



Measuring Change in Household Decision in Response to Value Chain Interventions

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Theory

- ▶ Starting from a household production model

$$\text{Max } U(z, L - l_1 - l_2 - l_3 - l_4)$$

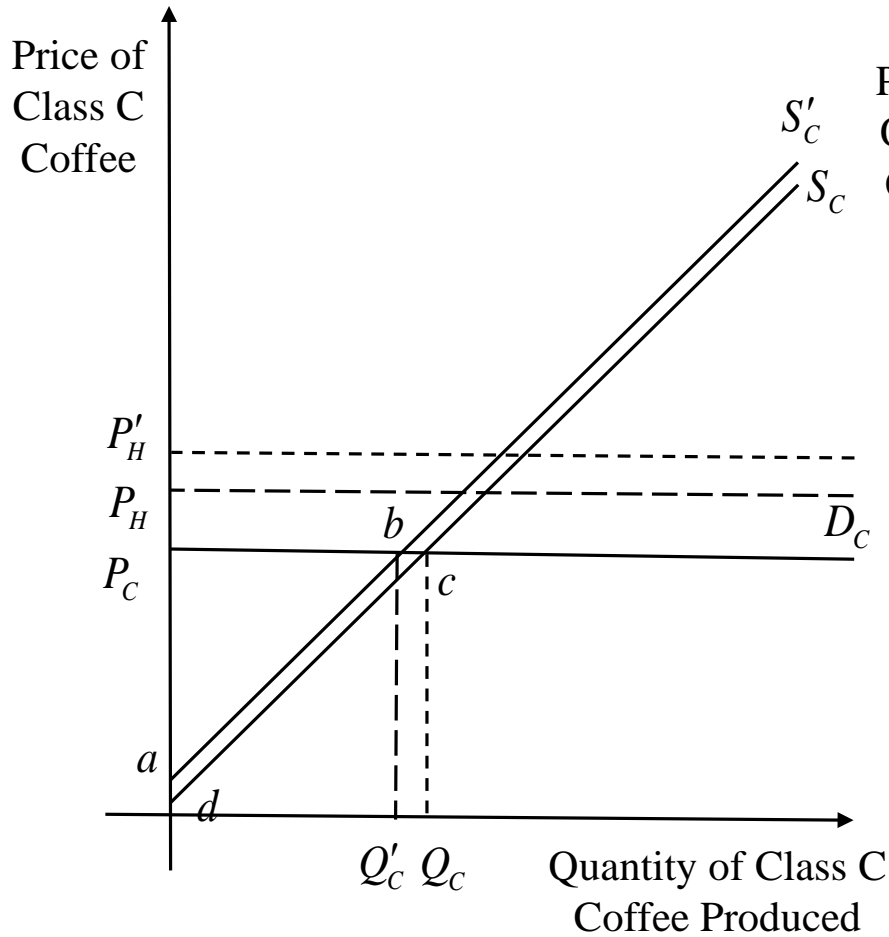
$$\text{s.t. } F(z, x, \tilde{x}, l_1) = 0$$

$$\begin{aligned} w'x + w_{k_1}(k_{g_1} + k_{h_1}) + w_{k_2}(k_{g_2} + k_{h_2}) + p'_1(\tilde{x} - g(k_{g_1}, k_{g_2}, l_2)) \\ \leq p'_2 h(k_{h_1}, k_{h_2}, l_3) + w_l l_4 + Y \end{aligned}$$

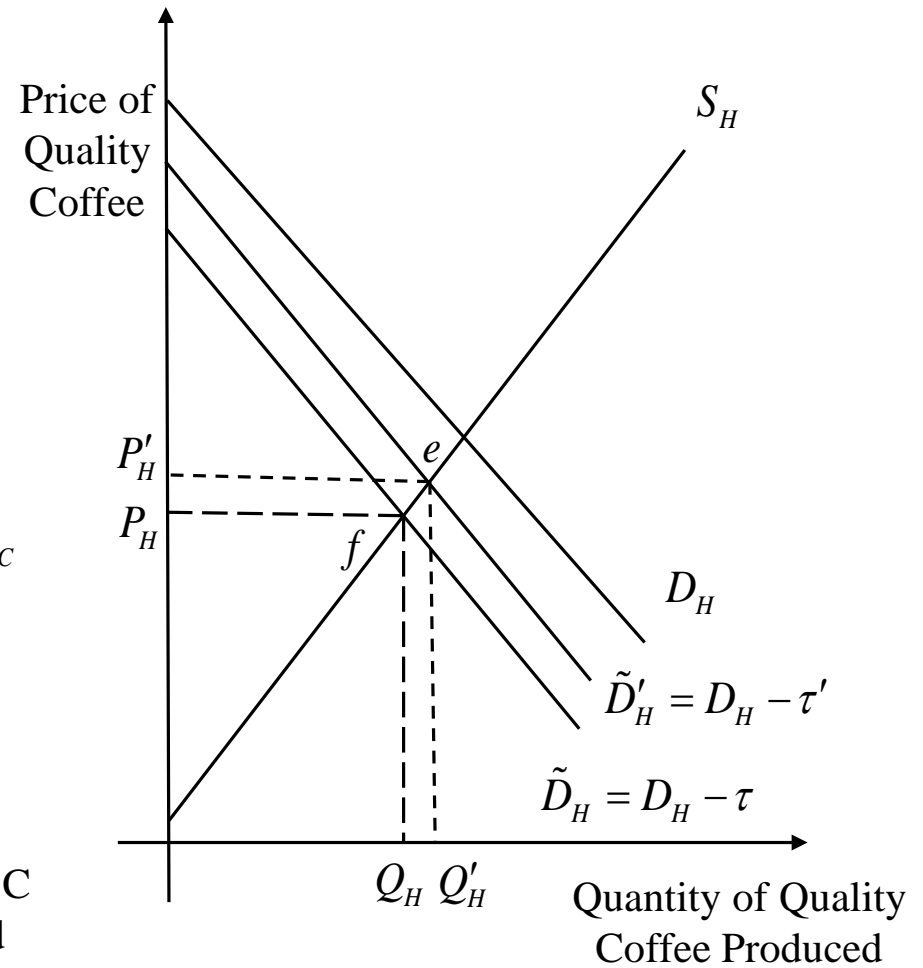
- ▶ We want to focus on the choice of marketable output

$$\begin{aligned} p'_2 h(\cdot) = \{ [p_{21} - \tau] \Phi(k_{h_{11}}, k_{h_{21}}, l_{31}) + p_{22} [1 - \Phi(k_{h_{11}}, k_{h_{21}}, l_{31})] \} h_1(k_{h_{11}}, k_{h_{21}}, l_{31}) \\ + p_{23} h_2(k_{h_{12}}, k_{h_{22}}, l_{32}) \end{aligned}$$

Welfare Impact of Value Chain



(a) Class C Coffee



(b) High Quality Coffee



Questions for Impact Analysis

- ▶ Did the intervention improve the prices received by farmers?
- ▶ Did this increase in the prices increase household income?
- ▶ Did the value chain intervention reduce the poverty rate?
- ▶ Did the value chain intervention improve food security?
- ▶ How does a value chain intervention affect the rest of the village?

Effect on Prices Received

- ▶ What is the impact of quality choice on average coffee prices received in Rwanda?

$$[p_{21} - \tau] \Phi(k_{h_{11}}, k_{h_{21}}, l_{31}) + p_{22} [1 - \Phi(k_{h_{11}}, k_{h_{21}}, l_{31})] \Rightarrow s_{Ht} P_{Ht} + s_{Ct} P_{Ct} = \bar{P}_{Rt}$$

$$\ln\left(\frac{\bar{P}_{Rt}}{P_t}\right) = f(SPREAD_t) = \alpha_0 + \alpha_1 t + \alpha_2 D_t + \alpha_3 t D_t$$

Table 1. Rwandan and Kenyan Coffee and Tea Prices

Price in U.S. Cents/lb.							
	Rwanda			Kenya			World
Year	Coffee	Tea		Coffee	Tea		Coffee
1995	74.03			141.11	60.0		138.42
1997	57.93			194.65	82.7		133.91
2000	26.69	4.273		68.67	90.8		64.24
2001	21.15	3.800		68.13	75.7		45.59
2002	12.60	4.295		69.05	67.2		47.74
2003	21.14	3.805		58.24	70.6		51.90
2004	29.66	4.432		83.80	72.9		62.15
2005	40.88	4.577		71.53	71.1		89.36
2006	49.36	5.555		125.09	91.7		95.75
2007	49.86	5.609		117.51	80.2		107.68
2008	54.03	5.609		116.45	105.2		124.25
2009	64.00	6.882		114.91	125.0		115.67
2010	62.38	7.018		227.78	126.6		147.24

Table 3. Regression Results for Change in Price Ratios from SPREAD

	SPREAD	SPREAD *Trend		F-Test	P[F]
ICA Coffee Price	0.04036	0.02019		5.79424	0.02414
	(0.62363)	(0.04999)			
Kenyan Coffee Price	0.98918	-0.03046		6.95283	0.01494
	(0.98964)	(0.07933)			
Rwandan Tea Price	0.59291	-0.00811		4.93312	0.04606
	(1.03593)	(0.09907)			
Kenyan Tea Price	-0.25774	0.12562		13.55392	0.00193
	(1.07267)	(0.08598)			

Table 3. Normalized Price Differences

Year	ICA Coffee Price	Kenyan Coffee Price	Rwandan Tea Price	Kenyan Tea Price
2000	-0.3539	0.1044	-0.3360	-0.9247
2001	-0.2488	-0.5998	-0.6574	-1.0299
2002	-2.8365	-2.2647	-2.4406	-1.8545
2003	-0.4625	-0.1096	-0.6620	-0.8854
2004	0.4054	-0.1881	-0.1434	-0.2509
2005	0.1737	1.3128	0.6595	0.4645
2006	0.8265	0.1523	0.6454	0.3292
2007	0.2395	0.3796	0.6563	0.6264
2008	-0.1042	0.6596	0.8697	0.2310
2009	1.2139	1.2321	0.7722	0.2251
2010	-0.2462	-0.9917	0.6462	0.1468

Effect of SPREAD on Household Income

- ▶ We estimate that the difference in village average incomes

$$\Delta x_{1s} = \bar{x}_{1sC} - \bar{x}_{1sT} = \alpha_0 + \alpha_1 0 + \alpha_2' z_{1s} + \varepsilon_{1s}$$

$$\Delta x_{2r} = \bar{x}_{2rC} - \bar{x}_{2rT} = \alpha_0 + \alpha_1 1 + \alpha_2' z_{2r} + \varepsilon_{2r}$$

Table 4. Difference in Mean Difference of Household Expenditures

Parameter	Estimate		Parameter	Estimate
Constant	-0.5033		Distance to Health Center	0.0035
	(2.4851)			(0.0048)
Year	-0.7644**		Reads	-0.9350
	(0.2897)			(1.9173)
Family Size	0.6107		Education 1 (Primary)	-1.1228
	(0.4859)			(1.5577)
Sex of HHD	-0.4037		Education 2 (Secondary)	-2.3979
	(1.8575)			(3.8044)
Distance to Market	-0.0112*		Education 3 (Above Sec)	5.3761
	(0.0062)			(5.4345)
Distance to Primary School	-0.0039			
	(0.0031)			

Poverty Rate

- ▶ The final piece of evidence for the effect of SPREAD in Rwanda we estimate the effect of commercial coffee production on the poverty rate.

$$y_{it} = \begin{cases} 1 & \text{if } E_{it} \leq T_t^* \\ 0 & \text{if } E_{it} > T_t^* \end{cases}$$

$$P(Z_{it}, \beta) = \frac{\exp(Z_{it}\beta + I_{it}Z_{it}\tilde{\beta})}{1 + \exp(Z_{it}\beta + I_{it}Z_{it}\tilde{\beta})}$$

Table 5. Effect of SPREAD on Poverty Rate for Individual Households

Parameter	2010	2005	Pooled	Difference Between 2010 and 2005
Constant	1.6954*** (0.3446)	2.3528*** (0.5204)	1.3674*** (0.2944)	0.6574 (0.6242)
Treatment	-0.8817*** (0.1889)	0.0024 (0.3578)	-0.6680*** (0.1642)	0.8841** (0.4046)
Total in Household	0.1030** (0.0415)	0.2528*** (0.0817)	0.1309*** (0.0367)	0.1498 (0.0916)
Sex of HHD	-0.5716** (0.2536)	0.0370 (0.3890)	-0.4141* (0.2113)	0.6086 (0.4542)
Distance to Market	0.0009 (0.0020)	0.0021 (0.0033)	0.0013 (0.0017)	0.0012 (0.0039)
Distance to School	0.0115** (0.0047)	0.0023 (0.0040)	0.0090* (0.0042)	-0.0091 (0.0062)

Table 5 (Continued)

Parameter	2010	2005	Pooled	Difference Between 2010 and 2005
Distance to Health Center	-0.0001 (0.0021)	0.0041 (0.0035)	0.0011 (0.0017)	0.0042 (0.0041)
Reads	-0.6129** (0.2661)	-0.9563* (0.4323)	-0.5344*** (0.2080)	-0.3434 (0.5064)
Education 1 (Primary)	-0.1360 (0.2348)	-0.5217 (0.3846)	-0.3140 (0.1920)	-0.3856 (0.4479)
Education 2 (Secondary)	-1.1305*** (0.3814)	-2.2234*** (0.8320)	-1.2474*** (0.3506)	-1.0929 (0.9155)
Education 3 (Post Sec)	-0.5270 (0.6513)	-1.3623 (0.9631)	-0.9723 (0.5751)	-0.8354 (1.1641)
EICV2			1.7903*** (0.1920)	

Food Security and SPREAD

- ▶ One empirical relationship that is useful when developing food security is Working's model

$$w_F = \alpha_F + \beta_F \ln(E) + \varepsilon_F$$

- ▶ However, we modify Working's model to consider the effect of commercialization of coffee on home production

$$\frac{y_F}{E_F + y_F} = \delta_0 + \delta_1 \ln(E) + \xi_F$$

Table 6. Effect of the Benefit from SPREAD on Food Expenditures (Bootstrapped)

Variable	Share of Food Produced by Household	Overall Budget Share of Food
Constant	0.92954***	1.35492***
	(0.10570)	(0.07822)
Log of Total Expenditure	-0.04332***	-0.11614***
	(0.01496)	(0.00769)
SPREAD	0.74303	-1.20004
	(3.99345)	(2.95389)
Log of Total Expenditure * SPREAD	-0.31917	0.08148
	(0.54332)	(0.28380)

Shifts in Village Employment

- ▶ The Wula Nafaa policy intervention in Senegal represents a slightly different value chain intervention.
 - ▶ Wula Nafaa improved the value chain for “nature friendly products” including the market for Baobab fruits.
 - ▶ The concept was that improving the market for nature friendly products would reduce the relative pressure on the forest from the production of charcoal.

$$I(Z_1, Z_2) = \sum_{i=1}^9 Z_{i1} \ln \left(\frac{Z_{i1}}{Z_{i2}} \right)$$

Figure 2. Labor Market with Wula Nafaa Effects

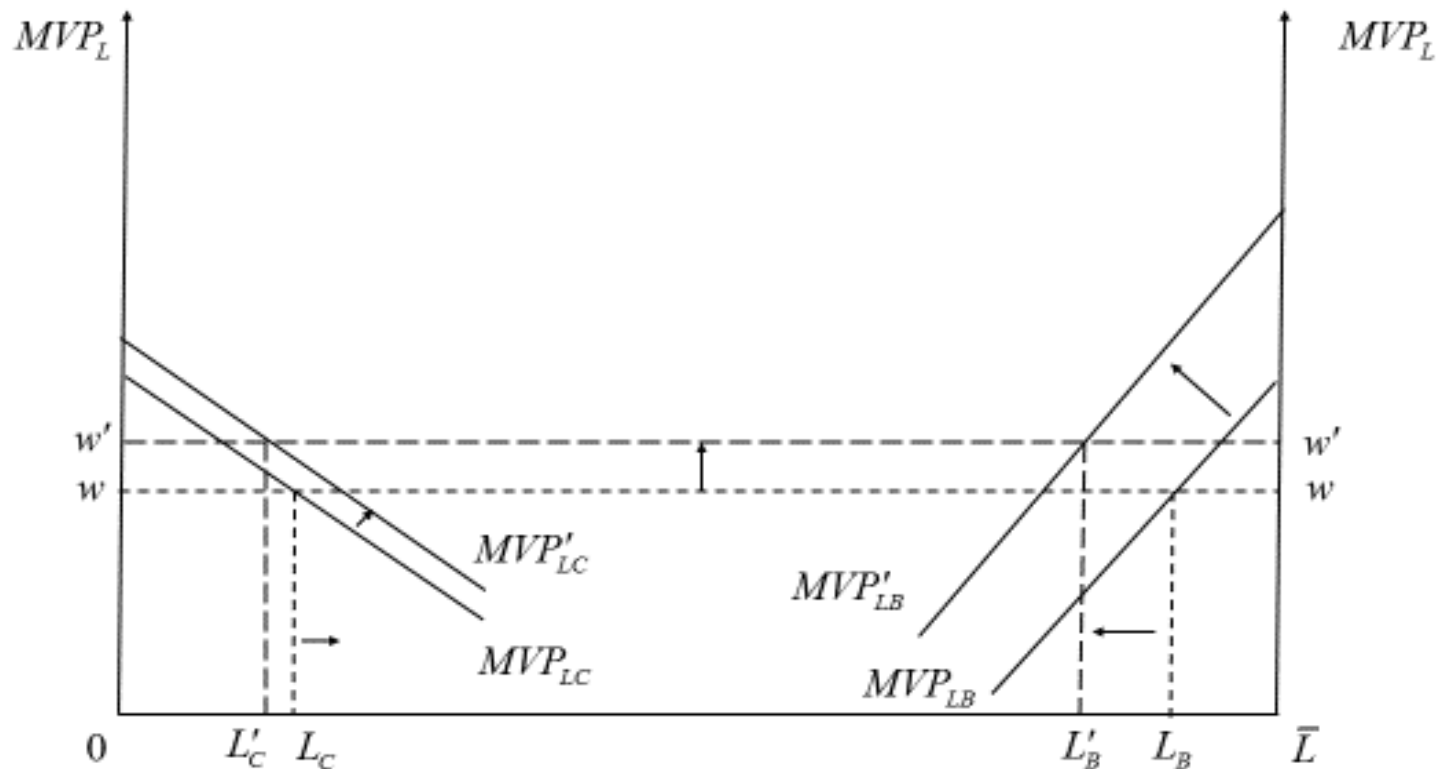


Table 7. Employment Shares for Control and Treatment Groups in Senegal

Industry	Control (Z_1)	Treatment (Z_2)
Charcoal	0.1593	0.0917
Baobab	0.1331	0.1935
Lalo	0.0342	0.1282
Jujube	0.0822	0.0758
Fonio	0.0450	0.0748
Livestock	0.0007	0.0042
Other Agriculture	0.2025	0.1352
Student	0.2989	0.2314
Unemployed	0.0441	0.0651

Conclusions

- ▶ Value chain interventions have the potential for improving food security in Feed the Future countries
 - ▶ Coffee producers are better off:
 - ▶ Household income increased
 - ▶ Poverty rates declined
 - ▶ Food security increased
- ▶ The remaining question is whether agriculture can lead a “transformation”
 - ▶ In Senegal, the value chain intervention shifted employment away from an extractive use (charcoal production)