

# Exploring the Sources of the Agricultural Productivity Gender Gap

Evidence from Sri Lanka

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## Abstract

Previous literature found overwhelming evidence of an agricultural gender gap in favor of male farmers. The case of Sri Lanka is unique as agricultural productivity, measured by yield per unit of land, is 25.4 percent higher among female farmers than male farmers. Using the nationally representative 2016 Sri Lanka Household Income and Expenditure Survey and the Oaxaca-Blinder decomposition technique, the paper explores the sources of this unconditional female productivity advantage. The analysis finds that the smaller plot size cultivated by women is the leading source of female productivity advantage, reflecting the inverse relationship between cultivated area and productivity. However, this productivity advantage does not translate into women's

higher crop earnings. Another important source is the gendered pattern of crop mix as women tend to cultivate more high-value, export-oriented crops, while men are more likely to grow paddy with low productivity. Once controlling for plot size and crop mix, a conditional male productivity advantage emerges, reflecting men's greater access to agricultural resources and potentially an unequal pattern of division of labor associated with social and gender norms. Policies to promote equitable access to resources and address other constraints to women's productivity in agriculture continue to be important in promoting gender equality.

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# Exploring the Sources of the Agricultural Productivity Gender Gap: Evidence from Sri Lanka

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## 1. INTRODUCTION

As the world's poor in developing countries are disproportionately engaged in agriculture, increasing agricultural productivity and income is key to raising rural living standards (Castañeda et al. 2018; World Bank 2007). Women comprise a large share of the agricultural labor force in developing countries – e.g., 49% in Africa, 37% in South Asia and 21% in Latin America (FAO 2011). Yet there is overwhelming evidence of a gap in agricultural productivity that is in favor of male farmers, which could lead to missed opportunities for improving the earnings of poor rural households.

A large body of earlier literature explored the sources of the gender productivity gap and found that women tend to have less access to productive resources such as land, labor, other inputs (e.g., fertilizer, improved seeds), credit, or extension services; experience lower quality inputs (e.g., inferior soil quality); have lower access to transport and markets; and face greater institutional constraints such as inadequate land rights, low tenure security, unequal gender norms and discrimination (e.g., Croppenstedt, Goldstein and Rosas 2013; FAO 2011; Quisumbing et al. 2014; and Udry 1996). Most studies found that the gender gap is reduced or even disappears, once controlling for input usage and other factors of production. It was subsequently argued that gender gaps could be overcome if female farmers had the same level of access to inputs and other agricultural resources as men. However, with a few exceptions, most of these earlier studies were limited in geographical scope.<sup>1</sup>

A set of recent papers revisited the issue using nationally representative data (e.g., Aguilar et al. 2015; Ali et al. 2016; Backiny-Yetna and McGee 2015; Carletto, Savastano and Zezza 2013; de la O Campos, Covarrubias and Patron 2016; Kilic, Palacios-Lopez and Goldstein 2015; Oseni et al. 2014; and Slavchevska 2015). These studies relied on the Oaxaca-Blinder decomposition method (Oaxaca 1973; Blinder 1973) to decompose the gender gap in agricultural productivity into two portions: a component explained by differences in observable attributes (endowment effect) and an unexplained component of differences in the returns to endowment (structural effect). Compared to earlier estimates in the literature, these studies found a larger magnitude of the fraction of the (unexplained) returns to endowment, implying that even if female farmers had access to the same inputs as male counterparts, a productivity gender gap would still remain. That is, simply equalizing access to productive resources may

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<sup>1</sup> For instance, using nationally representative data from Burkina Faso, Akresh (2005) was able to replicate the Pareto inefficient intrahousehold resource allocations found by Udry (1996) in the areas examined in the paper but not in other parts of the country.

not lead to equal outcomes unless the factors behind the differential returns are rectified. Moreover, these studies have been largely limited to Africa. This is partly because it is more common for male and female farmers to manage different plots in Africa, facilitating gender differentiated analysis, and partly because high-quality nationally representative household surveys had recently become available in some African countries (Kilic, Winters and Carletto 2015). Research on this issue is surprisingly scarce in countries outside the Africa region, including South Asia.<sup>2</sup>

Sri Lanka provides an interesting case to study the productivity gender gap since the Household Income and Expenditure Survey (HIES) is representative at the national level and separately contains detailed information on agricultural production such as land, inputs, and crop mix at the level of the individual farmer. Initial analysis of the data reveals a stark contrast to the previous literature: it shows that productivity measured by yields (defined as output value per acre) is *higher* among female farmers than male farmers.

This paper explores the sources of this unconditional female productivity advantage using multivariate regression analysis and Oaxaca-Blinder decompositions. We find that the leading contributor to this productivity gap in favor of women is the smaller size of the plots that women cultivate, reflecting the inverse relationship between farm size and agricultural productivity commonly found in the literature. Another important source is the gendered pattern of crop mix: women tend to cultivate more high-value, export-oriented crops than men, who are more likely to grow paddy, which suffers from low productivity. Male farmers, on the other hand, have greater access to agricultural resources, which helps offset partly their initial productivity disadvantage.

The contribution of this paper to the literature is threefold. First, this is the first study to analyze the agricultural productivity gender gap using nationally representative data in Sri Lanka, thereby contributing to the scarce literature in South Asia on this topic. While the data primarily captures smallholder farmers due to the nature of the household survey, the setting is particularly interesting as it starts out from an unconditional productivity gap in favor of women which, to the best of our knowledge, has not been observed in any other country. Second, a particular focus is on analyzing how the gendered pattern of crop mix would influence the productivity gender gap among smallholder farmers. While paddy, the main staple crop in Sri

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<sup>22</sup> One exception is Mahajan (2019), which studies the agricultural gender gap using a nationally representative survey in India.

Lanka, tends to be regarded as a ‘men’s crop’ (FAO 2018), high-value and export-oriented crops such as tea feature disproportionately in the crop mix of Sri Lanka’s female farmers. We develop a simple Export Orientation Index to capture the export intensity of a farmer’s crop mix. A smaller plot size and the associated higher land productivity confer a productivity advantage on female farmers, which is reinforced by a higher-value crop mix. Third, we investigate not only the determinants of the productivity gender gap but also those of the agricultural earnings gap. This analysis reveals that the unconditional productivity advantage does not translate into higher incomes for female farmers.

The remainder of the paper is organized as follows. Section 2 presents the Sri Lankan context for the agriculture sector, including details on production patterns and productivity by the gender of farmers. Section 3 describes the data and reports summary statistics. Section 4 presents the empirical methodology and main results. Section 5 discusses policy implications and concludes.

## 2. SRI LANKA: AGRICULTURAL PRODUCTIVITY AND GENDER

Sri Lanka has experienced substantial progress in poverty reduction. Between 2012/13 and 2016, the \$3.20 poverty rate fell from 16.2% to 11% (World Bank 2021a). However, as agriculture remains an important source of livelihoods for the poor (World Bank 2021c), identifying opportunities to increase productivity and incomes in the sector is a priority for reducing poverty and lifting the living standards in rural areas.

Women’s labor force participation in Sri Lanka is low, at 37.8%, compared to 79.1% for men in 2019 (World Bank 2021d). Agriculture accounted for 23.6% and 27.6% of male and female employment, respectively (World Bank 2021d). Improving the returns to income-generating activities for women in the farm sector is important given that many of them work as unpaid family workers and because women have fewer opportunities to participate in nonfarm activities due to their household and care responsibilities (World Bank 2021c).

For the purpose of our analysis, ‘farmers’ in this study are defined as those who reported a positive gross crop output value in the 2016 HIES. By this definition, there were 1.7 million farmers in 2016, of whom 1.3 million were male farmers and 0.4 million were female farmers.<sup>3</sup>

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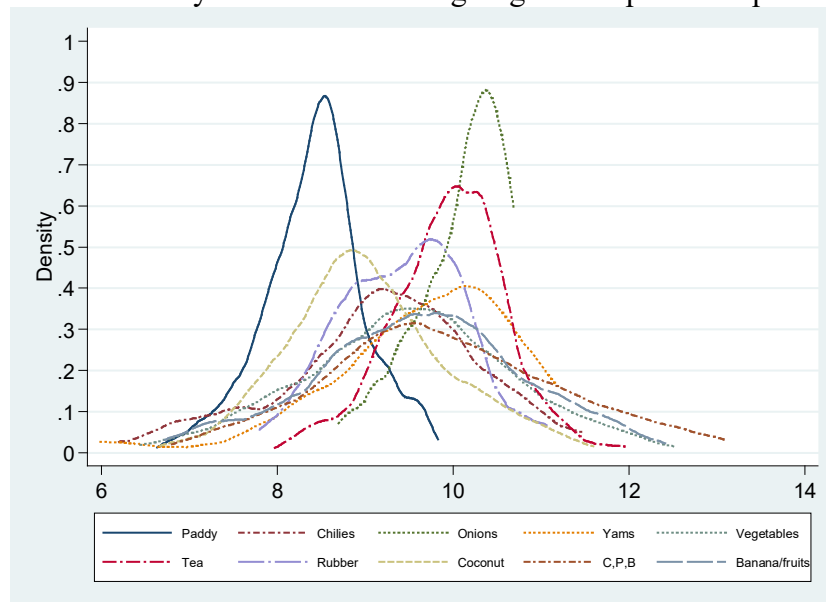
<sup>3</sup> These numbers should not be interpreted as representing the gender breakdown of the workforce in the agriculture sector. Because the definition considers only those farmers with a positive crop output, most unpaid family workers who account for a large share of female workers in Sri Lanka are not included. Also, these figures do not include agricultural wage workers who have different profiles from self-employed farmers (World Bank

It should be noted that, by construction, this definition considers only those who reported a crop output and not necessarily all those involved in agriculture. In particular these numbers do not include agricultural wage workers or unpaid family workers.

Paddy is the main staple crop in Sri Lanka and a vast amount of land area is devoted to paddy cultivation. Nearly half of all farm households grow paddy, mostly for home consumption or domestic sales (World Bank 2021b). Major cash crops include tea, rubber, spices (e.g., cinnamon) and coconut, and a large share of their production is aimed toward export markets (World Bank 2021b). In particular, 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% of tea production is accounted for by smallholders and the rest by large plantations (ILO 2018).

Comparing the log of gross output value per acre by individual crop, our measure of productivity, we find that paddy stands out for its low productivity while export-oriented crops such as tea appear to be significantly more productive (Figure 1). Consistent with the low productivity of paddy, poor farmers rely more on paddy cultivation than other crops for their income (World Bank 2021b).<sup>4</sup>

Figure 1. Kernel density estimates of the log of gross output value per acre by crop



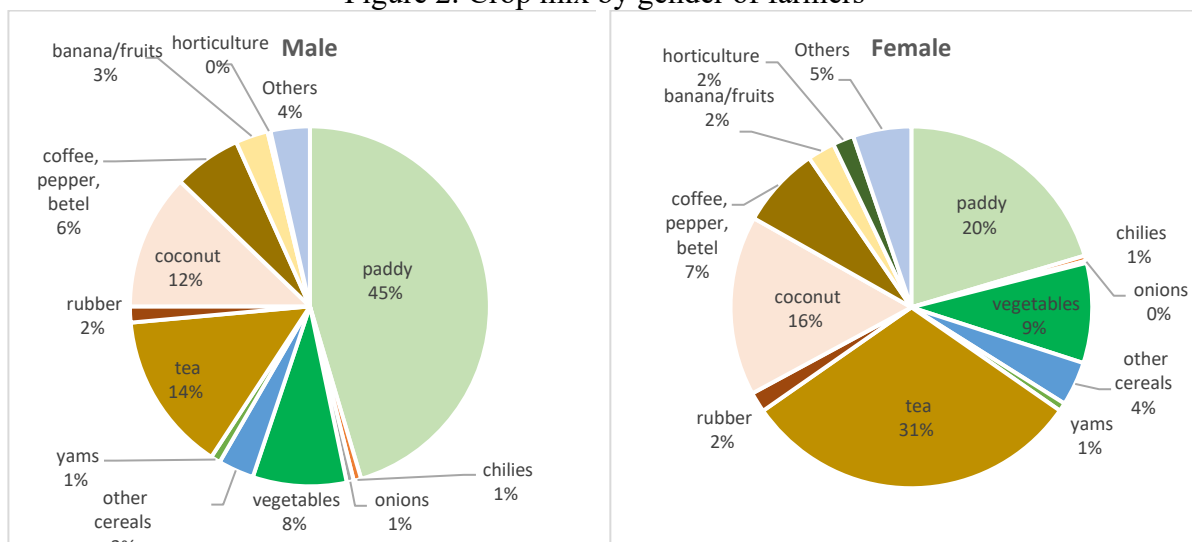
2021b, Box 4). A final caveat is that the sample includes those individuals whose main activity does not involve farming as long as they report a positive crop output.

<sup>4</sup> The poorest farmers, those who belong to the bottom 20% of the household income distribution, are most reliant on paddy farming, with over 40% of their farm output value coming from paddy, while the contribution of cash crops to their income is low. In contrast, farmers in the top 20% receive only about 26% of their farm output value from paddy (World Bank 2021b).

Source: Authors' calculation using HIES 2016.  
 Note: C, P, B = coffee, pepper, betel.

The crop mix of female farmers contains a greater share of export-oriented crops than that of male farmers, which increases their overall productivity. Figure 2 shows the composition of the crop mix by the farmer's gender, as measured by the average share of area devoted to each crop. Among male farmers, about 45% of land was accounted for by paddy, which is more than twice as much as the share among female farmers (20%). In addition, the crop mix of female farmers tends to skew toward export-oriented crops: for example, an average of 31% of land area was dedicated to tea cultivation among female farmers, whereas the share was only 14% for male farmers.

Figure 2. Crop mix by gender of farmers



Source: Authors' estimations using HIES 2016.

In contrast to the previous literature, initial analysis suggests that female farmers are more productive than male farmers, unconditionally. Gender differences in crop productivity, income, and access to land are evident. Overall, male farmers have higher earnings than female farmers, as shown in Figure 3a which presents the kernel density estimates of the log of total gross crop output value by gender. Female farmers tend to cultivate less land, as shown by the kernel density estimates of the log of land area by gender (Figure 3b.) Figure 3c demonstrates the kernel density estimates of the log of crop output value divided by the cultivated area (Rs/acre), which measures land productivity. Female farmers have higher land productivity per unit of land than male farmers. The next section investigates the sources behind this unconditional female productivity advantage.

Figure 3a. Kernel density estimates of the log of crop output value

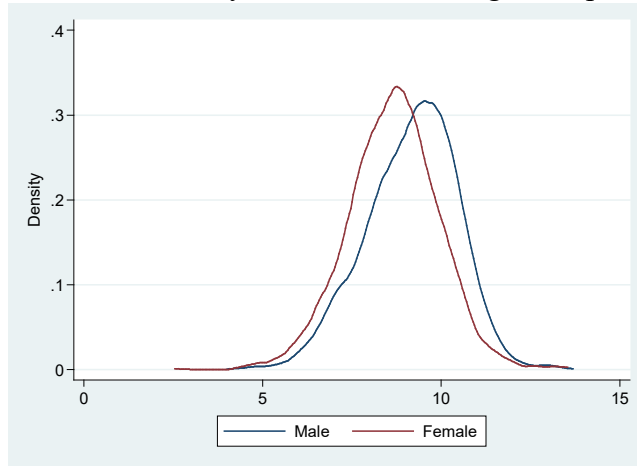


Figure 3b. Kernel density estimates of the log of land area

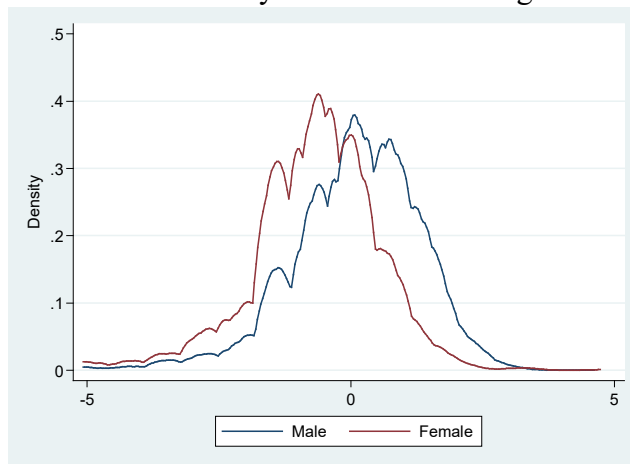
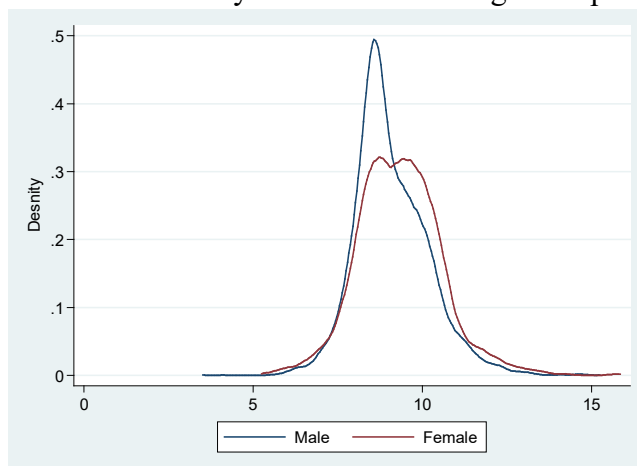


Figure 3c. Kernel density estimates of the log of output per acre



Source: Authors' estimations using HIES 2016.

Note: Estimates are based on the monthly value of gross crop output.

### 3. DATA AND DESCRIPTIVE STATISTICS

#### *(a) Data*

Studies on the agricultural productivity gender gap typically use one of two indicators to identify farm outcomes by gender: (i) the gender of the household head or (ii) the gender of the plot (or farm) manager. Several papers point out that the latter is likely better at capturing the gender gap, since the former does not take into account the distribution of inputs and the specific decision-making process among household members (de la O Campos, Covarrubias and Patron 2016<sup>5</sup>; Peterman et al. 2011). Another problem with using the gender of the household head to compare agricultural productivity across households is that there are potential omitted variables, given that many female heads of household tend to be widowed, have a migrant husband, or are otherwise systematically different from male-headed households (Kleinjans 2013).

The advantage of our household data set is that the survey captures who is the primary responsible person for each crop production. We use detailed data on individual farmers and their agricultural activities from the Household Income and Expenditure Survey 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. Data on agricultural self-employment activities include information on crops cultivated, crop area, value 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), cash crops (tea, rubber, coconuts, coffee/pepper/betel, banana/fruits) and livestock (meat, eggs, milk), fish, horticulture, other crops and livestock.<sup>6</sup>

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<sup>5</sup> In Uganda, De la O Campos et al. (2015) find a conditional agricultural productivity gender gap of about 10 percent when using female plot manager, but find no conditional gap when using gender of household head as the gender variable.

<sup>6</sup> While the data are detailed enough to conduct further analysis, certain data limitations should be acknowledged. 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 cost value is available in the data. 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, soil quality or actual use of extension services (though the survey asks about the distance from home to the closest Agrarian Service Center).

(b) *Measuring characteristics of crop mix*

A movement of resources from low-value to high-value agriculture, including export agriculture, has been considered as a channel through which smallholders may raise agricultural productivity and income (Otsuka, Nakano and Takahashi 2016; Ton et al. 2018; Wang, Wang and Delgado 2014). Farmers' crop choice may be gendered, partly reflecting gender norms associated with different crops (Carr 2008). The majority of the previous literature finds that male farmers have more access to production and marketing of cash and export crops than their female counterparts (Ali et al. 2016; Croppenstedt et al. 2013; Hill and Vigneri 2014; Kilic, Palacios-Lopez and Goldstein 2015; Maertens and Swinen 2012; and Mahaja 2019). A meta-analysis by Ola and Menapace (2020) finds that in Africa, male farmers are more likely than female farmers to participate in high-value markets, but it does not find such a systematic effect in Asia and South America.

A simple Export Orientation Index is constructed to capture the relative importance of export-oriented and domestically oriented crops, which tend to be high- and low-valued crops respectively in a farmer's portfolio. Specifically, the index is calculated as follows:

$$XIND_i = \sum_k (ShX_k \times ShS_{ik})$$

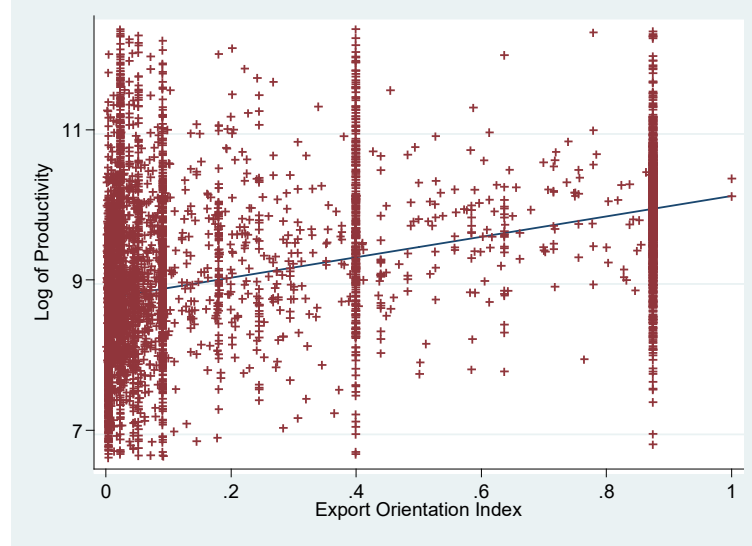
where  $XIND_i$  is the Export Orientation Index for farmer  $i$ , and  $ShX_k$  is the export intensity of crop  $k$ , i.e., the share of exports of the overall production quantity at the national level taken from FAOSTAT (2014-2017 average).<sup>7</sup>  $ShS_{ik}$  is the share of cultivated area for agricultural item  $k$  in individual  $i$ 's total cultivated area.<sup>8</sup> Figure 4 shows a positive relationship between productivity and the Export Orientation Index. Reflecting the difference in crop mix between men and women as seen in Figure 2, the Export Orientation Index among female farmers was estimated at 33.9 on average, nearly twice as large as the estimated index value of 17.7 among male farmers. It should be noted that this index reflects export shares at the aggregate national level and does not capture likely significant heterogeneity across farmers.

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<sup>7</sup> Food and Agriculture Organization of the United Nations, FAOSTAT, <http://www.fao.org/faostat/en/#home>.

<sup>8</sup>  $ShX_k$ , 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).

Figure 4. The Correlation between the Export Orientation Index and Productivity



Source: Authors' calculation using HIES 2016.  
 Note: The line is the fitted line.

We also examine to what extent farmers' crop mix is diversified. Diversification tends to be associated with risk-coping strategies (Di Falco and Chavas in Ethiopia, 2009; McCord et al. in Kenya, 2015); resilience to climate shocks (Birthal and Hazrana in India, 2019; Lin, 2011; and Mulwa and Visser in Namibia, 2020); food security (Bellon et al. in Ghana, 2020; Waha et al. for 18 African countries, 2018); poverty reduction (Michler and Josephson in Ethiopia, 2017), and sustainable agriculture in Sri Lanka (Dharmasiri 2008). On the other hand, some papers recognize the role of crop specialization in raising agricultural productivity (Huffman and Evenson in the United States, 2001; Latruffe et al. in Poland, 2005; Kurosaki in West Punjab, 2003). How diversification versus specialization would affect agricultural productivity appears to depend on the country and the context.

Following common practice in the literature, we measure a farmer's level of crop diversification using the Simpson Index of Diversification (SID)<sup>9</sup>:

$$SID_i = 1 - \sum_k P_{ik}^2$$

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. A high value indicates that a farmer cultivates many crops, in an evenly distributed way, which is consistent with the notion of high diversification. A zero score implies that the farmer cultivates only one crop, which is consistent with complete specialization. The average SID for female farmers is estimated to be 0.060 which is

<sup>9</sup> SID is equal to one minus the Herfindahl index, which is widely used to measure industry concentration.

substantially lower than that for male farmers (0.115). In fact, the data shows that Sri Lankan male and female farmers cultivated an average of 1.36 and 1.19 crops, respectively, implying an overall low level of diversification.

(c) *Descriptive statistics*

Table 1 shows the summary statistics for the full, male, and female samples. The last column shows the *p*-values resulting from the test of mean differences by the gender of farmers.

Table 1. Summary statistics of self-employed farmers<sup>a</sup>

	Mean			<i>t</i> -test
	Total	Male	Female	( <i>p</i> -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) <sup>c</sup>	16,905	15,976	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 nonlabor 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 ag family workers	0.179	0.220	0.059	0.000***
Agricultural inputs (Rs./month)	4,812	5,449	2,923	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 ICT	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***

Source: authors' calculation using HIES 2016.

Notes: <sup>a</sup> 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.

<sup>c</sup> Productivity is measured as gross crop income divided by cultivated area in acres.

\*, \*\*, and \*\*\* indicate that the male-female difference is significant at the 10, 5 and 1% level, respectively.

ICT = information and communication technology.

The summary statistics confirm the patterns shown in figures 3a–3c: the average monthly gross crop income of male farmers (Rs 16,970) is higher than that of female farmers (Rs 11,086); average land area cultivated by female farmers (1.04 acres) is only about half of that of male farmers (1.95 acres); and the average value of crop output per acre, our proxy for agricultural productivity, is *higher* for female farmers (Rs 19,809/acre) than male farmers (Rs 15,976/acre), resulting in an unconditional productivity advantage for female farmers.

Table 1 further shows that female farmers make less use of agricultural inputs (Rs 2,923/month) than male farmers (Rs 5,449/month).<sup>10</sup> They are less likely to receive subsidies (18.0%) than male farmers (38.9%),<sup>11</sup> and conditional on receipt, the amount received by women (Rs 658/month) is smaller than for male farmers (Rs 935/month). Further disadvantages include lower access to finance (proxied by whether the farmer had a loan); less access to unpaid agricultural family labor,<sup>12</sup> and a lower degree of mechanization (proxied by tractor ownership). Female farmers also have fewer opportunities for nonfarm activities relative to male farmers: while 44.9% of male farmers are engaged in nonfarm labor activities and drew 29.7% of income from these sources, only 19.3% of female farmers have access to nonfarm labor opportunities which comprise 10.3% of their income. On the other hand, female farmers appear to have more access to nonlabor income such as remittances and public transfers.<sup>13</sup>

Table 2 reports gross crop income, cultivated area, and log of productivity by crop and by gender. The last column shows, for each crop, the result of the *t*-test to determine whether the productivity differences between male and female farmers are statistically significant. The results suggest that there is no female productivity advantage within the same crop, but rather, there appears to be a male productivity advantage for paddy, tea, and vegetables. The implication is that productivity differences *between* crops rather than *within* crops are likely to be one of the driving forces behind the higher unconditional productivity among female farmers.

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<sup>10</sup> Agricultural inputs include seeds, fertilizer, chemicals, hired labor, transport cost, and agricultural equipment/rental.

<sup>11</sup> Most of the subsidies consist of fertilizers, and about 90% of them are accounted for by paddy.

<sup>12</sup> 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% in this category were female, and 58% in this category (2% of males and 81% of females) were spouses of household heads.

<sup>13</sup> Remittances from abroad were received by 2.9% of male farmers and 4.9% of female farmers; domestic remittances were received by 5.4% of male farmers and 16.7% of female farmers.

Table 2. Crop income, cultivated area and productivity by crop and gender

	Gross crop income (Rs.)			Cultivated Area (acre)			Log of Productivity <sup>b</sup>			<i>t</i> -test ( <i>p</i> -value)
	Total	Male	Female	Total	Male	Female	Total	Male	Female	
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 <sup>a</sup>	15,487	16,970	11,086	1.7238	1.9452	1.0438	9.14	9.09	9.30	0.000***

Source: Authors' calculation using HIES 2016.

Notes: <sup>a</sup> Sri Lankan farmers cultivated 1.32 crops on average.

<sup>b</sup> Productivity is measured by yield, i.e., gross real monthly output divided by the area cultivated (Rs./acre).

\*, \*\*, and \*\*\* indicate that the male-female difference is significant at the 10%, 5%, and 1% level, respectively.

#### 4. EMPIRICAL METHODOLOGY AND RESULTS

##### *(a) Gender differentials in agricultural productivity*

We first specify the yield function in the following form:

$$Y_i = \alpha G_i + \mathbf{Z}_i \beta + \varepsilon_i$$

where  $Y_i$  is the log of productivity (crop output value per acre) or earnings (crop output value) for farmer  $i$ ;  $G_i$  is a binary variable capturing the gender of the farmer (=1 if female, =0 if male);  $\mathbf{Z}_i$  is a vector of covariates for farmer  $i$ ; and  $\varepsilon_i$  is an error term. To identify the contribution of each variable to productivity, we sequentially introduce covariates and investigate how including them influences the coefficient on the gender dummy.

Regression (1) of Table 3 shows that the unconditional productivity gap without any covariates is 25.4% in favor of female farmers, which is statistically significant at the 1% level. After introducing district dummies (Regression (2)), the coefficient for the gender dummy is 10 percentage points lower, indicating that the gap is reduced. Regression (3) adds a series of personal and household characteristics including years of education, age, age squared, whether the individual is the household head (=1 if household head, =0 otherwise), ethnicity dummies, the share of nonfarm labor income in total income, the share of nonlabor income in total income, whether the farmer has any livestock/fishery activity (=1 if yes, =0 otherwise), household size, child dependency ratio (the number of children under 10 years of age divided by the number of family members aged 10 or above), and dummy variables for whether the farmer lives in the urban sector (=1 if urban, =0 otherwise) or estate sector (=1 if estate, =0 otherwise) (the rural sector is the omitted category). The coefficient for the gender dummy slightly decreases but remains positively significant at the 1% level, suggesting that personal, household and location characteristics do not fully explain the higher female productivity.

Table 3. Determinants of crop productivity and earnings

Sample	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dependent variable	Full	Full	Full	Full	Full	Full	Full	Male	Female	Full	Male	Female
	Log of productivity	Log of productivity	Log of productivity	Log of productivity	Log of productivity	Log of productivity	Log of productivity	Log of productivity	Log of productivity	Log of crop income	Log of crop income	Log of crop income
Gender (=1 if female)	0.254*** (0.036)	0.151*** (0.034)	0.129*** (0.036)	0.013 (0.034)	-0.065* (0.035)	-0.155*** (0.033)	-0.072*** (0.025)			-0.084*** (0.025)		
Age			0.013* (0.007)	0.014** (0.006)	0.015** (0.007)	0.016** (0.006)	0.009** (0.005)	0.009* (0.005)	0.012 (0.011)	0.008* (0.005)	0.008 (0.005)	0.010 (0.011)
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)	-0.000 (0.000)	-0.000** (0.000)	-0.000** (0.000)	-0.000 (0.000)
Years of education			0.013*** (0.004)	0.012*** (0.004)	0.026*** (0.004)	0.024*** (0.003)	0.006** (0.003)	0.007** (0.003)	0.004 (0.007)	0.007** (0.003)	0.007** (0.003)	0.004 (0.007)
Household head			0.052 (0.041)	0.052 (0.038)	0.152*** (0.038)	0.143*** (0.035)	0.068** (0.027)	0.074** (0.034)	0.042 (0.050)	0.071** (0.028)	0.079** (0.035)	0.047 (0.050)
Share of nonfarm labor income in total income (%)			-0.607*** (0.040)	-0.500*** (0.037)	-0.934*** (0.041)	-0.808*** (0.039)	-0.509*** (0.031)	-0.519*** (0.034)	-0.409*** (0.093)	-0.537*** (0.032)	-0.533*** (0.035)	-0.470*** (0.095)
Share of nonlabor income in total income (%)			-0.723*** (0.054)	-0.544*** (0.052)	-1.043*** (0.051)	-0.853*** (0.049)	-0.579*** (0.041)	-0.573*** (0.048)	-0.554*** (0.081)	-0.588*** (0.042)	-0.572*** (0.049)	-0.554*** (0.083)
Incidence of livestock activity			-0.137** (0.068)	-0.065 (0.062)	-0.181*** (0.064)	-0.111* (0.058)	-0.036 (0.045)	-0.052 (0.047)	0.005 (0.147)	-0.044 (0.045)	-0.049 (0.046)	-0.034 (0.153)
Household size			0.009	0.012	0.018**	0.020**	0.003	0.007	-0.001	0.002	0.005	-0.003

	(0.009)	(0.009)	(0.008)	(0.008)	(0.006)	(0.007)	(0.016)	(0.006)	(0.007)	(0.015)
Child dependency ratio	0.056 (0.049)	0.030 (0.045)	0.016 (0.044)	-0.005 (0.041)	-0.004 (0.032)	-0.040 (0.033)	0.055 (0.073)	-0.010 (0.033)	-0.042 (0.035)	0.032 (0.072)
Log of cultivated land (acres)			-0.351*** (0.014)	-0.322*** (0.014)	-0.720*** (0.014)	-0.717*** (0.017)	-0.737*** (0.028)	0.202*** (0.015)	0.229*** (0.017)	0.132*** (0.031)
Export Orientation Index		1.413*** (0.055)		1.292*** (0.051)	0.904*** (0.040)	0.941*** (0.047)	0.825*** (0.084)	0.867*** (0.042)	0.935*** (0.047)	0.713*** (0.089)
Log of agricultural input costs <sup>a</sup>					0.482*** (0.012)	0.482*** (0.014)	0.491*** (0.023)	0.519*** (0.012)	0.512*** (0.014)	0.544*** (0.024)
Simpson Index of Diversification					0.591*** (0.048)	0.603*** (0.051)	0.550*** (0.140)	0.630*** (0.050)	0.619*** (0.053)	0.668*** (0.143)
Number of unpaid ag family workers					0.046** (0.018)	0.035* (0.019)	0.113* (0.065)	0.045** (0.020)	0.031 (0.020)	0.154** (0.067)
Incidence of crop subsidy					-0.718*** (0.095)	-0.713*** (0.101)	-0.444 (0.312)	-0.835*** (0.097)	-0.790*** (0.103)	-0.595* (0.324)
Log of crop subsidy					0.061*** (0.011)	0.063*** (0.012)	0.015 (0.039)	0.077*** (0.011)	0.074*** (0.012)	0.038 (0.041)
Tractor					0.088*** (0.025)	0.075*** (0.025)	0.138 (0.105)	0.071** (0.029)	0.054* (0.030)	0.114 (0.097)
Access to finance					0.127*** (0.029)	0.132*** (0.033)	0.068 (0.064)	0.119*** (0.027)	0.122*** (0.030)	0.064 (0.064)

Access to ICT							0.004 (0.027)	0.009 (0.030)	-0.003 (0.059)	0.001 (0.027)	0.006 (0.030)	0.008 (0.058)
Log of distance to nearest Agrarian Service Center							0.009 (0.008)	0.010 (0.009)	0.010 (0.022)	0.006 (0.008)	0.005 (0.009)	0.018 (0.023)
Incidence of natural calamity							-0.032 (0.024)	-0.014 (0.026)	-0.058 (0.059)	-0.028 (0.025)	-0.002 (0.027)	-0.085 (0.060)
Constant	9.034*** (0.015)	8.795*** (0.140)	9.057*** (0.263)	8.771*** (0.247)	8.773*** (0.243)	8.536*** (0.230)	5.157*** (0.188)	5.137*** (0.208)	5.132*** (0.471)	4.967*** (0.189)	5.025*** (0.208)	4.618*** (0.456)
District dummies		X	X	X	X	X	X	X	X	X	X	X
Number of observations	5613	5613	5613	5613	5613	5613	5613	4408	1205	5683	4449	1234
R <sup>2</sup>	0.011	0.185	0.250	0.350	0.353	0.437	0.669	0.668	0.670	0.759	0.771	0.706

Source: Authors' estimation using HIES 2016.

*Note:* The dependent variable for all regressions except (10-12) is the log of productivity. Productivity is measured by yield, i.e., gross real monthly output divided by the area cultivated (Rs/acre). The dependent variable for regression (10-12) is the log of earnings (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 (1-2), ethnicity dummies, sector dummies (urban, rural, estate), and district dummies are included as control variables.

\*, \*\*, and \*\*\* indicate that the coefficients are significant at the 10, 5 and 1% level, respectively.

Robust standard errors are in parentheses.

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

Regression (4) adds the Export Orientation Index, while not controlling for the log of land area. The coefficient for the Export Orientation Index turns out to be positively significant at the 1% level, confirming the importance of export intensity in a farmer's crop mix in raising productivity. As an alternative way of introducing the structure of crop mix, we included the share of each crop's cultivated area out of total cultivated area, with the share of paddy as the omitted category (this regression is not reported in Table 3). The coefficients for the shares of all crops except 'other cereals' turn out to be positively significant, confirming the higher productivity of cash crops relative to staples. Once the Export Orientation Index is included, the coefficient for the gender dummy becomes insignificant. This result is consistent with the insight from the descriptive statistics shown in Table 2, which reveal little gender productivity differences within the same crops (and in fact, a male productivity advantage for some crops).

Regression (5) introduces the log of land area as a control variable without controlling for the Export Orientation Index. The sign of the coefficient on the gender dummy is reversed and negatively significant, revealing a conditional gender gap in favor of male farmers once adjusting the smaller land area that female farmers cultivate. The coefficient on the log of land area is negative and significant at the 1% level, confirming an inverse relationship between cultivated area and agricultural productivity, which is consistent with the findings in the previous literature.<sup>14</sup> Controlling for the log of land area and the Export Orientation Index (Regression (6)), we find a male conditional productivity advantage of 15.5%.

Regression (7) introduces a series of agricultural variables, namely the log of agricultural inputs, the Simpson Index of Diversification, the number of unpaid agricultural workers in the family, incidence of crop subsidy, log of the value of crop subsidy conditional upon subsidy receipt, a dummy variable for whether the household has a tractor as a measure of mechanization, incidence of natural calamity, and log of the distance from home to the closest Agrarian Service Center. As a proxy for access to 'digital agriculture' (Deichmann, Goyal, and

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<sup>14</sup> Since Chayanov's seminal work (1926/1966), many papers have found the inverse-relationship between land size and agricultural productivity. The explanation includes family labor (Feder 1985), factor market imperfections (Eswaran and Kotwal 1986; Feder 1985), price risk aversion (Barrett 1996), soil quality (Barrett, Bellemare and Hou 2010; Benjamin 1995) and measurement errors of farm size (Carletto, Savastano and Zezza 2013; Lamb 2003). However, there is no consensus in the literature on the existence of an inverse productivity-size relationship. Some studies argue that there is a U-shaped relationship with the highest levels of productivity being achieved by the smallest and largest farms as larger farms involve more capital use (Carter and Wiebe 1990; Foster and Rosenzweig 2017; Sheng Ding and Huang 2019). Other studies relate the relationship of farm size and productivity to the stages of economic development (Otsuka, Liu and Yamauchi 2016; Rada and Fuglie 2019). For instance, Otsuka et al (2016) argue that the smallholder productivity advantage is likely to be weakened or even reversed in Asian countries experiencing rapid economic growth and rising wages, as the structural transformation may involve a gradual change from labor-intensive to capital-intensive agricultural systems.

Mishra 2016; Fabregas, Kremer and Schilbach 2019; Kaila and Tarp 2019), a dummy is added for whether any household member spent money on Information and Communication Technology (ICT) such as a mobile phone, e-mail/internet or a computer (=1 if any expenditure on these items, =0 otherwise). As a proxy for access to finance, a dummy variable is introduced to indicate whether a farmer had any loan (=1 if yes, =0 otherwise). We use Regression (7) as our base specification.

Once we control for these variables, the magnitude of the negative coefficient on the gender dummy decreases to 7.5% but remains significant at the 1% level, implying that the conditional male productivity advantage is partly attributable to greater access to agricultural resources. The remaining male advantage, after controlling for personal, household, location, and agricultural variables, may potentially reflect the influence of unobservable factors such as gender-specific social norms which could determine the division of labor and influence agricultural productivity. Regressions (8) and (9) estimate regression (7) separately by gender, allowing for differential returns to productive inputs, which are a key element of the structural effect of the Oaxaca-Blinder decomposition (described in the next section).

The coefficient for the Simpson Index of Diversification turns out to be positively significant at the 1% level, suggesting that diversified farmers are on average more productive. The coefficients for the share of nonfarm labor income and the share of nonlabor income are negatively significant at the 1% level. This result is consistent with the observation that farmers tend to utilize their nonfarm earnings, including remittances, to move out of agriculture rather than invest it back (e.g., Kilic et al. in Albania, 2009; Rozelle, Taylor and DeBrauw in China, 1999). The coefficient on the number of unpaid agricultural family workers is positively significant at the 5% level, confirming a positive association with productivity.

The incidence of subsidy is negatively associated with productivity, possibly because poor farmers are more likely to be recipients of subsidies. The coefficient for the log of subsidy values is positively significant, showing that larger subsidies are associated with higher productivity, conditional on subsidy receipt. The coefficients for access to finance and mechanization are positively significant at the 1% level. Meanwhile, access to ICT was not statistically significant. It is possible that with nearly 90% of households owning some form of

ICT, variations in access to ICT are not well proxied with this information. Other things equal,<sup>15</sup> the coefficient for education turns out to be positively significant.

To explore the gender gap in crop earnings, the log of crop output value is regressed on the same independent variables as those in our base specification (7), for the overall sample (regression (11)) and by gender (regressions (12) and (13)). The coefficient for the gender dummy in the pooled sample turns out to be negatively significant at the 1% level, indicating a conditional gender gap in earnings in favor of male farmers in the magnitude of 8.4%. In contrast to our productivity regressions, log of land area is positively significant at the 1% level, highlighting the importance of access to land for crop income generation. The Export Orientation Index, the Simpson Diversification Index, agricultural inputs, unpaid agricultural family labor, the value of subsidy conditional on receipt, mechanization, and access to finance all turn out to be positively significant at the 1% or 5% level, suggesting that these variables are positively associated with both higher productivity and earnings. Additional years of schooling and hence better skills are also linked to higher productivity and income.

*(b) Oaxaca-Blinder decomposition*

Using the Oaxaca-Blinder decomposition, we decompose the productivity and earnings gaps into (1) a component driven by gender differences in levels of observable attributes (endowment effect) and (2) a component coming from gender differences in returns to the same set of observables (structural effect) (Ali et al. 2016; Blinder 1973; Jann 2008; Oaxaca 1973). The decomposition analysis helps identify the relative weight or importance of different factors that drive the productivity and earnings differentials. Specifically, we estimate:

$$\begin{aligned} \bar{Y}_M - \bar{Y}_F &= \sum_{k=1}^K [(\bar{X}_{Mk} - \bar{X}_{Fk})\hat{\beta}_k^*] \\ &+ \sum_{k=1}^K [\bar{X}_{Mk} (\widehat{\beta}_{Mk} - \hat{\beta}_k^*)] + \sum_{k=1}^K [\bar{X}_{Fk} (\widehat{\beta}_{Fk} - \hat{\beta}_k^*)] + (\hat{\beta}_{M0} - \hat{\beta}_{F0}) \end{aligned}$$

where the first term ( $\sum_{k=1}^K [(\bar{X}_{Mk} - \bar{X}_{Fk})\hat{\beta}_k^*]$ ) is the endowment effect while the remaining terms ( $\sum_{k=1}^K [\bar{X}_{Mk} (\widehat{\beta}_{Mk} - \hat{\beta}_k^*)] + \sum_{k=1}^K [\bar{X}_{Fk} (\widehat{\beta}_{Fk} - \hat{\beta}_k^*)] + (\hat{\beta}_{M0} - \hat{\beta}_{F0})$ ) are the structural effect.

$\bar{Y}_M - \bar{Y}_F$  is the mean gender difference of the log of productivity or crop income, and  $\bar{X}_{Mk}$  and  $\bar{X}_{Fk}$  are the average value of covariate  $k$  for men and women respectively.  $\hat{\beta}_{M0}$ ,  $\hat{\beta}_{F0}$ ,  $\widehat{\beta}_{Mk}$  and

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<sup>15</sup> The positive coefficient for educational attainment emerges after controlling for the share of nonfarm labor income as a proxy of nonfarm activities. This is perhaps because those who possess more education tend to use more time outside agriculture (Appleton and Balihuta 1996).

$\hat{\beta}_{Fk}$  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.

Recent papers using this approach in Africa find unconditional gender gaps in favor of men ranging from 4% in Nigeria (in the North) to 25% in Malawi (Aguilar et al. 2015; Ali et al. 2016; Backiny-Yetna and McGee 2015; Carletto et al. 2013; Kilic, Palacios-Lopez and Goldstein 2015; Oseni et al. 2014; and Slavchevska, 2015). Compared to the earlier literature, they find relatively large structural effects, which can be attributed to differences in returns to endowments or unobservable terms. An advantage of the Oaxaca-Blinder strategy is that in addition to allowing the decomposition of the gender gap into endowment and structural effects, it also evaluates the marginal contribution of each factor. For instance, among the main variables influencing the gender gap are: (i) higher utilization of male labor, i.e., plots managed by male farmers hire more male laborers which contributes to their productivity advantage (endowment effects); (ii) male supervisors may be more effective on male-managed plots (structural effects) (Backiny-Yetna and McGee in Niger, 2015; Kilic, Palacios-Lopez and Goldstein in Malawi, 2015; Oseni et al. in Nigeria, 2015; and Slavchevska in Tanzania, 2015); (iii) a higher child dependency ratio contributes to a female productivity disadvantage through the structural effect as women have less time for farming due to the time spent in childcare and other household responsibilities (Ali et al. in Uganda; 2015, Backiny-Yetna and McGee in Niger; 2015; Kilic, Palacios-Lopez and Goldstein in Malawi, 2015). All the cited studies find a sizeable endowment effect of land area contributing to female productivity advantage, given the generally smaller plot size cultivated by women and the inverse relationship between cultivated area and productivity.

The results from the Oaxaca-Blinder decomposition of land productivity are shown in Figure 5a and in the first two columns of Table 4.

Figure 2a. Oaxaca-Blinder decomposition for productivity gender gap

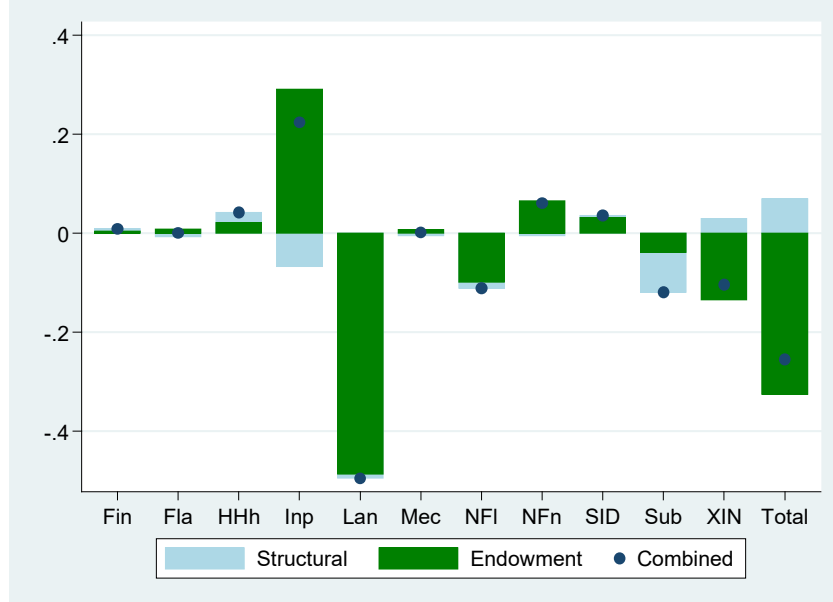
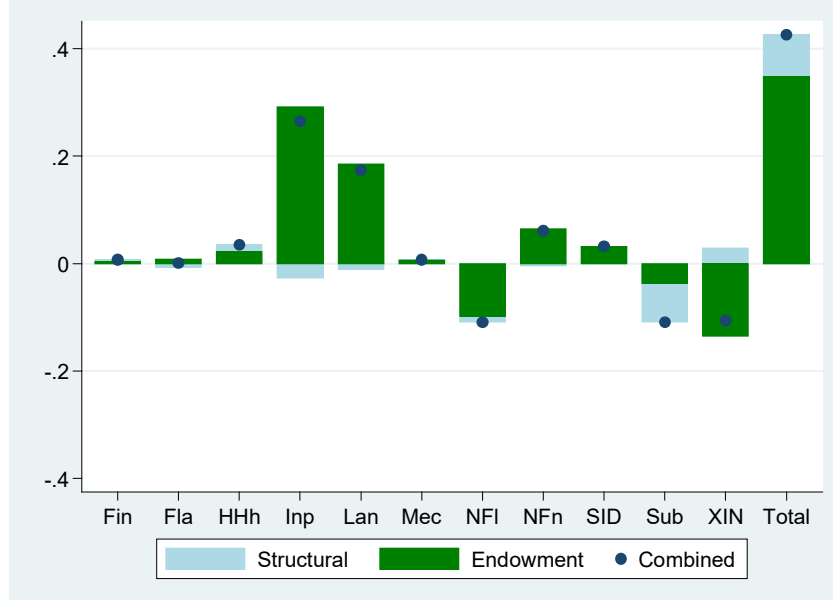


Figure 5b. Oaxaca-Blinder decomposition for earning gender gap



Source: Authors' estimations using HIES 2016.

Note: Fin = access to finance; Fla = number of unpaid agricultural family workers; HHh = household head; Inp = agricultural inputs; Lan = log of cultivated area; Mec = mechanization; 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 4. Oaxaca-Blinder Productivity and Earnings Gap Decompositions

	Decomposition of Productivity Gap		Decomposition of Earning 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***		
B. Aggregate decomposition (%)					
	<u>Endowment</u>	<u>Structural</u>	<u>Endowment</u>	<u>Structural</u>	
Total	-0.325***	0.072***	0.348***	0.078***	
C. Detailed decomposition (%)					
Fin	Access to finance	0.004***	0.005	0.003***	0.004
Inp	Agricultural inputs <sup>a</sup>	0.291***	-0.067	0.292***	-0.027
Fla	Unpaid agricultural family workers	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***	0.000
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: Authors' estimation using HIES 2016.

Notes: \*, \*\*, and \*\*\* indicate that the coefficients are significant at the 10, 5 and 1% level, respectively. Negative sign indicates female productivity or earning advantage while positive sign shows male productivity or earning advantage.

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

The green and blue bars represent the size and direction of each variables' contribution to endowment and structural effects respectively while the dots show the combined effect. A negative (positive) bar in Figure 5a and Figure 5b and negative (positive) sign in table 4 indicate that the variables contribute to female (male) productivity or income advantage. For example, the 'Total' bar on the far right in Figure 5a represents the gender gap owing to both endowment and structural effects. The negative endowment effect is greater in value than the positive structural effect, indicating female farmers are more productive, unconditionally. Specifically, panel B of Table 4 reports a female productivity advantage of 25.4% (the same as the result of Regression (1) in Table 3) since the endowment effect of 32.5% in favor of women outweighs the structural effect in favor of men (7.2%).

The detailed decomposition by individual variables in Panel C shows that the endowment effects are statistically significant for all variables while none of the structural effects are statistically significant. A smaller cultivated area is the largest contributor to female endowment and ultimately, to a productivity advantage due to the inverse relationship between cultivated area and productivity. The large contribution of a smaller land area to female productivity advantage through the endowment effect is consistent with the previous literature using a similar decomposition methodology (e.g., Aguilar et al. in Ethiopia, 2015; Ali et al. in Uganda, 2016; Carletto et al. in Uganda, 2013; Kilic, Palacios-Lopez and Goldstein in Malawi, 2015; Mahajan in India, 2019; Oseni et al. in Nigeria, 2014; and Slavchevska in Tanzania, 2015).

The second largest contributor to female productivity advantage is the endowment effect of the Export Orientation Index, which is consistent with the relatively large presence of export-oriented and high-value crops in the female crop mix. 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 (e.g., Ali et al. in Uganda, 2016; Kilic, Palacios-Lopez and Goldstein in Malawi, 2015; Mahajan in India, 2019). Less access to nonfarm labor income among female farmers also contributes to female productivity advantage.

A set of variables contributes to a male productivity advantage, partially offsetting the female productivity advantage. The largest contributor to the male endowment advantage is greater access to agricultural inputs such as fertilizer, seeds, chemicals, hired labor, and means of transportation (29.1%). A higher level of crop diversification captured by the Simpson Diversification Index also contributes to a male productivity advantage. Finally, access to finance is positively associated with productivity but does not seem to make a large difference between men and women farmers, possibly because commercial financing options are limited for most farmers in Sri Lanka. This also appears to be the case for mechanization and unpaid agricultural family labor.

Notably, the unconditional productivity advantage experienced by female farmers relative to male farmers—despite the numerous disadvantages described above—does not translate into higher incomes. Figure 5b and the last two columns of Table 4 show the Oaxaca-Blinder decomposition of the crop earnings gap. Male farmers outearn female farmers by a significant 42.6%. Both the endowment effect (34.8 %) and to a lesser extent the structural effect (7.8%) contribute to male earnings advantage. Contrary to the result from the productivity gap

decomposition, having access to more land confers a large earnings advantage to male farmers (18.5%). Agricultural inputs are the main contributor to a greater earnings advantage for male farmers (29.2%).

## 5. CONCLUSIONS AND POLICY IMPLICATIONS

While the previous literature overwhelmingly found an agricultural gender gap in favor of male farmers, the case of Sri Lanka is unique as agricultural productivity, measured by gross output per acre, is 25.4% higher among female farmers than male farmers. Using the Oaxaca-Blinder decomposition technique, we find that the leading factor contributing to this unconditional female productivity advantage is a smaller cultivated area among female farmers, combined with the presence of an inverse relationship between cultivated area and productivity. This female productivity advantage does not translate into higher income among female farmers, however, as smaller plots are associated with lower crop income. Thus, policies designed to promote equitable land rights for women and men could help address this gap. With regard to land ownership, there are some long-standing issues that may warrant attention. For example, Sri Lanka's land laws may 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).

Another important source of Sri Lanka's female productivity advantage is the different pattern of crop mix cultivated by male and female farmers. While the crop mix of female farmers contains a relatively large portion of export-oriented, high-value crops such as tea, the typical crop mix among male farmers includes a large share of paddy, a domestically oriented crop which yields low returns. Thus, promoting export-oriented, high-value crops can help raise productivity and incomes. However, the Sri Lankan government's import substitution strategy, which favors import competing commodities such as paddy, along with a fertilizer subsidy program mainly focused on paddy cultivation, is likely to discourage a shift toward high-value agriculture (World Bank 2013, 2015). Improving productivity of paddy can contribute to food security while releasing land and labor for the cultivation of higher-value crops, within agroclimatic constraints.

Finally, controlling for land area and crop mix, male farmers have a productivity advantage over female farmers. This is largely explained by their greater access to resources, including agricultural inputs, transportation, credits, unpaid agricultural family labor, and mechanization. Our result therefore highlights the continued need to level the playing field between men and women. Further, our analysis shows that the male productivity advantage persists even after adjusting for agricultural resources and other endowments. The remaining unexplained part may possibly reflect an unequal pattern of division of labor driven by gendered social norms. Analysis based on the Sri Lanka Time Use Survey 2017 suggests 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 to their counterparts working outside agriculture (World Bank 2021b). Thus, interventions that could ease women’s household responsibilities, for instance, are likely to help increase women’s agricultural productivity and generate more crop income.

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