0.015)			-0.351 *** (0.014)		-0.322 *** (0.014)
Export Orientation Index	0.904 *** (0.040)	0.867 *** (0.042)				1.413 *** (0.055)	1.292 *** (0.051)
Log of agricultural inputs	0.482 *** (0.012)	0.519 *** (0.012)					
Simpson Index of Diversification	0.591 *** (0.048)	0.630 *** (0.050)					
Number of unpaid agricultural family labor	0.046 ** (0.018)	0.045 ** (0.020)					
Incidence of crop subsidy	-0.718 *** (0.095)	-0.835 *** (0.097)					
Log of crop subsidy	0.061 *** (0.011)	0.077 *** (0.011)					
Tractor	0.088 *** (0.025)	0.071 ** (0.029)					
Access to finance	0.127 *** (0.029)	0.119 *** (0.027)					
Access to IT	0.004 (0.027)	0.001 (0.027)					
Log of distance to nearest agricultural service center	0.009 (0.008)	0.006 (0.008)					

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent variable	Log of productivity	Log of crop income	Log of productivity	Log of productivity	Log of productivity	Log of productivity	Log of productivity
Incidence of natural calamity	-0.032 (0.024)	-0.028 (0.025)					
Number of observations	5,613	5,683	5,613	5,613	5,613	5,613	5,613
R2	0.669	0.759	0.011	0.250	0.353	0.350	0.437

Source: World Bank staff estimation using HIES 2016.

Note: The dependent variable for all regressions except (2) is the log of productivity. Productivity is measured by yield, i.e., gross real monthly output divided by the area cultivated (SL Rs/acre). The dependent variable for regression (2) is the log of earnings (SL Rs). Gross real monthly output is used as a proxy for crop earnings. The regressions are estimated using ordinary least squares (OLS).

Except in regression (3), ethnicity dummies, sector dummies (urban, rural, estate), and district dummies are included as control variables.

Significance level: * = 10 percent, ** = 5 percent, *** = 1 percent. Robust standard errors are in parentheses.

a. Agricultural inputs include seeds, fertilizer, chemicals, hired labor, transport cost, agricultural equipment/rental, and others.

Cultivated area and productivity are negatively correlated, consistent with findings from other countries in the literature. The coefficient for the log of land area in regression (1) is found to be negatively significant at the 1 percent level, confirming an inverse relationship between cultivated area and agricultural productivity that has been commonly found in the existing literature—e.g., Aguilar et al (2015) in Ethiopia; Ali et al (2016) and Carletto, Savastano, and Zezza (2013) in Uganda; Kilic, Palacios-Lopez, and Goldstein (2015) in Malawi; Oseni et al (2015) in Nigeria; and Slavchevska (2015) in Tanzania. In contrast, the relationship between cultivated area and earnings is positive, suggesting that access to more land improves farmers' earnings. This relationship can be seen from the positive and statistically significant coefficient for cultivated area in the earnings regression.

Results also suggest that farmers tend to utilize their nonfarm income, including remittances, to move out of agriculture rather than to invest in agriculture. The coefficients for the share of nonfarm labor income and those for the share of nonlabor income are negatively significant. This suggests that the availability of other income sources is associated with lower productivity and lower crop income. This result is consistent with previous research in other countries, such as Kilic et al (2009) in Albania and Rozelle, Taylor, and DeBrauw (1999) in China.

Other correlates of productivity such as agricultural inputs, family labor, mechanization, and access to finance turn out to be positively associated with productivity and income. The coefficients for the agricultural inputs, unpaid agricultural family labor,[13] the mechanization (proxied by the ownership of tractor(s)), and access to finance (proxied by access to a loan) are positively significant at least at the 5 percent level for both productivity and earning regressions. The coefficient for the proxy of access to

13. Agricultural unpaid "family labor" is defined as those household members whose main activity is in agriculture; whose employment status is either "own-account worker," "contributing family worker," or "employer"; and who report no farm income. Under this definition, 70 percent in this category were female; 58 percent in this category (2 percent of the males and 81 percent of the females) were spouses of household heads.

"digital agriculture"[14] (Fabregas, Kremer and Schilbach, 2019) was not statistically significant. It is possible that with nearly 90 percent of information technology (IT) ownership at the household level, variations in access are not well proxied with this information. While the incidence of subsidy is associated with lower productivity and income, conditional upon receipt, subsidy appears to enhance productivity and income. More years of schooling and hence better skills also lead to higher productivity and income.

Gender Gaps in Productivity and Earnings

Delving further into the data on gender differences in productivity and earnings suggests that female farmers are on average more productive. The empirical measurement of gender gaps in agricultural productivity has been found to be challenging in the literature.[15] But the Sri Lanka HIES has a distinct advantage in providing farm activity information at the individual level, whereas many previous studies have had to rely on certain assumptions.

Interestingly, in Sri Lanka the productivity among female farmers (Rs 19,809 per acre) is found to be higher than that of male farmers (Rs 15,976 per acre). This is the difference in raw, unconditional productivity, not controlling for crop type or any other differences in inputs. Female productivity advantage is again confirmed through regression (3) in table 5: including only the gender dummy in the regression, the coefficient for the gender variable is positive and statistically significant. This is in stark contrast to other countries in the literature, which found male farmers to be more productive but which explained away the advantage by pointing to differential access to inputs. It was subsequently argued that gender gaps could be overcome if female farmers had the same level of access to inputs (see for example, Croppenstedt, Goldstein, and Rosas 2013; FAO 2011; Adeleke et al 2008; Udry 1996). Using high-quality plot-level data, some more recent papers find a persistent productivity gender gap in favor of males after controlling for inputs and other characteristics (e.g., Ali et al, 2016; Kilic et al. 2014; Oseni et al. 2015; Slavchevska 2015).

The productivity advantage of female farmers appears surprising at first, given that they have less access to inputs and a less diversified crop mix. Appendix table A.2 shows that female farmers make less use of agricultural inputs (Rs 2,923/month) than male farmers (Rs 5,449/month). The share of female farmers who receive fertilizer subsidies (18.0 percent) is smaller than the share of male farmers (38.9 percent); and the amount received (Rs 658/month) is also smaller than for male farmers (Rs 935/month). Further disadvantages include lower access to finance (6.8 percent for female farmers versus 9.8 percent for male farmers); less access to unpaid agricultural family labor and a lower degree of mechanization

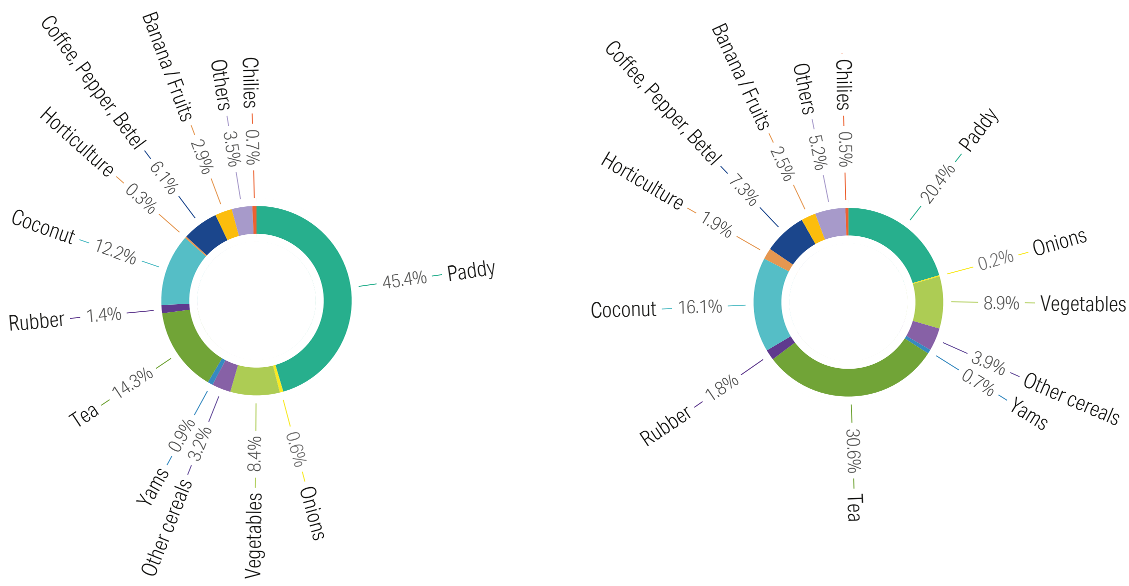
14. As proxy for access to information technology, a dummy variable is added to indicate whether any household member had an expenditure on a mobile phone, e-mail/internet, or computer.

15. See box 3 for a review of the literature.

(proxied by tractor ownership). On average, male farmers cultivate a slightly higher number of crops which is also reflected in the corresponding Simpson Index of Diversification, at 11.5 for male farmers and 0.6 for female farmers. Female farmers also have fewer opportunities for nonfarm activities relative to male farmers: while 44.9 percent of male farmers were engaged in nonfarm labor activities and drew 29.7 percent of income from these sources, only 19.3 percent of female farmers had access to nonfarm labor opportunities, and these comprised only 10.3 percent of their income.

While less diversified, the average crop mix of female farmers has a higher degree of export orientation than that of male farmers. Figure 8 shows the composition of crop mix by farmer's gender, as measured by the average share of cultivated area for each crop in total cultivated area. The share of paddy for male farmers accounted for about 45 percent, which is more than twice that of female farmers (20 percent). In contrast, the crop mix of female farmers tends to skew toward export-oriented crops: for example, the share of cultivated area dedicated to tea was 31 percent for female farmers versus 14 percent for male farmers. As a result, the Export Orientation Index among female farmers was estimated at 33.9, nearly twice as large as the estimated index value of 17.7 among male farmers.

FIGURE 8 Crop mix by farmer's gender



Source: World Bank staff estimations using HIES 2016.

Notably, the unconditional productivity advantage enjoyed by female farmers relative to male farmers—despite numerous disadvantages described above—does not translate into higher incomes. The gap observed between male and female farmers in Sri Lanka reverses when it comes to crop earnings, with male farmers earning on average Rs 16,970 per month, significantly higher than the earnings of female farmers at Rs 11,086. The male earnings advantage persists after adjusting for individual, household, location, and agricultural production-related characteristics. This is seen from the coefficients on the gender dummy in regression (2) in table 5, which are negatively significant at the 1 percent level.

The unconditional female productivity advantage appears to be explained by two factors: (i) lower access to land by female farmers, which results in higher productivity because of the inherent inverse relationship between land area and productivity; and (ii) the selection of a more profitable crop mix by female farmers. The productivity gap is further analyzed by conditioning it on different factors and attempting to identify what contributes to the female productivity advantage. Accounting for a number of personal, household, and location characteristics, the magnitude of the coefficient for the gender dummy was reduced but remained positively significant (regression (4)). However, once land area is controlled for, the sign of the coefficient for the gender dummy is reversed and becomes significant at the 1 percent level, suggesting the inverse relationship between land area and productivity is an important factor behind the female productivity advantage (regression (5)). In fact, female farmers have access to about one acre of land on average, which is only about half that of male farmers.

Moreover, female farmers tend to select a crop mix that consists of a higher share of higher-value crops, which increases their productivity relative to male farmers. Two sets of results support this observation. When accounting for the export-orientation of the production mix while not controlling for land area, the gender difference in productivity becomes statistically insignificant (regression (6)). In addition, as shown in the last four columns of table 6, which compare the log of productivity between male and

TABLE 6 Key summary statistics by crop and gender

	Gross crop income (Rs)			Cultivated area (acre)			Log of productivity[a]			
	Total	Male	Female	Total	Male	Female	Total	Male	Female	t-test (p-value)
Paddy	9,951	10,435	6,513	1.9	1.99	1.31	8.40	8.41	8.34	0.010 ***
Chilies	9,616	7,995	18,252	0.58	0.61	0.42	9.13	9.09	9.38	0.497
Onions	18,254	18,204	18,777	0.59	0.6	0.57	10.16	10.16	10.16	0.805
Yams	19,287	20,972	10,771	0.82	0.88	0.54	9.77	9.81	9.61	0.762
Vegetables	10,961	12,724	4,935	0.65	0.73	0.37	9.45	9.51	9.23	0.020 **
Tea	20,190	23,825	14,507	0.82	0.98	0.58	9.90	9.93	9.85	0.019 **
Rubber	20,702	20,757	20,539	1.36	1.37	1.36	9.43	9.47	9.28	0.119
Coconut	13,747	12,829	16,324	1.48	1.46	1.52	9.01	9.01	9.00	0.832
Coffee, pepper, betel	18,814	21,501	11,236	0.73	0.8	0.52	9.81	9.82	9.77	0.856
Banana/fruits	18,230	19,177	14,751	0.98	1.09	0.5	9.42	9.47	9.21	0.194
Total[a]	15,487	16,970	11,086	1.7238	1.9452	1.0438	9.14	9.09	9.30	0.000

Source: Staff calculation using HIES 2016.
Note: Significance level: * = 10 percent, ** = 5 percent, *** = 1 percent.
a. Productivity is measured by yield, i.e., gross real monthly output divided by the area cultivated (Rs/acre).

female farmers by crop, there is no female productivity advantage within the same crop. In fact, there appears to be a male productivity advantage for paddy, tea and vegetables, as seen from the t-test results in the last column, which indicate whether differences are statistically significant. This result suggests that productivity differences between crops rather than within crops are the driving force behind the higher unconditional productivity among female farmers. Once both the log of cultivated area and the Export Orientation Index are controlled for, the coefficient for the gender dummy becomes negatively significant, revealing a conditional male productivity advantage (regression (7) in table 5). Since regression (7) does not adjust for the variables concerning agricultural activities such as agricultural inputs, the magnitude of gender gap in favor of men is about 10 percentage points larger than that in our base regression (regression (1)) which controls for other production-related variables.

A decomposition analysis further helps identify the relative weight or importance of different factors that drive the productivity and earnings differentials. The decomposition is based on the same regressions but allows us to estimate the size of an endowment and structural effect for each variable, which can be used to assign a relative weight to the different characteristics. The original methodology was conceived to understand gender wage gaps and to break down the gap into an endowment effect (i.e., the difference in the gap that is due to differences in characteristics themselves) and a structural effect (i.e., the difference in the gap that is due to differential returns to characteristics, such as returns to education). Methodological details of the decomposition are briefly summarized in box 2. Previous studies have applied this decomposition method to analyze gender gaps in agriculture; see box 3 for a detailed review of the literature.

BOX 2 Oaxaca-Blinder decomposition

Using an Oaxaca-Blinder decomposition, we decompose productivity and earnings gaps into (i) a component driven by gender differences in levels of observable attributes (endowment effect) and (ii) a component coming from gender differences in returns to the same set of observables (structural effect) (Ali et al [2016]; Jann [2008]).

Specifically,

$$\bar{Y}_{\mathrm{MK}} - \bar{Y}_{\mathrm{FK}} =$$

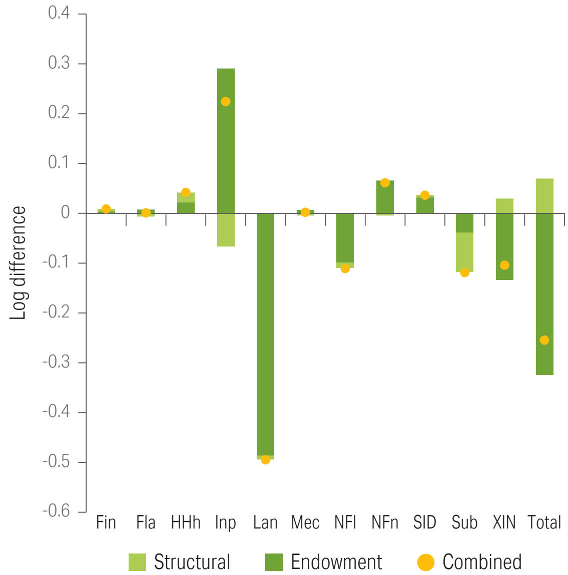
$$\Sigma_{k=1}^{K} \left[(\bar{X}_{\mathrm{MK}} - \bar{X}_{\mathrm{FK}})\, \hat{\beta}_{K}^{*} \right] \qquad \text{(endowment effect)}$$

$$+ \Sigma_{k=1}^{K} \left[\bar{X}_{\mathrm{MK}} (\hat{\beta}_{MK} - \hat{\beta}_{K}^{*}) \right] + \Sigma_{k=1}^{K} \left[\bar{X}_{\mathrm{FK}} - \hat{\beta}_{K}^{*}) \right] + (\hat{\beta}_{M\theta} - \hat{\beta}_{F\theta}) \qquad \text{(structural effect)}$$

where $\bar{Y}_{\mathrm{MK}} - \bar{Y}_{\mathrm{FK}}$ is the mean gender difference in log of productivity or crop income, and $\bar{X}_{\mathrm{MK}}$ and $\bar{X}_{\mathrm{FK}}$ are the average value of covariate K for men and women respectively. $\hat{\beta}_{M\theta}$, $\hat{\beta}_{F\theta}$, $\hat{\beta}_{MK}$ and $\hat{\beta}_{FK}$ are the returns to covariate K obtained from the ordinary least squares (OLS) regressions run separately by the gender of the farmer, and $\hat{\beta}_{K}^{*}$ are the returns to covariate K estimated by the pooled OLS model.

The decomposition confirms that the productivity gap in favor of women is explained by a smaller cultivated area and a higher-value crop mix among female farmers. The female productivity advantage can be explained by the endowment effect in favor of women, which outweighs the structural effect in favor of men. The results from a productivity decomposition are illustrated in figure 9 and table 7. The green and blue bars in the figure represent the size and direction of each characteristic in explaining the gap. A negative (positive) bar in figure 9 and negative (positive) sign in table 7 indicate that the characteristic works in favor of female (male) farmers. For example, the "Total" bar on the far right in figure 9 represents the gender gap owing to either endowment or structural effects. The negative endowment part is greater in value than the positive structural part, indicating female farmers are more productive. Specifically, panel B of table 7 reports that the female productivity advantage of -25.5 percent is decomposed into an endowment component of -32.5 percent and a structural component of 7.2 percent. The detailed decomposition in panel C by individual variables shows that the endowment effects are statistically significant for all the variables while none of the structural effects are statistically significant.

FIGURE 9 Oaxaca-Blinder decomposition for productivity gender gap



Source: World Bank staff estimations using HIES 2016.

Note: Fin = access to finance; Inp = agricultural inputs; Fla = number of unpaid agricultural family labor; Lan = log of cultivated area; Mec = mechanization; HHh = household head; NFI = share of nonfarm labor income; NFN = share of nonlabor income; SID = Simpson Index of Diversification; Sub = subsidy (sum of the coefficients for the incidence of subsidy and the log of the value of subsidy); XIN = Export Orientation Index.

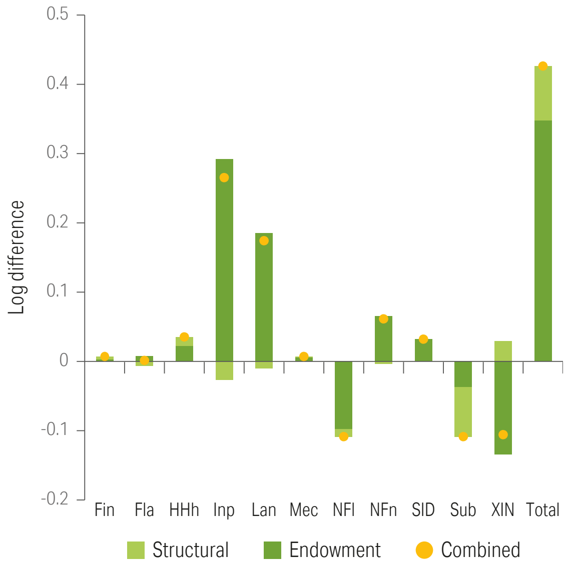
Access to land is the largest contributor to female endowment and ultimately to productivity advantage. The second largest contributor is the relatively large presence of export-oriented crops in the production mix among female farmers. This result contrasts with previous literature which found that the cultivation of cash crops contributes to male endowment advantage since male farmers are more likely to grow high-value cash crops; see for example Kilic, Palacios-Lopez, and Goldstein (2015) on Malawi; Ali et al (2016) on Uganda). Access to nonfarm labor income contributes to female productivity advantage. The latter could be because female farmers are less likely to have a nonfarm labor activity, and the availability of nonfarm labor income tends to be associated with lower agricultural productivity.

On the other hand, factors such as greater access to agricultural inputs, crop diversification, and smaller receipt of nonlabor income contribute to male productivity advantage. This can be seen by comparing the specifications in regressions (7) and (1) in table 5, and the narrowing of the coefficient on the gender dummy once additional production-related factors are accounted for. Male farmers are able to utilize far more agricultural inputs such as fertilizer, seeds, chemicals, hired labor, and means of transportation, which contribute to a male endowment advantage over female farmers (29.1 percent). Greater access to fertilizers may in part be due to male farmers receiving more subsidies that are mostly linked to paddy.

Female farmers are also less diversified, and their greater access to nonlabor income reduces the female productivity advantage because the availability of income from other sources tends to decrease crop productivity. Finally, access to finance is positively associated with both productivity and earnings (table 5) but does not seem to make an appreciable difference between men and women farmers (figure 10), possibly because commercial financing options are limited for most farmers. This also appears to be the case for mechanization (proxied with tractor ownership) and unpaid agricultural family labor.

Male farmers outearn female farmers significantly, mainly owing to greater use of inputs. Both the endowment effect (34.8 percent) and to a lesser extent the structural effect (7.8 percent) contribute to male earnings advantage. Male farmers outearn female farmers by a significant share—42.6 percent (figure 10, table 7). Greater access to agricultural inputs among male farmers is the leading contributor, as suggested by the large endowment effect of 29.1 percent. Contrary to the result from the productivity gap decomposition, having access to more land confers a large earnings advantage to male farmers (18.5 percent).

FIGURE 10 Oaxaca-Blinder decomposition for earning gender gap



Source: Staff estimations using HIES 2016.

Note: Fin = access to finance; Inp = agricultural inputs; Fla = number of unpaid agricultural family labor; Lan = log of cultivated area; Mec = mechanization; HHh = household head; NFI = share of nonfarm labor income; NFN = share of nonlabor income; SID = Simpson Index of Diversification; Sub = subsidy (sum of the coefficients for the incidence of subsidy and the log of the value of subsidy); XIN = Export Orientation Index.

TABLE 7 Productivity and earnings gap decompositions

	Decomposition of productivity gap		Decomposition of earnings gap	
A. Mean gender differential (log)				
Mean productivity of male farmers		9.034 ***		
Mean productivity of female farmers		9.288 ***		
Mean gender differential in productivity		-0.254 ***		
Mean earnings of male farmers				9.190 ***
Mean earnings of female farmers				8.764 ***
Mean gender differential in earnings				0.426 ***
	Endowment	Structural	Endowment	Structural
B. Aggregate decomposition (%)				
Total	-0.325 ***	0.072 ***	0.348 ***	0.078 ***

		Endowment	Structural	Endowment	Structural
C. Detailed decomposition (%)					
Fin	Access to finance	0.004 ***	0.005	0.003 ***	0.004
Inp	Agricultural inputsa	0.291 ***	-0.067	0.292 ***	-0.027
Fla	Number of unpaid agricultural family labor	0.008 **	-0.007	0.008 **	-0.007
Lan	Log of cultivated area	-0.487 ***	-0.008	0.185 ***	-0.011
Mec	Mechanization	0.007 ***	-0.005	0.006 ***	0.001
HHh	Household head	0.022 **	0.02	0.022 **	0.013
NFI	Share of nonfarm labor income	-0.099 ***	-0.012	-0.098 ***	-0.011
NFn	Share of nonlabor income	0.066 ***	-0.005	0.065 ***	-0.004
SID	Simpson Index of Diversification	0.032 ***	0.004	0.032 ***	0
Sub	Sum of subsidy	-0.039 ***	-0.08	-0.037 ***	-0.072
	Incidence of crop subsidy	-0.154 ***	-0.063	-0.159 ***	-0.054
	Log of crop subsidy	0.115 ***	-0.017	0.122 ***	-0.018*
XIN	Export Orientation Index	-0.134 ***	0.03	-0.135 ***	0.029

Source: World Bank staff estimation using HIES 2016.

Note: Negative sign indicates female productivity or earning advantage, while positive sign shows male productivity or earning advantage.
Significance level: * = 10 percent, ** = 5 percent, *** = 1 percent.
a. Agricultural inputs include seeds, fertilizer, chemicals, hired labor, transport cost, and agricultural equipment/rental.

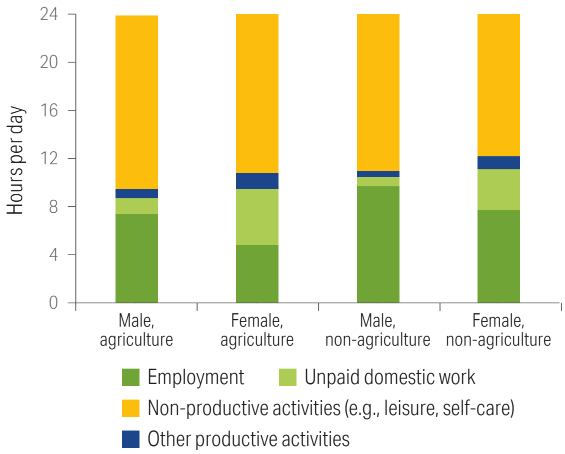
Social norms could also be driving a wedge between male and female productivity, besides productivity-related factors discussed and analyzed above. It has been widely documented that across countries, women spend more time in household work and child care, while men spend more time in market work (Ferrant, Pesando, and Nowacka 2014; Suárez Robles 2010). Even more important, if both market work and home activities are accounted for, women spend more time working in total than men (Rubiano-Matulevich and Viollaz 2019; Ilahi 1999). Such unequal patterns are typically driven by gender and social norms. Unequal time allocation (and unequal distribution of inputs of production) is also found to contribute to inefficiencies in agricultural productivity (Udry et al 1995).[16]

Overall, our findings above are consistent not only with input constraints, but also with a context in which gender-specific norms influence agricultural production decisions and productivity. The literature frequently describes women's limitations in the activities that can be taken up and notes their preference for agricultural work, including small livestock farming, that can be conducted from home and allows them to tend to household chores and childcare at the same time. Our regression result shows that the productivity gender gap in favor of men remains after controlling for personal, household, location, and agricultural variables (regression (1) in table 5). Gender-specific norms are a plausible factor that accounts for the persistent gender gap.

16. Analysis is based on the Sri Lanka Time Use Survey 2017, which collects information on how individuals spend their time in 15-minute intervals throughout the day, with detailed records of the activity conducted.

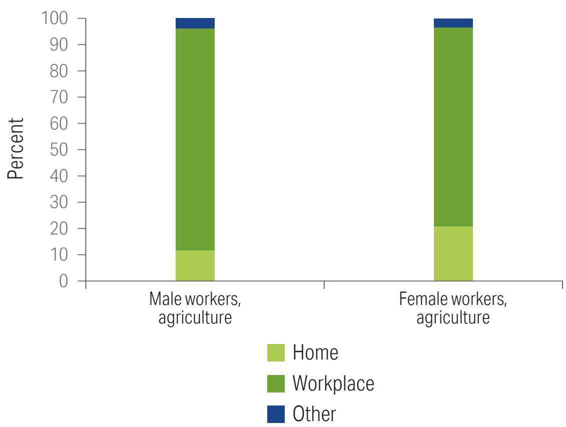
Indeed, time use data suggest that women working in agriculture spend significantly less time on paid employment and more time on unpaid domestic work, whether compared to male workers in agriculture or their counterparts working outside of agriculture. Figure 11 reports the differences in a day's time use by gender, with hours spent on employment, unpaid domestic work, other unpaid work, and nonproductive activities (such as leisure, self-care, learning, etc.). The number of hours spent on paid work by women engaged in the agriculture sector is 4.8 hours per day on average. This is significantly lower than the number of hours spent on paid work by male workers in the same sector (7.4 hours) or women employed outside of the agriculture sector (7.7 hours). Moreover, women are about twice as likely to be working from home, which might reflect the need to tend to household chores and care responsibilities (figure 12).

FIGURE 11 Differences in daily time use by gender



Source: World Bank staff estimation using Sri Lanka Time Use Survey 2017.

FIGURE 12 Agriculture workers' work location, by gender



Source: World Bank staff estimation using Sri Lanka Time Use Survey 2017.

BOX 3 Measuring the gender gap in agricultural productivity: A literature review

The measurement of gender gaps in agricultural productivity is empirically challenging. Studies on the gender agricultural productivity gap typically rely on one of two strategies: (i) interhousehold differences, based on agricultural production of male- or female-headed households, or (ii) intrahousehold differences, based on agricultural production of male- or female-managed plots. The problem with comparing agricultural productivity based on the head of household is that there are possible omitted variables, since most women who head households tend to be widowed, have a migrant husband, or in general display systematic differences from male-headed households. Moreover, both strategies rely on linear estimations, which could result in biased coefficients if the endogeneity of input choices is not addressed (see Quisumbing [1996] for a review). Despite this issue, comparing male- and female-managed plots allows for analyses of the returns to productive inputs. In this regard, the Sri Lanka HIES provides a unique opportunity to study the determinants of the gender gap, as it has detailed information for male- and female-managed plots.

In previous studies, the gender gap in agricultural productivity is driven by the structural effect. A widely used strategy to evaluate the agricultural productivity gender gap is the Oaxaca-Blinder decomposition (Oaxaca 1973; Blinder 1973). The Oaxaca-Blinder strategy decomposes the simple difference in productivity between genders in a component explained by differences in farmer and plot characteristics (endowment effect) and an unexplained component or differences in the returns to such factors (structural effect). Some studies using this approach have found that the gender gap in agricultural productivity is largely driven by the structural component. For example, Aguilar et al (2015) estimate a gap of 23.4 percent in favor of men in Ethiopia, with 57 percent of it still unexplained after accounting for land and manager characteristics. Ali et al (2016) estimate a gap of 17.5 percent in Uganda, with 30.4 percent attributed to unexplained returns to endowments. Oseni et al (2015) find a gap of 28 percent in favor of men in northern Nigeria, again mainly driven by differentiated returns. Backiny-Yetna and McGee (2015) find the gender gap in Niger to be 18.3 percent in favor of men, with 148 percent of it explained by the structural effect. But differences across countries are important in determining the relative contribution of these effects. Contrary to these findings, Kilic et al (2015) estimate a gender gap of 25 percent in favor of men in Malawi but find that 82 percent of it is driven by differentials in observables, rather than the structural component.

The child dependency ratio, male labor, crop diversification, productive inputs, and land size are among the main drivers of the gender gap in productivity. An advantage of the Oaxaca-Blinder strategy is that it not only allows decomposition of the gender gap in the endowment and structural effects, but also allows the evaluation of each factor's marginal contribution. This strategy has allowed previous studies to highlight the most important determinants to the structural component of the agricultural gender gap. For example, differences in the returns to extension services, land certification, land extension, and product diversification have been found to be the main drivers of the structural gap in Ethiopia (Aguilar et al. 2015). In Uganda, the main drivers of the structural gap were identified as coming from the child dependency ratio, uptake of and return to improved seeds and pesticides, and male-owned assets (Ali et al. 2016). For Niger, the main drivers of the structural effect were family and hired labor, the child dependency ratio, distance of the household to the nearest major road, and elevation of the plot (Backiny-Yetna and McGee 2015). In Tanzania, the main drivers of the structural effect were plot area and family labor (Slavchevska 2015). In Malawi, where the endowment effect was the main driver of the gender gap, the most important factors were high-value crop cultivation and household male labor inputs (Kilic, Palacios-Lopez, and Goldstein 2015). To summarize, existing literature has found the most important factors contributing to the gender gap in agricultural productivity may be the child dependency ratio, male labor, crop diversification, and productive inputs.

The inverse relationship between land size and agricultural productivity is a critical factor to explain differences in agricultural output. The inverse relationship between land size and agricultural productivity has been long studied.[a] Most studies have found this relationship to hold in a variety of contexts (Berry and Cline 1979; Carter 1984; Eswaran and Kotwal 1986; Benjamin 1995; Barrett 1996), although a few did not find evidence of such a relationship (Kevane 1996; Zaibet and Dunn 1998). It is not clear yet what explains the inverse relationship, though there is some consensus that family labor could be an important driver (Carter 1984; Barrett 1996). Smaller farms use more family labor than larger farms (Carter 1984), and there is a U-shaped relationship as larger commercial farms, investing in capital and commercial crops, have monotonic increases to land size (Carter and Wiebe 1990). Other factors identified as important drivers are price risk (Barrett 1996) and land quality (Benjamin 1995). Mismeasurement of plot sizes was also put forward as a possible explanation (Lamb 2003), but recent studies using more sophisticated measures of land size confirmed the inverse relationship (Carletto, Savastano, and Zezza 2013; Larson et al. 2014).

The literature has not yet reached an agreement on the association between the inverse relationship and gender. That association has been less explored because of the methodological issues outlined above (Quisumbing 1996). Some studies found evidence of returns to land size contributing in favor of women (Aguilar et al. 2015; Kilic, Palacios-Lopez, and Goldstein 2015; Ali et al. 2016; Backiny-Yetna and McGee 2015; Slavchevska 2015). The most widely accepted explanation for this result is that the inverse relationship plays in favor of women, as women control smaller plots. As discussed, it is widely agreed that the inverse relationship holds in the context of family labor allocation. Udry et al (1995) and Udry (1996) document that plots controlled by women in the African context are farmed less intensely than similar plots controlled by men, although this could be context dependent. For example, Barrett, Bellemare, and Hou (2010) argue that activities are gendered in Madagascar, but control over plots does not vary significantly within households, suggesting that the inverse relationship found in their study is not driven by intrahousehold asymmetries.

a. The origin of the study of the inverse relationship has been attributed for historical studies to Chayanov (1966), on the Soviet Union in the early 20th century; for contemporary studies, the seminal work is Sen (1962) in the context of India.

4.

Conclusion and Policy Implications

Using detailed information on agricultural activities among farm households in Sri Lanka, this note describes and further disaggregates by gender patterns in production, productivity, and incomes. The analysis describes varying spatial patterns in production across the country, in which high-productivity areas coincide with those having a high share of high-value crops that are more export-oriented, and low-productivity areas are mainly located in places with a high level of paddy production. Subsistence farming has declined significantly over time but remains at high levels for paddy.

Female farmers enjoy an unconditional productivity advantage which is primarily attributed to lower access to land. Women cultivate a smaller area of land, and the underlying inverse relationship between cultivated area and productivity leads to higher average productivity. Despite this productivity advantage, the small size of cultivated land among female farmers leads to lower crop income relative to male farmers.

The second source of female productivity advantage is that the crop mix of female farmers contains a relatively large portion of export-oriented/higher-value crops. Female farmers tend to grow more high-value crops, such as tea while a relatively large share of male farmers engages in paddy farming, which is domestically oriented and yields low returns. Thus promoting export-oriented/high-value crops could contribute to higher agricultural productivity and incomes as well as enhance gender equality. Once controlling for land area and crop mix, male farmers have a conditional productivity advantage over female farmers. This is largely explained by their greater access to resources, including agricultural inputs, transportation, subsidy, unpaid family labor, and mechanization.

The analysis in this paper points to several areas where policies could focus to improve rural livelihoods. First, diversification accompanied by a shift to high-value agriculture could help raise agricultural productivity. Nearly half of Sri Lanka smallholders are engaged in paddy production and their productivity is low. In contrast, the cultivation of export-oriented crops—which tend to be high-value crops—is associated with higher productivity and crop income. For this, the local agroecological context will matter for the type of diversification as not all areas are suitable for the cultivation of high-value plantations crops. Increasing the productivity of paddy farmers is another important route to improving overall productivity. Data suggest that improvements in the last decade have been slow. It will be important to understand which factors might have played a role.

Policies to equalize access to resources like land and agricultural inputs, as well as interventions that could free up women's household responsibilities, are likely to help increase women's access to land and generate more crop income. With regard to land ownership, there are some long-standing issues that may warrant attention. For example, the land law can discriminate against women who opt to be governed by personal laws. Women who marry under the Thesawalami law cannot gain control of property without their husband's consent (Zainudeen 2016). Under the Land Development Ordinance of 1935 and its subsequent amendments, the grant of state land in agricultural settlement schemes continues to favor men over women because grants are generally made to the male head of the household (Ranaraja 2020). It would also be important to understand the constraints that lead to unequal access to agricultural resources. The analysis shows that male productivity advantage persists even after adjusting for agricultural resources and other characteristics, possibly reflecting remaining unequal patterns driven by gender and social norms.

Appendix

TABLE A.1 Distribution of production systems for farm households, by district

Province	District	Crops only	Mixed crop-livestock	Livestock only
Western	Colombo	79.95	2.8	17.25
Western	Gampaha	81.25	3.88	14.87
Western	Kalutara	97.57	1.27	1.16
Central	Kandy	89.83	4.61	5.56
Central	Matale	92.28	3.21	4.51
Central	Nuwara Eliya	74.78	9.86	15.36
Southern	Galle	97.33	1.3	1.37
Southern	Matara	95.32	2.32	2.36
Southern	Hambantota	89.33	3.67	7
Northern	Jaffna	60.9	11.8	27.3
Northern	Mannar	65.23	8.26	26.5
Northern	Vavuniya	63.9	22.05	14.05
Northern	Mulaitivu	66.93	21.59	11.48
Northern	Kikinochchi	70.74	4.17	25.09
Eastern	Batticaloa	50.04	10.12	39.84
Eastern	Ampara	88.67	6.27	5.06
Eastern	Trincomalee	75.57	7.85	16.58
North-Western	Kurunegala	90.25	6.44	3.31
North-Western	Puttalam	76.42	7.79	15.79
North Central	Anuradhapura	86.96	8.87	4.17
North Central	Polonnaruwa	88.07	5.95	5.98
Uva	Badulla	91.4	5.01	3.59
Uva	Monaragala	97.52	0.87	1.61
Sabaragamuwa	Ratnapura	97.87	0.85	1.28
Sabaragamuwa	Kegalle	95.37	2.05	2.58
Total		88.43	5.07	6.49

Source: World Bank staff calculation using HIES 2016.

Note: The table shows the share of farm households engaged in different production systems. Livestock activities are identified if the household reports output value from meat, fish, eggs, milk, and other livestock.

TABLE A.2 Summary statistics of self-employed farmers[a]

	Mean			t-test
	Total	Male	Female	(p-value)
Monthly real gross crop income (Rs)	15,487	16,970	11,086	0.000 ***
Cultivated area (acres)	1.724	1.945	1.044	0.000 ***
Productivity (Rs/acre)[b]	16,905	15976	19,809	0.000 ***
Household head	0.793	0.876	0.546	0.000 ***
Age	51.7	51.9	51.1	0.000 ***
Years of education	8.524	8.461	8.711	0.007 ***
Access to nonfarm labor income	0.385	0.449	0.193	0.000 ***
Access to non-labor income	0.470	0.451	0.529	0.000 ***
Share of nonfarm labor income (%)	0.248	0.297	0.103	0.000 ***
Share of nonlabor income (%)	0.174	0.144	0.262	0.000 ***
Number of unpaid agricultural family labor	0.179	0.220	0.059	0.000 ***
Agricultural inputs (Rs/month)	4812	5449	2923	0.000 ***
Tractor (=1 if tractor(s), =0 otherwise)	0.104	0.122	0.048	0.000 ***
Incidence of natural calamity	0.114	0.109	0.132	0.071 *
Access to finance	0.090	0.098	0.066	0.000 ***
Access to IT	0.880	0.882	0.874	0.267
Incidence of crop subsidy	0.337	0.389	0.180	0.000 ***
Value of crop subsidy (Rs/month)	898	935	658	0.150
Export Orientation Index	0.216	0.177	0.339	0.000 ***
Simpson Index of Diversification	0.102	0.115	0.060	0.000 ***
= 1 if urban, = 0 otherwise	0.0271	0.0266	0.0287	0.9931
= 1 if rural, = 0 otherwise	0.9500	0.9490	0.9529	0.2583
= 1 if estate, = 0 otherwise	0.0229	0.0244	0.0184	0.1048

Source: World Bank staff calculation using HIES 2016.

Note: Significance level: * = 10 percent, ** = 5 percent, *** = 1 percent.

a. Self-employed farmers are defined as those who had income from at least one crop activity. Those farmers having only livestock activity are not included due to the lack of land information.

b. Productivity is measured as gross income divided by cultivated area in acres.

TABLE A.3 Summary statistics of agricultural wage workers[a]

	Mean			t-test (p-value)
	Total	Male	Female	
Monthly real crop wage (Rs)	13,330	15,460	10,319	0.000 ***
Household head	0.544	0.739	0.269	0.000 ***
Age	45.4	44.9	46.1	0.019 **
Years of education	6.088	6.361	5.704	0.000 ***
Share of nonfarm labor income (%)	0.002	0.002	0.001	0.523
Share of farm self-employment (%)	0.085	0.121	0.035	0.000 ***
Share of nonfarm non labor income (%)	0.091	0.087	0.097	0.164
= 1 if urban, = 0 otherwise	0.011	0.013	0.008	0.256
= 1 if rural, = 0 otherwise	0.657	0.720	0.568	0.000 ***
= 1 if estate, = 0 otherwise	0.332	0.267	0.425	0.000 ***

Source: World Bank staff calculation using HIES 2016.

Note: Significance level: * = 10 percent, ** = 5 percent, *** = 1 percent.

a. Wage workers are defined as those who responded that their main activities were crop activities at the ISIC four-digit level and who had a wage. Self-employed farmers and agricultural wage workers are not mutually exclusive since some individuals have both self-employed and wage jobs.

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