



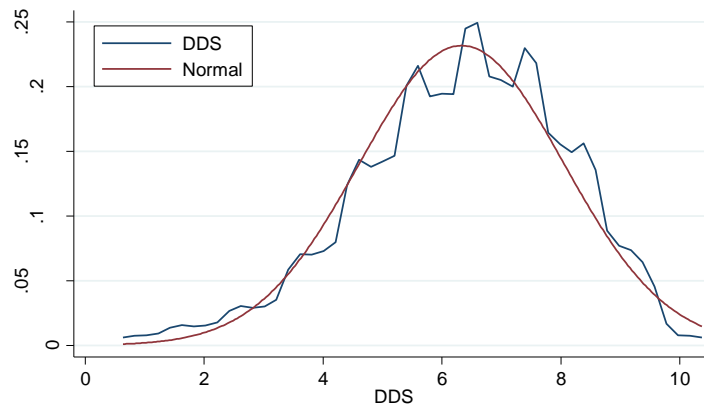
Production diversity and dietary diversity in smallholder subsistence- and market-oriented farming households in rural Paraguay

- Supplemental Tables and Figures -

November 26, 2018

PART A

Figure A1.
Kernel Density Estimate of DDS



Note: Kernel density estimate with Epanechnikov kernel (bandwidth = 0.3694).

PART B

Table B1.
Results from regressions of DDS and energy intake per AME on two indicators of agricultural biodiversity (crops species richness and crop nutritional functional richness)

	Crop Species Richness (CSR)			Crop Nutr. Functional Richness (CNFR)		
	DDS	DDS	Energy	DDS	DDS	Energy
ACB	0.023*** (0.002)	0.026*** (0.002)	103.1*** (12.31)	0.050*** (0.005)	0.060*** (0.005)	218.5*** (21.52)
HH Size		0.002 (0.004)	-310.4*** (27.68)		0.000 (0.003)	-314.6*** (26.23)
Female Head of HH		0.005 (0.017)	103.3 (89.49)		0.012 (0.017)	127.6 (87.68)
Age of Head of HH		-0.001** (0.001)	-2.232 (3.031)		-0.002*** (0.001)	-3.005 (2.924)
Mother's Education (No Ed.)		0.051* (0.026)	140.69 (103.6)		0.050** (0.025)	140.0 (100.8)
Income Quintile 2		0.018 (0.025)	-46.12 (109.9)		0.011 (0.025)	-68.91 (102.8)
Income Quintile 3		0.051** (0.022)	-28.02 (101.3)		0.034 (0.022)	-90.04 (98.15)
Income Quintile 4		0.046* (0.029)	-25.14 (113.5)		0.031 (0.027)	-84.90 (113.7)
Income Quintile 5		-0.006 (0.028)	-454.1*** (146.1)		-0.019 (0.029)	-504.9*** (148.9)
Total Area Cultivated		0.001** (0.001)	0.942 (2.016)		0.001*** (0.000)	1.390 (2.403)
Total Qty Harvested		0.000 (0.000)	0.000 (0.000)		0.000 (0.000)	0.001 (0.001)
Prop. of Harvest Sold		-0.070** (0.028)	-239.7* (135.7)		-0.053* (0.029)	-144.1 (124.4)
Total Qty Sold (Gs.)		-0.000* (0.000)	-0.069 (0.108)		-0.000** (0.000)	-0.123 (0.122)
Food Expenditures 7d		0.098*** (0.010)	842.8*** (63.87)		0.108*** (0.010)	875.8*** (62.30)
Dept. San Pedro		-0.022 (0.038)	652.0*** (228.9)		-0.027 (0.035)	648.2*** (196.5)
Dept. Caaguazú		-0.044 (0.039)	768.8*** (65.00)		-0.069* (0.035)	691.7*** (180.5)
Dept. Itapúa		-0.003 (0.039)	112.8 (77.71)		0.012 (0.035)	200.2 (203.6)
Dept. Alto Paraná		-0.096** (0.048)	-132.3 (253.7)		-0.088* (0.046)	-85.92 (221.0)
Dept. Other		-0.012 (0.039)	333.9 (218.3)		-0.019 (0.034)	321.0* (180.6)
Constant	1.717*** (0.022)	1.605*** (0.070)	2,218.7*** (341.2)	1.609*** (0.033)	1.481*** (0.063)	1,788.6*** (308.12)
<i>N</i>	1,297	1,193	1,193	1,297	1,193	1,193

Robust (linearized) standard errors incorporating survey design shown in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Source: Authors' calculations.

Table B2.
Results from regressions of DDS and energy intake per AME on two indicators of agricultural biodiversity (crops species richness and crop nutritional functional richness)
- Regressions with an interaction term -

	Crop Species Richness (CSR)		Crop Nutr. Functional Richness (CNFR)	
	DDS	Energy	DDS	Energy
ACB	0.024*** (0.002)	102.5*** (15.29)	0.057*** (0.005)	223.6*** (29.23)
HH Size	0.002 (0.004)	-310.5*** (27.56)	0.000 (0.004)	-314.2*** (26.1)
Female Head of HH	0.004 (0.017)	103.3 (89.41)	0.012 (0.017)	127.8 (87.94)
Age of Head of HH	-0.001** (0.001)	-2.230 (3.037)	-0.001*** (0.001)	-3.033 (2.952)
Mother's Education (No Ed.)	0.051** (0.026)	140.9 (103.5)	0.050** (0.025)	139.4 (100.8)
Income Quintile 2	0.017 (0.025)	-46.41 (109.3)	0.011 (0.025)	-67.28 (103.3)
Income Quintile 3	0.049** (0.022)	-28.70 (99.65)	0.032 (0.022)	-86.14 (96.75)
Income Quintile 4	0.043 (0.028)	-26.04 (112.7)	0.028 (0.028)	-79.90 (114.7)
Income Quintile 5	-0.011 (0.029)	-455.3*** (142.0)	-0.023 (0.029)	-497.6*** (147.7)
Total Area Cultivated	0.001** (0.001)	0.971 (2.009)	0.001*** (0.000)	1.200 (2.418)
Total Qty Harvested	0.000 (0.000)	0.000 (0.001)	0.000 (0.000)	0.001 (0.001)
Prop. of Harvest Sold	-0.132** (0.054)	-254.3 (242.9)	-0.114 (0.076)	-47.24 (282.7)
Total Qty Sold (Gs.)	-0.000* (0.000)	-0.070 (0.108)	-0.000** (0.000)	-0.118 (0.123)
Food Expenditures 7d	0.097*** (0.010)	842.6*** (63.95)	0.108*** (0.010)	876.8*** (62.11)
ACB x Prop. of Harvest Sold	0.010 (0.007)	2.530 (29.94)	0.012 (0.013)	-20.69 (52.53)
Dept. San Pedro	-0.021 (0.038)	652.2*** (229.2)	-0.026 (0.035)	646.3*** (196.8)
Dept. Caaguazú	-0.045 (0.039)	768.7*** (216.4)	-0.068* (0.035)	691.2*** (180.5)
Dept. Itapúa	-0.002 (0.039)	113.0 (245.1)	0.013 (0.035)	198.3 (203.8)
Dept. Alto Paraná	-0.098** (0.047)	-132.9 (253.5)	-0.088* (0.046)	-84.26 (220.7)
Dept. Other	-0.012 (0.039)	333.8 (218.3)	-0.018 (0.034)	318.9* (181.2)
Constant	1.619*** (0.072)	2.222*** (335.4)	1.496*** (0.066)	1,762*** (302.9)
N	1,193	1,193	1,193	1,193

Robust (linearized) standard errors incorporating survey design shown in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
Source: Authors' calculations.

Table B3.
Results from regressions of DDS and energy intake per adult equivalent on two alternative indicators of agricultural biodiversity (FCPR and Simpson's Index)

	DDS	FCPR DDS	Energy	DDS	SIM DDS	Energy
ACB	0.025*** (0.003)	0.027*** (0.002)	104.8*** (13.16)	0.176*** (0.037)	0.200*** (0.033)	912.9*** (147.9)
HH Size		0.003 (0.003)	-307.1*** (27.30)		0.009** (0.003)	-284.1*** (26.50)
Female Head of HH		0.002 (0.016)	89.04 (89.27)		-0.002 (0.018)	86.72 (92.06)
Age of Head of HH		-0.001*** (0.001)	-2.572 (3.000)		-0.001 (0.001)	-0.235 (3.070)
Mother's Education (No Ed.)		0.051* (0.026)	141.6 (43.64)		0.059** (0.027)	174.2 (106.4)
Income Quintile 2		0.018 (0.025)	-40.87 (110.2)		0.030 (0.028)	-7.391 (108.1)
Income Quintile 3		0.049** (0.022)	-35.05 (102.3)		0.067*** (0.024)	27.91 (104.0)
Income Quintile 4		0.044 (0.027)	-31.64 (113.2)		0.067** (0.031)	59.66 (125.4)
Income Quintile 5		-0.010 (0.028)	-465.77*** (147.2)		0.017 (0.032)	-352.6** (156.5)
Total Area Cultivated		0.001** (0.001)	1.615 (2.089)		0.001* (0.001)	-0.187 (2.405)
Total Qty Harvested		-0.000 (0.000)	0.000 (0.001)		0.000 (0.000)	0.001 (0.002)
Prop. of Harvest Sold		-0.052* (0.028)	-161.7 (135.5)		-0.011 (0.031)	-22.15 (141.2)
Total Qty Sold (Gs.)		-0.000* (0.000)	-0.067 (0.107)		-0.000** (0.000)	-0.121 (0.130)
Food Expenditures 7d		0.096*** (0.010)	834.5*** (63.92)		0.087*** (0.010)	805.3*** (66.98)
Dept. San Pedro		-0.016 (0.039)	687.5*** (226.9)		0.027 (0.038)	814.9*** (218.8)
Dept. Caaguazú		-0.044 (0.039)	779.5*** (213.9)		-0.002 (0.038)	909.0*** (204.9)
Dept. Itapúa		-0.001 (0.040)	136.2 (244.7)		0.087 (0.038)	440.0* (232.4)
Dept. Alto Paraná		-0.103** (0.048)	-146.7 (252.4)		-0.026 (0.050)	130.2 (240.2)
Dept. Other		-0.007 (0.039)	361.7* (215.8)		0.036 (0.037)	498.8** (202.9)
Cons	1.714*** (0.021)	1.611*** (0.070)	2,236*** (336.8)	1.755*** (0.025)	1.514*** (0.075)	1,831*** (346.7)
N	1,297	1,193	1,193	1,297	1,193	1,193

Robust (linearized) standard errors incorporating survey design shown in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
Source: Authors' calculations.

Table B4.
Results from regressions of DDS and energy intake per adult equivalent on two alternative indicators of agricultural biodiversity (Food Crop Production Richness and Simpson Index)
- Regressions with an interaction term -

	FCPR		SIM	
	DDS	Energy	DDS	Energy
ACB	0.025*** (0.002)	104.4*** (16.36)	0.173*** (0.038)	754.7*** (155.5)
HH Size	0.002 (0.004)	-307.1*** (27.13)	0.009** (0.004)	-284.9*** (26.53)
Female Head of HH	0.002 (0.016)	89.10 (89.29)	-0.001 (0.018)	95.42 (91.08)
Age of Head of HH	-0.001** (0.001)	-2.570 (3.006)	-0.001 (0.001)	0.212 (3.086)
Mother's Education (No Ed.)	0.052** (0.026)	142.0 (104.4)	0.062** (0.027)	188.6* (107.3)
Income Quintile 2	0.018 (0.025)	-41.11 (109.7)	0.027 (0.028)	-23.29 (103.4)
Income Quintile 3	0.046** (0.023)	-35.63 (100.3)	0.064*** (0.024)	9.067 (102.7)
Income Quintile 4	0.040 (0.027)	-32.37 (112.3)	0.064** (0.031)	40.11 (121.7)
Income Quintile 5	-0.015 (0.029)	-466.7*** (142.3)	0.015 (0.032)	-367.7** (152.4)
Total Area Cultivated	0.002** (0.001)	1.641 (2.083)	0.001* (0.001)	0.035 (2.314)
Total Qty Harvested	-0.000 (0.000)	0.000 (0.001)	0.000 (0.000)	0.001 (0.002)
Prop. of Harvest Sold	-0.114** (0.051)	-172.2 (241.3)	-0.088 (0.057)	-423.7** (205.8)
Total Qty Sold (Gs.)	-0.000 (0.000)	-0.067 (0.107)	-0.000** (0.000)	-0.118 (0.127)
Food Expenditures 7d	0.096*** (0.010)	834.4*** (64.00)	0.086*** (0.010)	799.5*** (66.38)
ACB x Prop. of Harvest Sold	0.011 (0.007)	1.988 (32.33)	0.147* (0.087)	812.7** (372.0)
Dept. San Pedro	-0.014 (0.039)	687.7*** (227.2)	0.026 (0.038)	808.4*** (219.2)
Dept. Caaguazú	-0.044 (0.039)	779.4*** (213.8)	-0.004 (0.039)	896.8*** (205.4)
Dept. Itapúa	-0.000 (0.039)	136.4 (245.1)	0.088** (0.039)	443.6* (232.5)
Dept. Alto Paraná	-0.105** (0.049)	-147.1 (252.2)	-0.028 (0.050)	115.4 (240.7)
Dept. Other	-0.007 (0.039)	361.8* (215.9)	0.035 (0.038)	488.2** (203.4)
Constant	1.626*** (0.072)	2.239*** (329.3)	1.526*** (0.077)	1,902*** (343.4)
<i>N</i>	1,193	1,193	1,193	1,193

Robust (linearized) standard errors incorporating survey design shown in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
Source: Authors' calculations.

Table B5.
Results from regressions of DDS (based on purchased foods) and two indicators of agricultural biodiversity (crops species richness and crop nutritional functional richness)

	Crop Species Richness (CSR)		Crop Nutr. Functional Richness (CNFR)	
	DDS (Purchased)	DDS (Purchased)	DDS (Purchased)	DDS (Purchased)
ACB	-0.059*** (0.012)	-0.025** (0.011)	-0.046*** (0.007)	-0.016*** (0.006)
ACB ²	0.003*** (0.001)	0.001** (0.001)		
HH Size		-0.005 (0.006)		-0.004 (0.006)
Female Head of HH		0.069*** (0.023)		0.067*** (0.023)
Age of Head of HH		-0.002*** (0.001)		-0.002*** (0.001)
Mother's Education (No Ed.)		0.003 (0.038)		0.006 (0.039)
Income Quintile 2		0.035 (0.033)		0.040 (0.033)
Income Quintile 3		0.035 (0.036)		0.043 (0.036)
Income Quintile 4		0.025 (0.039)		0.033 (0.040)
Income Quintile 5		-0.027 (0.041)		-0.017 (0.041)
Total Area Cultivated		0.001 (0.001)		0.001 (0.001)
Total Qty Harvested		-0.000 (0.000)		-0.000 (0.000)
Prop. of Harvest Sold		-0.030 (0.049)		-0.033 (0.048)
Total Qty Sold (Gs. 100,000)		0.000 (0.000)		0.000 (0.000)
Food Expenditures 7d		0.233*** (0.023)		0.229*** (0.024)
Dept. San Pedro		-0.151*** (0.053)		-0.155*** (0.053)
Dept. Caaguazú		-0.129** (0.053)		-0.129** (0.053)
Dept. Itapúa		-0.114* (0.061)		-0.115* (0.059)
Dept. Alto Paraná		-0.150*** (0.054)		-0.153*** (0.054)
Dept. Other		-0.110** (0.055)		-0.113** (0.055)
Constant	1.602*** (0.041)	1.389*** (0.106)	1.625*** (0.045)	1.375*** (0.106)
N	1,297	1,193	1,297	1,193

Robust (linearized) standard errors incorporating survey design shown in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
Source: Authors' calculations.

Table B6.
Analysis of the relationship between household daily intakes per AME of protein, iron, vitamin A, and zinc and indicators of agricultural biodiversity

	Proteins	Iron	Vitamin A	Zinc
Basic Agricultural Biodiversity Measures				
CSR	3.337*** (0.415)	0.536*** (0.099)	28.47*** (10.78)	0.490*** (0.059)
CNFR	7.858*** (0.784)	1.047** (0.198)	44.74* (23.53)	1.094*** (0.108)
Other Agricultural Biodiversity Measures				
FCPR	3.445*** (0.431)	0.561*** (0.105)	30.32*** (11.40)	0.499*** (0.060)
SIM	27.45*** (5.061)	3.414*** (1.286)	252.1 (170.4)	4.277*** (0.684)

Notes: Partial regression coefficients from ordinary least squares regressions. Separate models were analyzed for each indicator of agricultural biodiversity with each dependent variable. N = 1,193 households. ***, ** and * indicate the statistical significance of the partial regression coefficients at 1%, 5%, and 10% levels, respectively. Coefficient estimates shown with robust (linearized) SEs in parentheses. CSR denotes 'Crop Species Richness', CNFR 'Crop Nutritional Functional Richness', FCPR 'Food Crop Production Richness', and SIM 'Simpson Index'. Source: Authors' calculations.

PART C

Table C1.
Mean proportion of harvested crop sold by agricultural rural households, by predominant cash-crop, mixed crop, and predominant subsistence crop (EIG 2011/12)

Crop	Dietary Food Group	Proportion Sold	Std Error	[95% CI]	
Predominant subsistence crops					
Assorted Vegetables	Other Vegetables	0.01	0.01	0.00	0.03
Avocado	Other Fruits	0.02	0.02	-0.02	0.07
Bananas	Other Fruits	0.05	0.01	0.02	0.07
Bitter Orange	None	0.15	0.06	0.02	0.27
Butter Beans	Beans and Peas	0.08	0.04	0.01	0.16
Carrots	Other Vit A–Rich Veg and Fru	0.10	0.05	0.00	0.20
Cassava	Starchy Staple Foods	0.05	0.01	0.03	0.07
Common Beans	Beans and Peas	0.10	0.03	0.05	0.15
Corn (var. chipa)	Starchy Staple Foods	0.09	0.01	0.06	0.12
Corn (var. pororo)	Starchy Staple Foods	0.04	0.03	-0.03	0.10
Corn (var. tupí)	Starchy Staple Foods	0.08	0.01	0.06	0.10
Garlic	None	0.16	0.14	-0.12	0.44
Grapefruit	Other Fruits	0.09	0.03	0.04	0.14
Grapes	Other Fruits	0.01	0.01	-0.01	0.03
Guayaba	Other Fruits	0.02	0.02	-0.02	0.06
Kidney Beans	Beans and Peas	0.09	0.01	0.07	0.11
Lemon	Other Fruits	0.00	0.00	0.00	0.01
Lettuce	Other Vegetables	0.16	0.08	0.01	0.32
Locro	Starchy Staple Foods	0.13	0.06	0.02	0.25
Mandarin Oranges	Other Fruits	0.04	0.01	0.01	0.06
Mango	Other Vit A–Rich Veg and Fru	0.01	0.01	-0.01	0.02
Musk Melon	Other Vit A–Rich Veg and Fru	0.17	0.05	0.08	0.26
Oranges	Other Fruits	0.04	0.01	0.01	0.06
Other Vegetables	Other Vegetables	0.01	0.01	0.00	0.02
Papaya	Other Vit A–Rich Veg and Fru	0.02	0.02	-0.01	0.05
Peaches	Other Fruits	0.01	0.01	-0.01	0.04
Peanuts	Nuts and Seeds	0.06	0.02	0.03	0.10
Pineapple	Other Fruits	0.13	0.03	0.07	0.20
Pumpkin	Other Vit A–Rich Veg and Fru	0.15	0.13	-0.11	0.40
Scallion	Vit A–Rich Dark Green Veg	0.05	0.03	-0.01	0.11
Watermelon	Other Fruits	0.13	0.03	0.07	0.19

Note: Table shows mean proportions of harvested crops sold by rural households, along with std errors (Std Err) and the 95% confidence intervals ([95% CI]), n = 1,297. The following crops is produced but not sold by households: nispero, pear, plum, rice, radish (proportion sold = 0).

Table C1. (cont.)
Mean proportion of harvested crop sold by agricultural rural households, by predominant cash-crop, mixed crop, and predominant subsistence crop (EIG 2011/12)

Crop	Dietary Food Group	Proportion	Std		
		Sold	Error	[95% CI]	
Mixed Crops					
Beets	Other Vegetables	0.25	0.13	-0.01	0.52
Cabbage	Other Vegetables	0.32	0.16	0.01	0.63
Cucumber	Other Vegetables	0.55	0.24	0.08	1.02
Feijao	Beans and Peas	0.26	0.15	-0.04	0.56
Onions	Other Vegetables	0.35	0.10	0.16	0.55
Other Temp. Crops	None	0.39	0.16	0.07	0.70
Parsley	Vit A-Rich Dark Green Veg	0.41	0.19	0.04	0.79
Peas	Other Vegetables	0.24	0.07	0.11	0.37
Red Pepper	Other Vit A-Rich Veg and Fru	0.45	0.10	0.24	0.66
Sorghum	Starchy Staple Foods	0.44	0.30	-0.16	1.04
Strawberry	Other Fruits	0.49	0.20	0.09	0.89
Sugar Cane	None	0.22	0.06	0.11	0.33
Swiss Chard	Vit A-Rich Dark Green Veg	0.22	0.23	-0.23	0.67
Tomatoes	Other Vegetables	0.53	0.09	0.36	0.70
West Indian Pumpkin	Other Vit A-Rich Veg and Fru	0.41	0.13	0.15	0.66
Predominant cash crops					
Caper Spurge*	None	0.98	0.03	0.92	1.03
Cotton	None	0.92	0.03	0.86	0.99
Flowers	None	1.00	-	-	-
Medicinal Herbs	None	0.99	0.00	0.98	1.00
Other Perm. Crops	None	0.81	0.09	0.64	0.98
Sesame	None	0.93	0.02	0.88	0.98
Soy	Beans and Peas	0.98	0.01	0.97	1.00
Stevia**	None	1.00	-	-	-
Tobacco	None	0.86	0.07	0.72	0.99
Tung***	None	0.98	0.02	0.95	1.01
Wheat	Starchy Staple Foods	0.99	0.00	0.98	1.00
Yerba Mate	None	0.96	0.04	0.87	1.04

Note: Table shows mean proportions of harvested crops sold by rural households, along with std errors (Std Err) and the 95% confidence intervals ([95% CI]), n = 1.297, *) Caper Spurge (Euphorbia lathyris), **) Stevia rebaudiana, ***) Tung Tree (Vernicia fordii)

PART D

**Table D1.
Adult Equivalent (AE) units applied to members
of agricultural households analyzed in the study (EIG 2011/12)**

Males			Females		
Age (Years)	Energy (kcal/day)	AE	Age (Years)	Energy (kcal/day)	AE
< 1.9	900	0.35	< 1.9	900	0.35
2.0-2.9	1,000	0.38	2.0-2.9	1,000	0.38
3.0-5.9	1,400	0.54	3.0-3.9	1,200	0.46
6.0-8.9	1,600	0.62	4.0-6.9	1,400	0.54
9.0-10.9	1,800	0.69	7.0-9.9	1,600	0.62
11.0-11.9	2,000	0.77	10.0-11.9	1,800	0.69
12.0-13.9	2,200	0.85	12.0-18.9	2,000	0.77
14.0-14.9	2,400	0.92	19.0-25.9	2,200	0.85
15.0-15.9	2,600	1.00	26.0-50.9	2,000	0.77
16.0-25.9	2,800	1.08	≥ 51.0	1,800	0.69
26.0-45.9	2,600	1.00			
46.0-65.9	2,400	0.92			
≥ 66.0	2,200	0.85			

Sedentary level of physical activity was assumed. The estimates are based on the Estimated Energy Requirements (EER) equations, using reference heights (average) and reference weights (healthy) for each age-sex group. For adults, the reference man is 5 feet 10 inches tall and weighs 154 pounds; the reference woman is 5 feet 4 inches tall and weighs 126 pounds. For children and adolescents, reference height and weight vary (IOM 2002).



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