The survival of smallholder farmers in agricultural export markets

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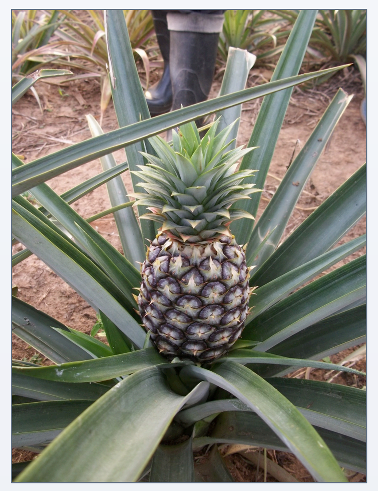
Introduction

- Export agriculture offers potentially high returns to smallholder farmers in developing countries, but also carries substantial risks.
- We examine the impact of a significant demand shock in the export pineapple market on the livelihoods of smallholder farmers in southern Ghana.

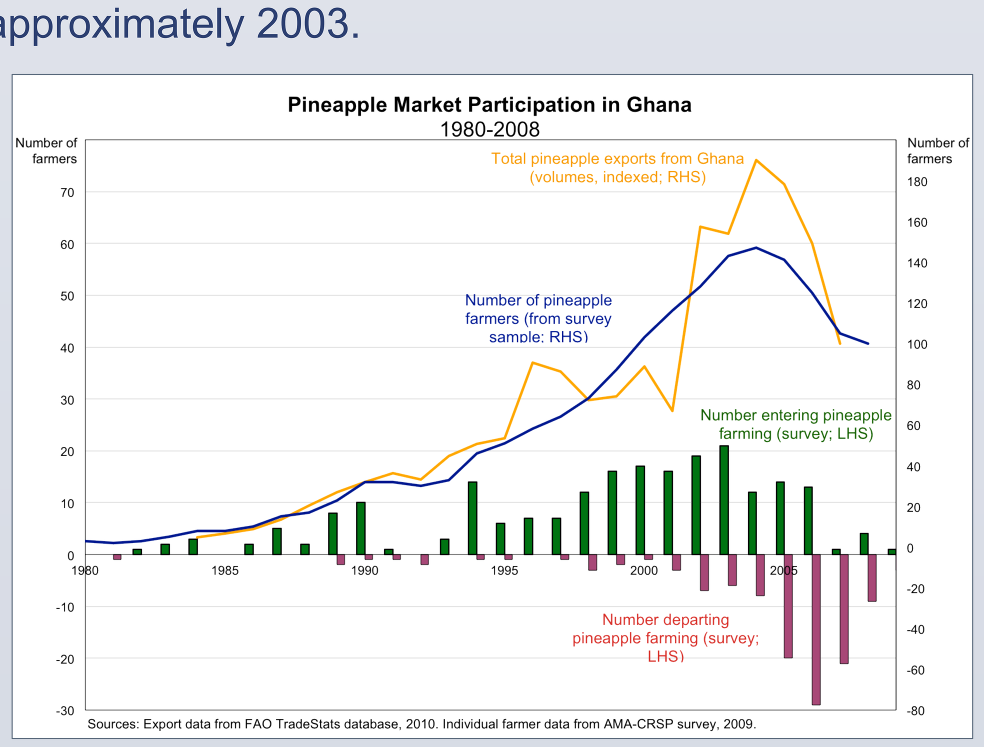


Objectives

1. Examine how price uncertainty affects the smallholder's decision to enter and exit a market at the theoretical level.
2. Study the disadoption dynamics using a hazard model and a multinomial logit model to explain which farmers remained solvent through the shock and which farmers were forced to leave the industry.
3. Measure the long-run consequences of the shock on the welfare of affected households using propensity score matching (not yet reported here).

Background

- Several studies examine the increased opportunities of smallholders due to the proliferation of supermarkets in low- to middle-income countries (Reardon et al. 2009).
- Most careful evidence finds that, even after controlling for the initial advantages enjoyed by those who participate in modern agrifood value chains, smallholder suppliers tend to enjoy higher net earnings per hectare (Udry and Goldstein 1999; Michelson 2010).
- These positive effects have encouraged aid agencies to train and equip farmers in developing countries to grow cash crops, such as pineapple. However, crucial questions remain about the ability of smallholders to survive in export agricultural markets as it exposes them to significant risks.
- Ghana was a major exporter of pineapple until approximately 2003.



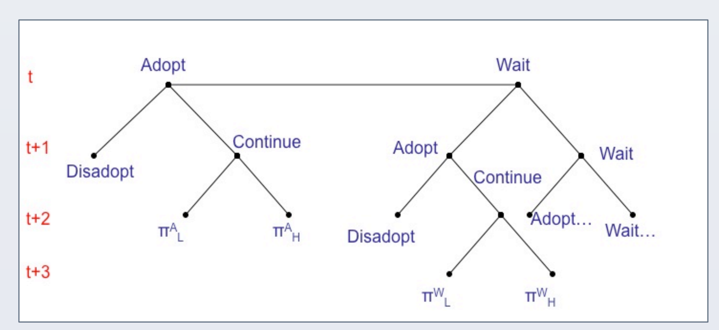
Data

- The data come from three surveys of four communities in the Akwapim South district in Southern Ghana collected by Christopher Udry and Markus Goldstein in 1997-1998, Jacqueline Vanderpuye-Orgle in 2005 and Thomas Walker in 2009.
- The data include a wide range of subjects, including personal income, expenditure and consumption, gifts, transfers, loans and in-sample networks.
- The data were supplemented with focus groups with pineapple producers and farmer based organization members held in September 2009 and July 2010. Their stories corroborate the large decline in pineapple exports, with farmers complaining of buyers defaulting on oral their oral contracts.

Wave		Darmang	Pokrom	Oboadaka	Konkonuru	Total
1997-1998	Households	51	51	51	54	213
	Individuals	106	111	102	112	429
2009	Households	81	78	76	81	316
	Individuals	158	147	149	151	605

Theoretical Framework

We study the dynamic decision of a risk-averse farmer to adopt and disadopt a technology over time faced with price and production uncertainty.



- Farmers must choose between growing pineapples or not. If farmers do not adopt in the first time period, they have the option of growing pineapples in the subsequent time period.
- Buyers who previously purchased pineapples from farmers gradually begin to disappear, which the farmers experience as a change in the probability of obtaining the higher price of exported pineapple, p_H (pineapples sell alternatively on the local market at the lower price, p_L). Following the shock, adopters must decide whether they will continue to invest to produce pineapple or disadopt.
- Farmers will decide to adopt in the first time period if the expected profit of adopting is greater than the expected profit of adopting in the next time period, i.e., $E^t[\pi^{*,t+2}] > E^t[\pi^{*,t+3}]$, where $\pi^{*,t}$ represents the profit function given optimal input choices.

Farmer decision pre-shock:

$$\max_{\{\mathbf{U}^t,\mathbf{U}^{t+1},\mathbf{U}^{t+2}\}} \left(\rho^2 \cdot \mathbf{E^t}[p_h^{t+2} \cdot q^{t+2}] - \sum_{i=0}^{2} \rho^i \cdot c^{t+i}(\mathbf{U^{t+i}}, \mathbf{Y^{t+i}})\right)$$

subject to

$$p_h^{t+2} = g(p_h^{t+1}, \mathbf{X^{t+1}}, \varepsilon_{p_h}^{t+2})$$

$$q^{t+2} = f(\mathbf{U}^t, \mathbf{U}^{t+1}, \mathbf{U}^{t+2}, \mathbf{Z}^t, \mathbf{Z}^{t+1}, \varepsilon_q^{t+2})$$

Farmer decision post-shock:

$$\max_{\{\mathbf{U}^{t+1},\mathbf{U}^{t+2}\}} \left(\rho \cdot \mathbf{E^{t+1}}[p_h^{t+2} \cdot q^{t+2}] - \sum_{i=1}^{2} \rho^{i-1} \cdot c^{t+i}(\mathbf{U^{t+i}}, \mathbf{Y^{t+i}})\right) \quad (1)$$

subject to

$$p^{t+2} = \begin{cases} \lambda(t) & g(p_h^{t+1}, \mathbf{X^{t+1}}, \varepsilon_{p_h}^{t+2}) \\ 1-\lambda(t) & h(p_l^{t+1}, \mathbf{X^{t+1}}, \varepsilon_{p_l}^{t+2}) \end{cases} \quad (2)$$

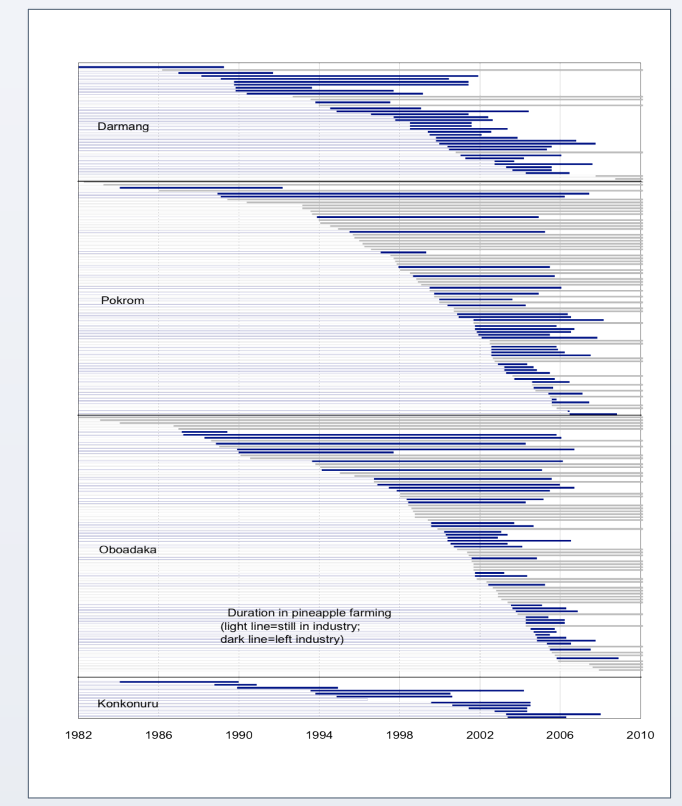
$$q^{t+2} = f(\mathbf{U}^t, \mathbf{U}^{t+1}, \mathbf{U}^{t+2}, \mathbf{Z}^t, \mathbf{Z}^{t+1}, \varepsilon_q^{t+2}) \quad (3)$$

- First order conditions in both cases show that the time t expected discounted marginal product of input u^t_j at t +2 equals the marginal cost at time t.
- The decision to adopt in time period t or t+1 depends on farmers' subjective expectation of future prices and expected output.

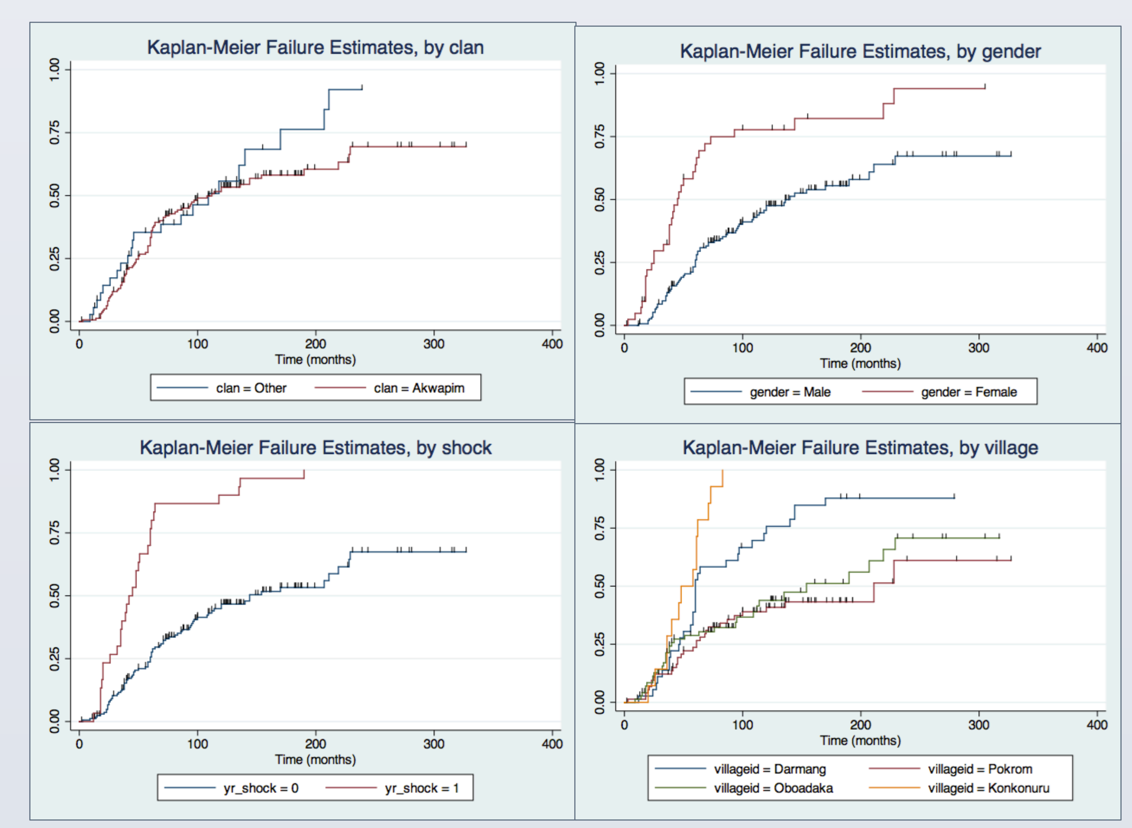
Preliminary Results

- ***Survival analysis:*** the adoption duration is the probability that adoption duration is at least of length *t*.

  $S(t) = 1 - F(t) = Prob(T \geq t)$
- ***Hazard Rate***: the probability that the duration will end in the short time interval Δt.



Kaplan – Meier estimates:



Hazard Models:

Table 1: Hazard Models

Variable	Log rank (Chi2)	Box Cox	Exponential	Weibull
Age (at start)	NA	0.01	0.01	0.01
		(0.01)	(0.01)	(0.01)
Gender	25.97 ***	1.04***	0.96***	1.06***
		(0.22)	(0.21)	(0.22)
Clan	1.41	-0.28	-0.28	-0.32
		(0.26)	(0.26)	(0.26)
Disadopted in 2003-2005	52.45 ***	1.16***	1.05***	1.22***
		(0.24)	(0.23)	(0.24)
Darmang	33.97 ***	0.87***	0.87***	0.92***
		(0.27)	(0.27)	(0.27)
Oboadaka	33.97 ***	0.20	0.16	0.16
		(0.26)	(0.26)	(0.26)
Konkonuru	33.97 ***	1.41***	1.38***	1.62***
		(0.35)	(0.34)	(0.36)
constant			-5.87***	-7.75***
			(0.45)	(0.73)
N	109	194	194	194

***,**,* significant at 1, 5, 10%, respectively.

Preliminary Results (cont.)

Multinomial Logit:

Table 1: Multinomial Logit

Variable	Disadopted	Still Adopting
Coop member	1.88**	2.73**
	(0.91)	(0.99)
Akwapim	0.35	0.46
	(0.97)	(1.09)
Gender	-0.82	-1.85
	(0.94)	(1.07)
Age	0.05	0.03
	(0.03)	(0.03)
# HH members	-0.02	0
	(0.11)	(0.13)
Duration (months)	0.62	0.64
	(48.66)	(48.66)
Time to adoption	0.08	0.09
	(6.63)	(6.63)
Cannot read	-1.59	-1.85
	(0.97)	(1.05)
Owns house	0.87	1.36
	(0.87)	(0.97)
Pine training	4.06***	5.03***
	(1.05)	(1.12)
No schooling	1.13	1.38
	(1.18)	(1.34)
Constant	-5.48**	-9.79***
	(2.46)	(3.03)
N	431	431

Conclusions

- Taking into account the risks associated with adopting a new technology, especially one that is seldom consumed by the farmer, is critical for development projects linking smallholders to national and international markets.
- This work is still in progress, reported results are preliminary.

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Acknowledgements

- We thank Christopher B. Barrett, Robert Osei and the staff at the Institute of Statistical, Social and Economic Research for their support.
- We also thank Andrew Agyei-Holmes, Anna Kissiwa Mensah, Yaw Barimah and Imogen Halstead for field assistance.
- We are grateful for financial support from the International Growth Centre, LSE (RA-2009-06-010), the National Science Foundation (Doctoral Dissertation Improvement Grant No. SES-0851586), and USAID's AMA CRSP Program (Grant No. P686140), Cornell Travel Grant, Einaudi Travel Funds.

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