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The U.S. Government's Global Hunger & Food Security Initiative



Is small beautiful? Analyzing farm size and coffee farmer productivity in Burundi

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July 2017 • Rural Sociological Society Annual Meeting • Columbus, Ohio



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Background on coffee in Burundi



Source: The Global Knowledge Initiative



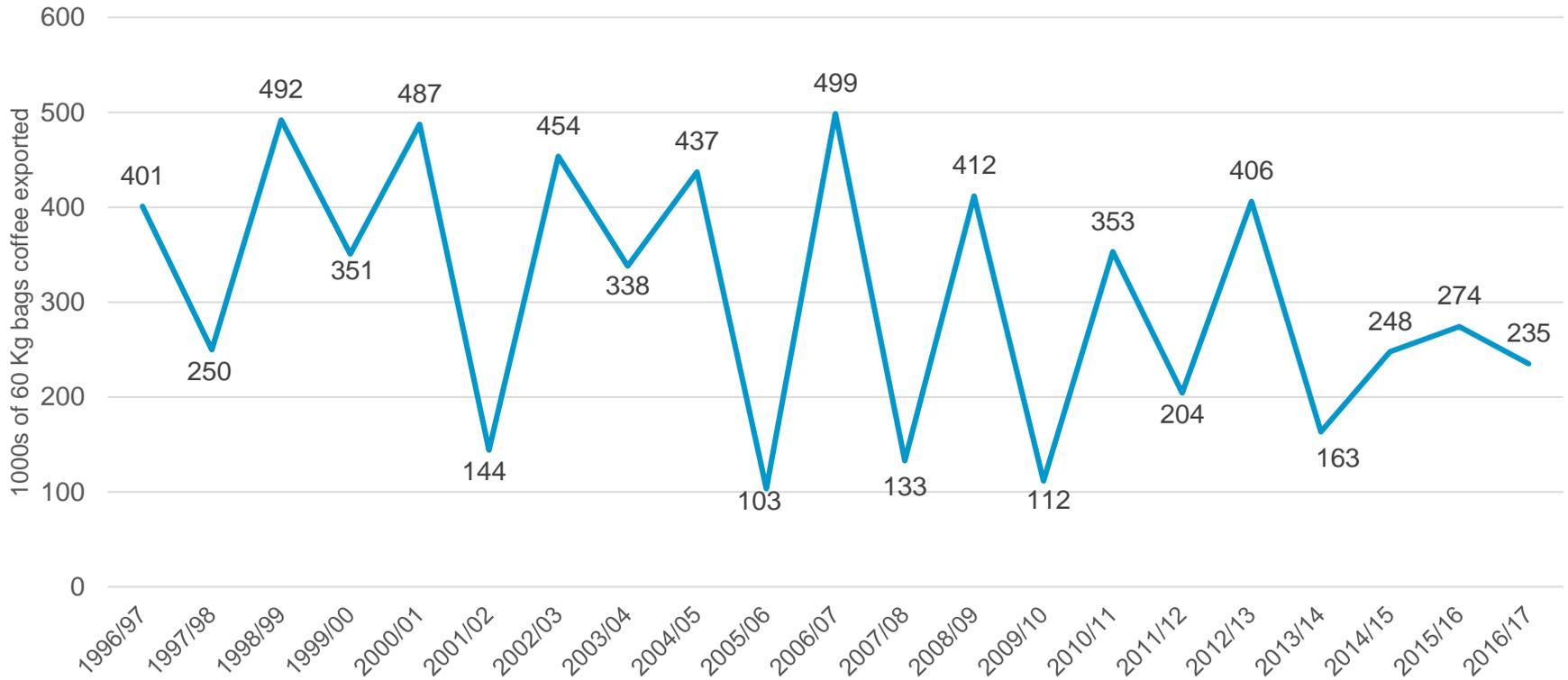
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Stagnating production

Annual coffee exports (in 1000s of 60 kg bags)



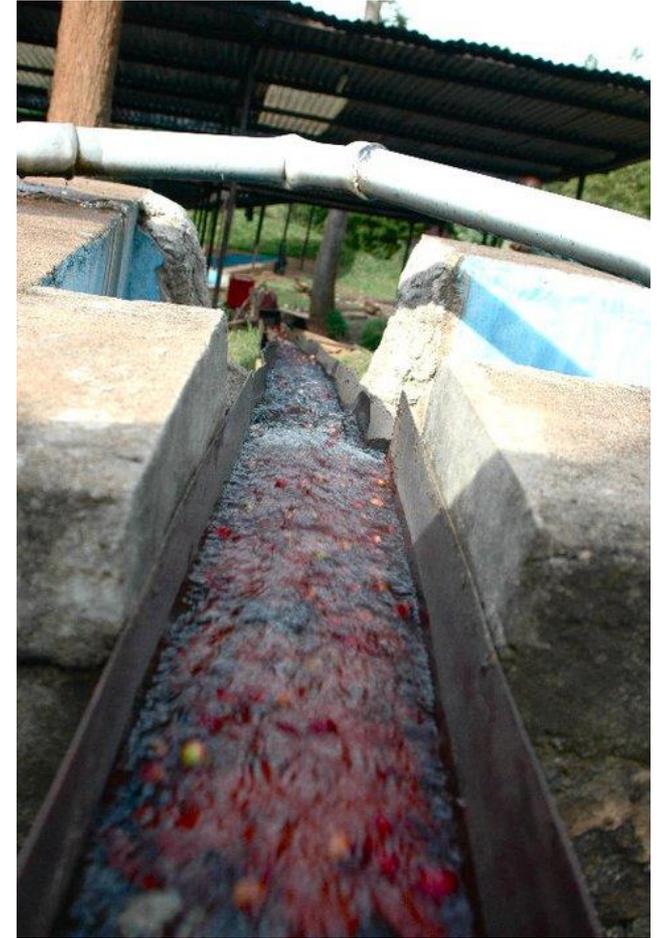
Research questions

(1) How do farm-level capacity to invest and incentive to invest in coffee affect productivity?

(2) As an indicator of incentive to invest in coffee, how does farm size relate to productivity for Burundian farmers?

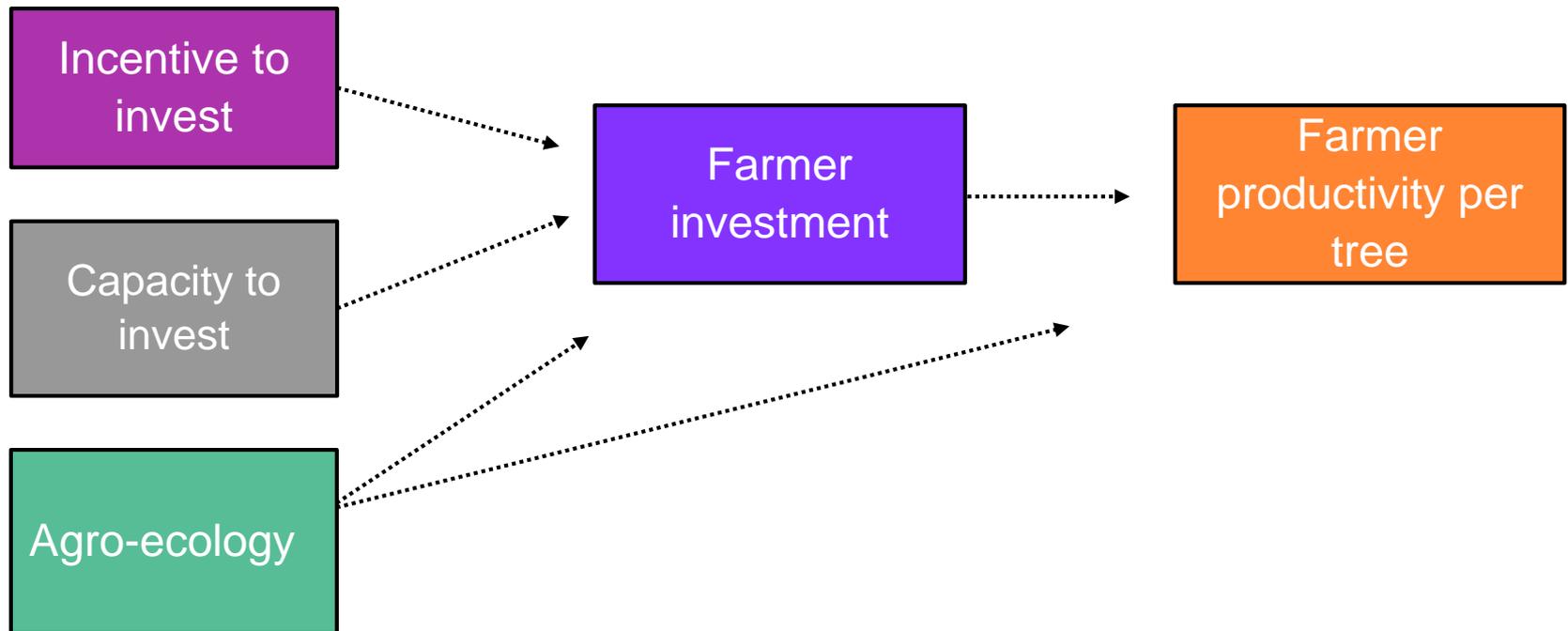
Data used

- Data from Africa Great Lakes Region Coffee Support Program
- Districts sampled: Gitega, Karusi, Ngozi, Kayanza
- Gathered from 1,024 farms
- 64 farms chosen per coffee washing station, associated with 16 coffee washing stations
- Survey focuses on agronomic practices, demographics, economic elements



Hypothesized causal model

Hypothesis: Capacity and incentive lead to investment, which leads to productivity. Different farmers may have capacity than have incentive to invest. When price low, small scale farmers invest more/are more productive than large farmers because they have few options (Clay et al, 2016).



Methodology

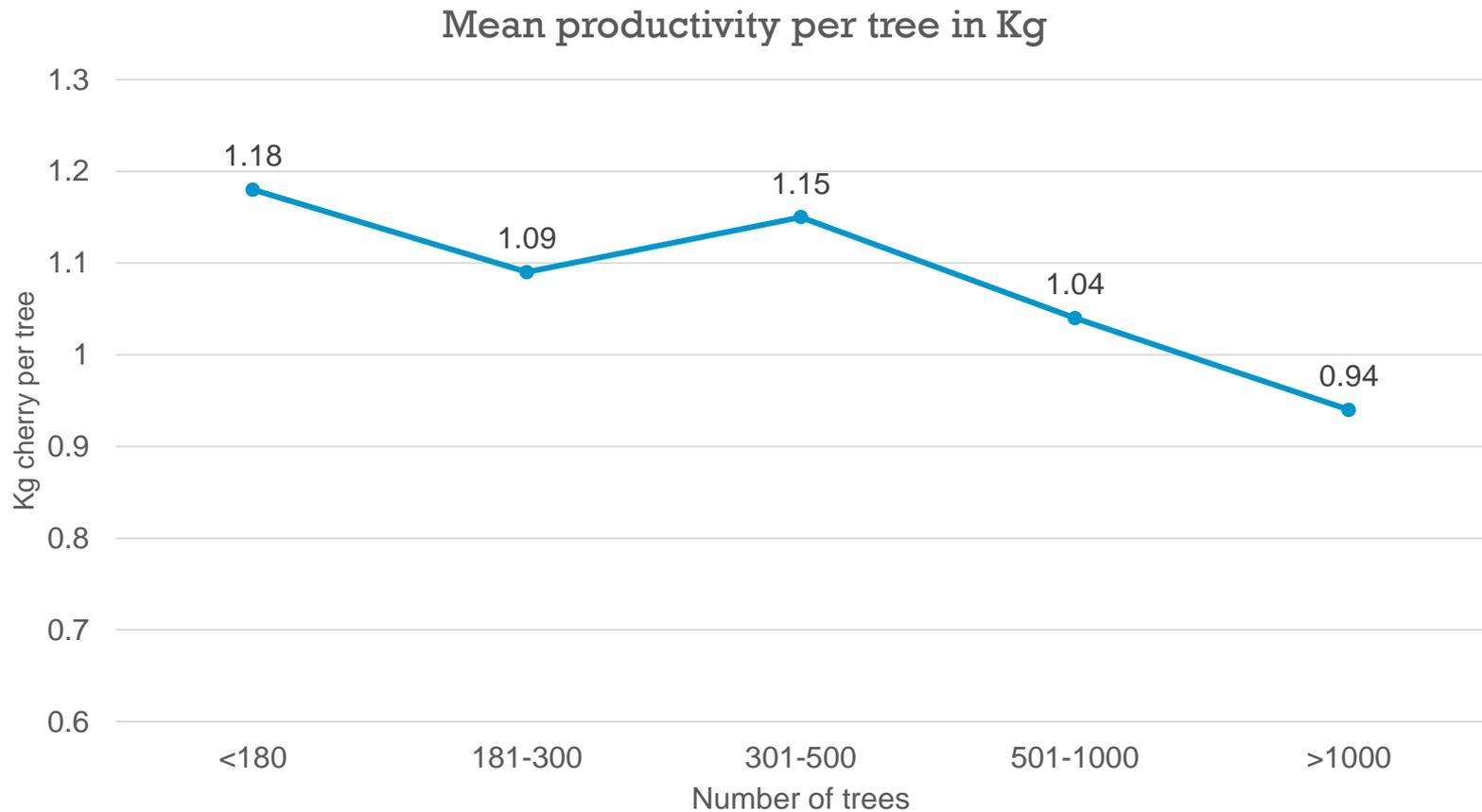
Data:

- Dependent variable (DV) is productivity per tree in Kg
- Independent variables (IVs) relate to:
 - **Incentive** (Farm size, non-coffee income, coffee price)
 - **Capacity** (demographics, input access/use, coop membership),
 - **Investment** (sorting, mulching, pruning, weeding, household/hired labor)
 - **Agro-ecology** (elevation)

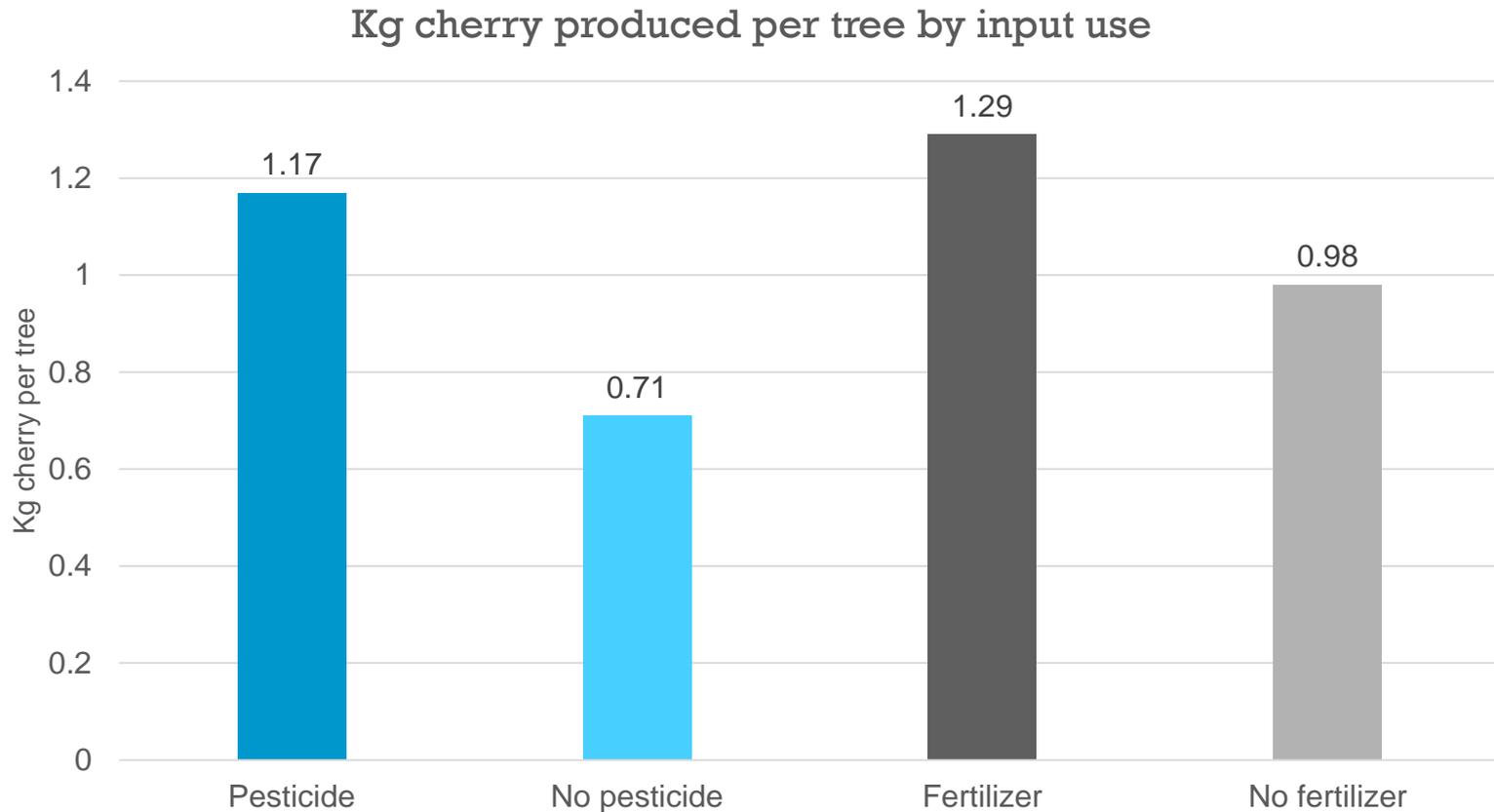
Analysis:

- Ordinary Least Squares (OLS) regression used to estimate relationship between DV and IVs
- Robust standard errors due to clustered sample

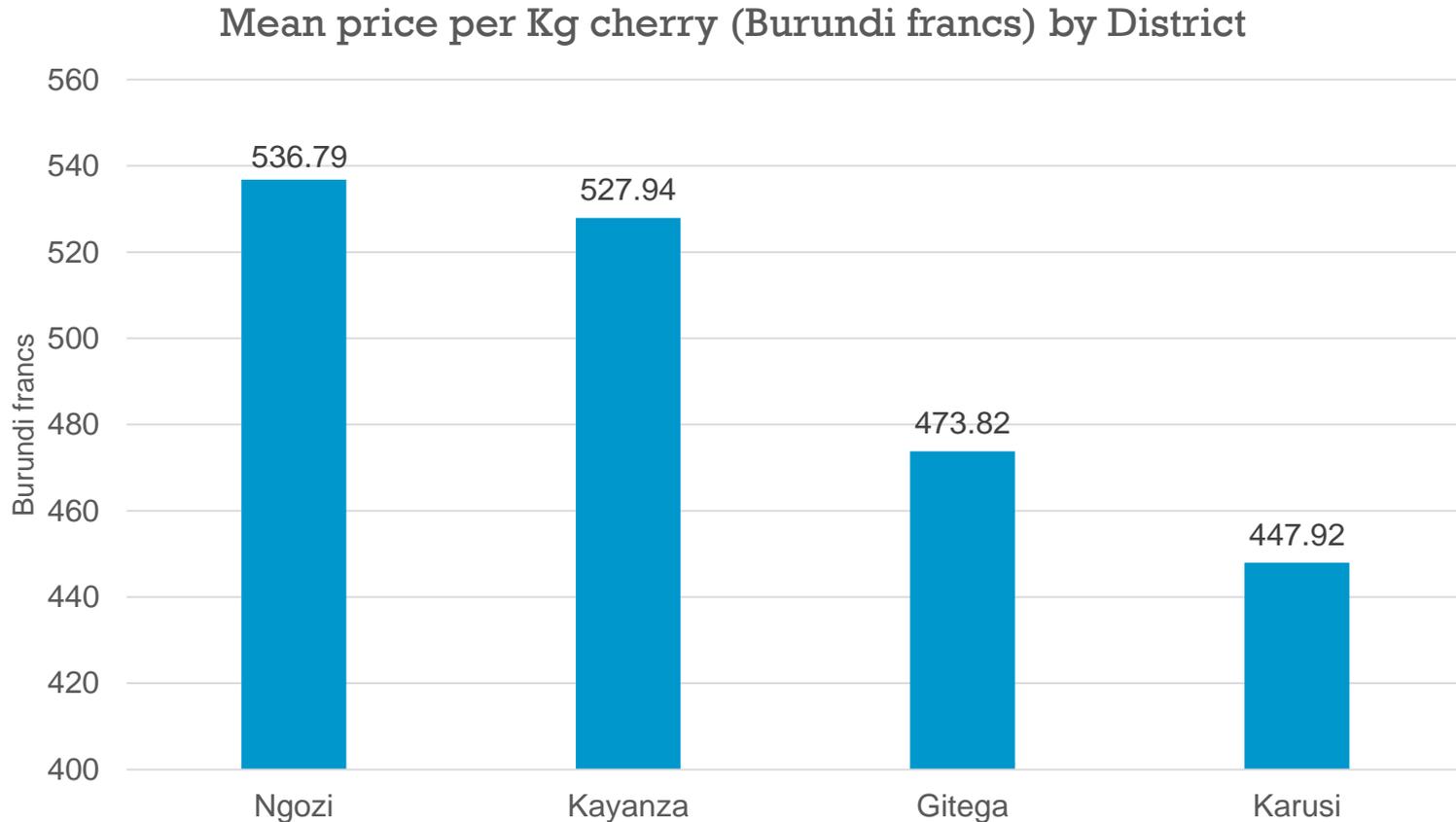
Key descriptive statistics: Productivity by farm size



Key descriptive statistics: Productivity by input use

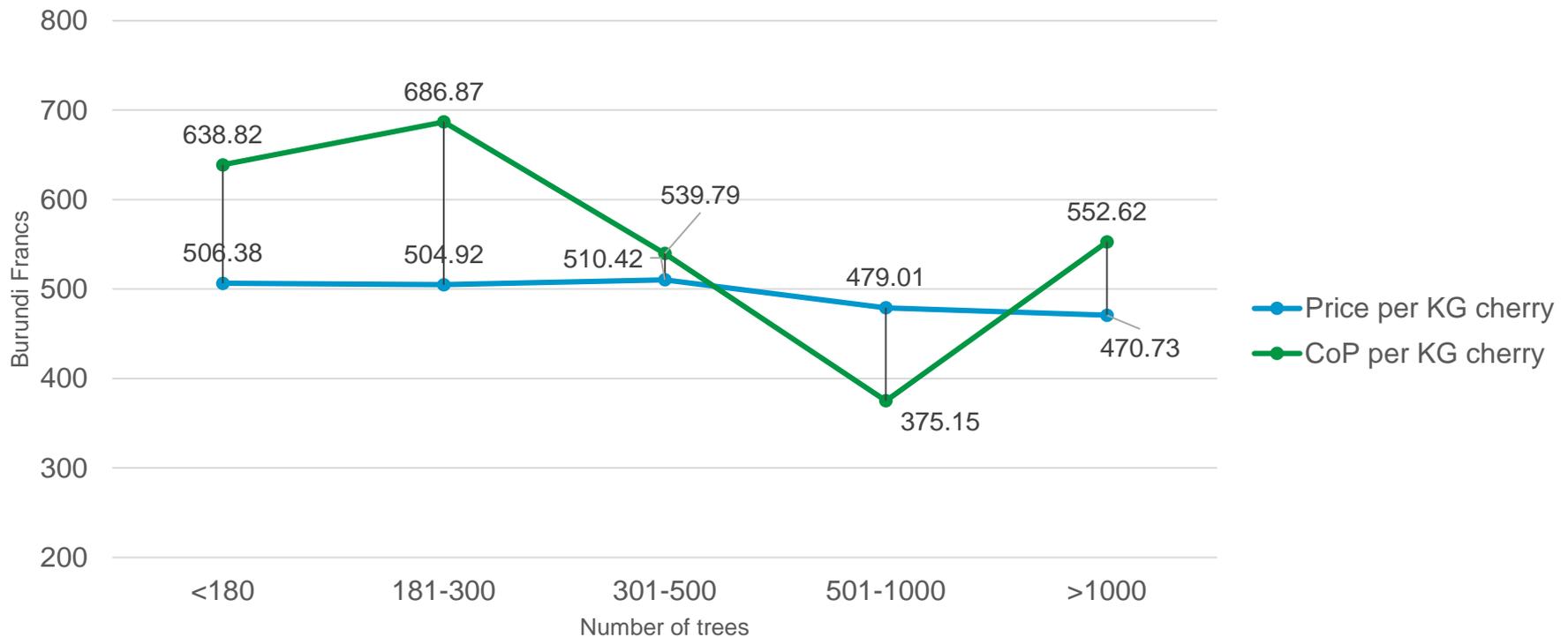


Price per Kg of coffee cherry by District



Key descriptive statistics: Price received and cost of production by farm size

Cost of production and price per kg of cherry by farm size (Burundi francs)



	Regression of KG cherry produced per tree on IVs	(1)	(2)	(3)
Capacity: Demographics	Gender of HHH		-0.1037 (0.0834)	-0.1104 (0.0832)
	HHH can read and write (2 groups)		0.1924*** (0.0582)	0.1726** (0.0583)
	Age of HHH		-0.0037 (0.0025)	-0.0029 (0.0025)
	HH size		-0.0156 (0.0139)	-0.0168 (0.0142)
	Current number of trees		-0.0003*** (0.0000)	-0.0003*** (0.0000)
Incentive	Non Coffee Income		0.0000*** (0.0000)	0.0000*** (0.0000)
	Percent income from coffee 2015		0.0132*** (0.0014)	0.0126*** (0.0015)
	Price per kg of cherry 2015		0.0018*** (0.0004)	0.0015*** (0.0004)
Capacity: Access to service	Applied pesticides	0.2072* (0.0852)	0.1050 (0.0825)	0.0224 (0.0847)
	Applied fertilizers	0.1872** (0.0642)	0.2535*** (0.0664)	0.2266*** (0.0663)
Agro-ecology	Member of coop		-0.1135 (0.0583)	-0.1213* (0.0578)
	Elevation in meters		0.0010** (0.0003)	0.0010** (0.0003)
Investment activities	Sorted cherry in farm	0.3597*** (0.1039)		0.1830** (0.0705)
	BestProdPract (SCALE)	0.2955*** (0.0854)		0.1819 (0.0951)
	Total HH labor value for cultivation, harvest, sorting per tree (BF)	-0.0003 (0.0002)		-0.0002 (0.0002)
	Total hired labor for cultivation, harvest & sorting per tree (BF)	0.0006** (0.0002)		0.0005* (0.0002)
	Constant	0.3229** (0.1045)	-1.8017** (0.5861)	-1.8967** (0.5954)
Observations	1,003	940	935	
R-squared	0.0966	0.2337	0.2457	

Note: Variables in italics lose significance when controlling for District



Conclusion

- 1. Farm size consistently important:** While larger farmers can profit from coffee, small farmers invest/produce more per tree. Smaller farmers may invest because they have few other choices (Clay et al, 2016; Verschelde et al, 2013).
- 2. Proportion of income:** Farmers with a higher proportion of income from coffee are more productive. This relates to general concept that incentive drives productivity.
- 3. Capacity to invest:** Literacy and fertilizer access and use influence productivity. Agrees with literature on education and productivity (Psacharopoulos & Patrinos, 2004).

Implications

Without additional policy analysis, difficult to make concrete suggestions. Two high-level implications:

- 1. Raise minimum prices:** In our sample, mean price is 499 BF/Kg, around \$0.29 USD. This is below regional prices. Because larger farms do not need to produce coffee to survive, they do not invest. Higher prices might encourage their investment, while allowing small scale farmers to profit.
- 2. Fertilizer access:** 60% of farmers in sample do not apply fertilizer. For farmers who do not use fertilizer, 79% said it is because fertilizer is not free and/or is too expensive. Unlike pesticide, which 85% use, farmers face difficulties accessing/purchasing fertilizer.

Discussion and limitations

1. Qualitative analysis needed to buttress quantitative findings – dearth of Burundi analysis in last decade
2. Additional analysis necessary on why pesticide and fertilizer access/use differ so much (40% use fertilizer; 85% use pesticide)
3. Analysis needed on differences between Districts; what characteristics make them different
4. Non-coffee income may mix incentive and capacity; farmers with additional income could purchase inputs. Moderate correlation between non-coffee income and fertilizer use.
5. Need more holistic understanding of incentive – forthcoming through CWS research.



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