

**Information from Markets Near and Far:
Mobile Phones and Agricultural Markets in Niger**

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Web Appendix

Table A1. Description of Key Variables: Grain Trader and Market Baseline Characteristics

Variable Name	Sample Mean (s.d.)	# of obs
Panel A: Trader-Level Characteristics		
<i>Socio-Demographic Characteristics</i>		
Ethnicity		395
<i>Hausa</i>	0.65	255
<i>Zarma</i>	0.17	65
<i>Other</i>	0.18	75
Age	45.71(12.2)	395
Gender(male=0, female=1)	0.11(.32)	395
Education (0=elementary or above, 1=no education)	0.62(.48)	395
Trader type		395
<i>Wholesaler</i>	0.17	67
<i>Semi-wholesaler</i>	0.15	61
<i>Intermediary</i>	0.15	61
<i>Retailer</i>	0.53	206
Years' of Experience	16.0(10.2)	395
<i>Commercial Characteristics</i>		
Engage in trading activities all year round	.94(.22)	395
Trade in agricultural output products only	0.98(.02)	395
Engage in activities outside of trade	0.92(.28)	395
Co-ownership of commerce	.19(.40)	395
More than 75 percent of commerce sold in principal market	.59(.49)	395
Changed "principal market" since he/she became a trader	.10(.31)	395
Number of markets where trade goods	4.42(2.84)	395
Number of markets where follow prices	3.87(3.0)	395
Number of days of storage	7.14(9.8)	395
Own cell phone	.29(.45)	395
Own means of transport (donkey cart, light transport)	.11(.32)	395
Panel B. Market-Level Characteristics		
Type of market		35
<i>Collection</i>	0.19	7
<i>Wholesale</i>	0.36	13
<i>Retail</i>	0.30	10
<i>Border</i>	0.15	5
Number of traders	137(99.6)	35
Road quality (1=paved road, 0=otherwise)	.71(.45)	35
Market located more than 50 km from paved road	.07(.26)	35
New paved road in past 5 years	.15(.37)	35
Located in an urban center (>35,000 people)	.39(.48)	35
Cell phone coverage 2005/2006	.78(.41)	35
Cell phone coverage 2004/2005	.62(.48)	35
Drought in 2004/2005	.40(.49)	35
Food crisis region in 2004/2005	.38(.48)	35

Notes: Data from the Niger trader survey collected by the author. Sample means are weighted by inverse sampling probabilities.

Table A2. Estimated Effects of Mobile Phone Coverage on Price Dispersion: DD Estimation with Fixed Effects

Dependent variable: $ P_{it} - P_{jt} $	(1)	(2)	(3)	(4)	(5)	(6)
Mobile Phone Dummy (both treated)	-2.85*** (.679)	-2.26*** (.932)	-2.28** (1.11)	-2.41** (1.09)	-2.26*** (.832)	-2.28*** (.732)
Lagged dependent variable						.359*** (.009)
Other covariates	No	No	No	Yes	Yes	Yes
Common Time Trend	Yes	Yes	Yes	Yes	Yes	Yes
Market-Pair Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Yearly time dummy	Yes	Yes	Yes	Yes	Yes	Yes
Monthly time dummy	No	Yes	Yes	Yes	Yes	Yes
Group-specific time trend	No	No	Yes	Yes	Yes	Yes
Cross-border markets	No	No	No	No	Yes	No
# of observations	54660	54660	54660	54660	62537	51698
# of cross-sectional observations	666	666	666	666	777	666
R ²	0.0047	0.0819	0.0819	0.0819	0.0828	
Joint effect						-1.92*** (.729)
Long-term effect						-3.55*** (1.15)
Pre-treatment value of dependent variable for control groups	22.81(17)	22.81(17)	22.81(17)	22.81(17)	22.81(17)	22.81(17)

Notes: Data from the Niger trader survey and secondary sources collected by the author. For market pairs, mobile phone dummy =1 in period t when both markets have mobile phone coverage, 0 otherwise. Distance dummy=1 if market pairs are separated by a distance of greater than or equal to 375 km, 0 otherwise. Road quality is equal to 1 if the road connecting a market pair is unpaved, 0 otherwise. Additional covariates include CFA/kg transport costs for millet at time t and the presence of drought in one market. Huber-White robust standard errors clustered by market pair are in parentheses. * is significant at the 10% level, ** significant at the 5% level, *** is significant at the 1% level. All prices are deflated by the Nigerien Consumer Price Index (CPI).

Table A3. Estimated Effects of Mobile Phone Coverage on Log of Price Dispersion: DD Estimation with First Differences

Dependent variable: $ \log(P_{it}/P_{jt}) $	(1)	(2)	(3)	(4)	(5)	(6)
Cell Phone Dummy (both treated)	-.018*** (.004)	-.012*** (.004)	-.012*** (.004)	-.012*** (.004)	-.013*** (.004)	-.015*** (.005)
Lagged dependent variable						.386*** (.008)
Other covariates	No	No	No	Yes	Yes	Yes
Common Time Trend	Yes	Yes	Yes	Yes	Yes	Yes
Market-Pair Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Yearly time dummy	Yes	Yes	Yes	Yes	Yes	Yes
Monthly time dummy	No	Yes	Yes	Yes	Yes	Yes
Group-specific time trend	No	No	Yes	Yes	Yes	Yes
Cross-border markets	No	No	No	No	Yes	No
# of observations	53820	53820	53820	53820	62223	51698
# of cross-sectional observations	666	666	666	666	777	666
R ²	0.0022	0.121	0.121	0.121	0.108	
Joint effect						-.006*** (.002)
Long-term effect						-.025*** (.009)
Pre-treatment value of dependent variable for control groups						

Notes: Data from the Niger trader survey and secondary sources collected by the author. For market pairs, mobile phone dummy =1 in period t when both markets have mobile phone coverage, 0 otherwise. Distance dummy=1 if market pairs are separated by a distance of greater than or equal to 375 km, 0 otherwise. Road quality is equal to 1 if the road connecting a market pair is unpaved, 0 otherwise. Additional covariates include CFA/kg transport costs for millet at time t and the presence of drought in one market. Huber-White robust standard errors clustered by market pair are in parentheses. * is significant at the 10% level, ** significant at the 5% level, *** is significant at the 1% level. All prices are deflated by the Nigerian Consumer Price Index (CPI).

Table A4. DD Estimates of the Impact of Mobile Phones on Price Dispersion by Year

Panel A: Price dispersion in 2001/2002			
	Cell Phone Mean	Non-Cell Phone Mean	T-C (s.e.)
Before treatment, mean(s.d.) 2000/2001	29.91 (9.64)	22.65(17.32)	7.25*** (1.00)
After treatment, mean(s.d.) 2001/2002	33.69(15.19)	27.35(19.9)	6.35*** (1.06)
After-before difference (DID) (s.e.)	1.84(1.20)	5.33*** (.831)	-3.49*** (.831)
% change in price dispersion	6.15%	23.53%	-15.41%
Panel B: Price dispersion in 2002/2003			
	Cell Phone Mean	Non-Cell Phone Mean	T-C (s.e.)
Before treatment, mean(s.d.) 2000/2001	18.20(14)	22.65(17.32)	-4.46(3.77)
After treatment, mean(s.d.) 2002/2003	23.88(22.09)	26.61416 19.96	-2.73(6.88)
After-before difference (DID) (s.e.)	4.81(3.23)	4.59*** (.560)	-.203(3.46)
% change in price dispersion	26.43%	20.26%	-0.90%
Panel C: Price dispersion in 2003/2004			
	Cell Phone Mean	Non-Cell Phone Mean	T-C (s.e.)
Before treatment, mean(s.d.) 2000/2001	21.01(17.03)	22.65(17.32)	-1.65(1.89)
After treatment, mean(s.d.) 2003/2004	18.32(13.3)	21.79(15.38)	-3.47** (1.68)
After-before difference (DID) (s.e.)	-2.27** (1.09)	-.226(.737)	-1.68(1.32)
% change in price dispersion	-10.80%	-1.00%	-7.42%
Panel D: Price dispersion in 2004/2005			
	Cell Phone Mean	Non-Cell Phone Mean	T-C (s.e.)
Before treatment, mean(s.d.) 2000/2001	19.33(15.89)	22.65(17.32)	-3.32*** (1.23)
After treatment, mean(s.d.) 2004/2005	23.58(19.24)	29.27(22.24)	-5.69*** (1.55)
After-before difference (DID) (s.e.)	4.20*** (.618)	7.25*** (.782)	-2.98*** (1.01)
% change in price dispersion	21.73%	32.01%	-13.16%
Panel E: Price dispersion in 2005/2006			
	Cell Phone Mean	Non-Cell Phone Mean	T-C (s.e.)
Before treatment, mean(s.d.) 2000/2001	20.10(16)	22.65(17.32)	-2.56** (1.10)
After treatment, mean(s.d.) 2005/2006	20.67(15.03)	23.72(16.4)	-3.05*** (1.10)
After-before difference (DID) (s.e.)	.201(.426)	1.70** (.709)	-1.62** (.809)
% change in price dispersion	1.00%	7.51%	-7.15%

Notes: Data from the Niger trader survey and secondary sources collected by the author. "Cell phone" is defined as those market pairs having cell phone coverage in that particular year. "No cell phone" is defined as those market pairs that never received mobile phone coverage between 2001 and 2006. The "percent change" is calculated as the after-before difference compared to the no cell phone price dispersion in the pre-treatment period. Huber-White robust standard errors clustered at the market pair-month level in parentheses. * is significant at the 10% level, ** significant at the 5% level, *** is significant at the 1% level. All prices are deflated by the Nigerian Consumer Price Index (CPI).

Table A5. Differences in Pre-Mobile Phone Trends in Price Dispersion by Mobile Phone Treatment Period

Dependent variable: $P_{it} - P_{jt}$	
Market Pairs Treated Year 1*Change in Pre-Treatment Years	8.02***(1.17)
Market Pairs Treated Year 2*Change in Pre-Treatment Years	.332(4.13)
Market Pairs Treated Year 3*Change in Pre-Treatment Years	.124(2.01)
Market Pairs Treated Year 4*Change in Pre-Treatment Years	-3.14(1.98)
Market Pairs Treated Year 5*Change in Pre-Treatment Years	-1.93(1.33)
Market Pairs Never Treated*Change in Pre-Treatment Years	-2.37(4.45)
R ²	0.0173
# of observations	7416

Notes: Data from the Niger trader survey and secondary sources collected by the author. Each row represents the year in which a specific market pair first received coverage, interacted with the change between the pre-treatment years (1999/2000 until 2000/2001). *E.g.*, "markets treated year 1" represents the market pair that received mobile phone coverage in 2001, the first year of mobile phone coverage. Huber-White robust standard errors clustered by market pair are in parentheses. * is significant at the 10% level, ** significant at the 5% level, *** is significant at the 1% level. All prices are in 2001 CFA.

Table A6. Estimated Effects of Mobile Phone Coverage on Price Dispersion: DD Estimation with Propensity Score Matching

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable: $ P_{it} - P_{jt} $	PSM	WLS	PSM	WLS	PSM	WLS	PSM	WLS
Mobile Phone Dummy (both treated)	-3.87*** (.698)	-4.29*** (.753)	-2.52*** (.593)	-2.82*** (.620)	-2.51*** (.594)	-2.82*** (.621)	-2.49*** (.593)	-2.81*** (.622)
Other covariates	No	No	No	No	No	No	Yes	Yes
Common Time Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Market-Pair Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Yearly time dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Monthly time dummy	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Group-specific time trend	No	No	No	No	Yes	Yes	Yes	Yes
Cross-border markets	No	No	No	No	No	No	No	No
# of observations	48860	48860	48860	48860	48860	48860	48860	48860
# of cross-sectional observations	611	611	611	611	611	611	611	611
R ²	0.0049	0.0053	0.0944	0.0964	0.0944	0.0964	0.0946	0.0966
Pre-treatment value of dependent variable for control groups	22.81(17)	22.81(17)	22.81(17)	22.81(17)	22.81(17)	22.81(17)	22.81(17)	22.81(17)

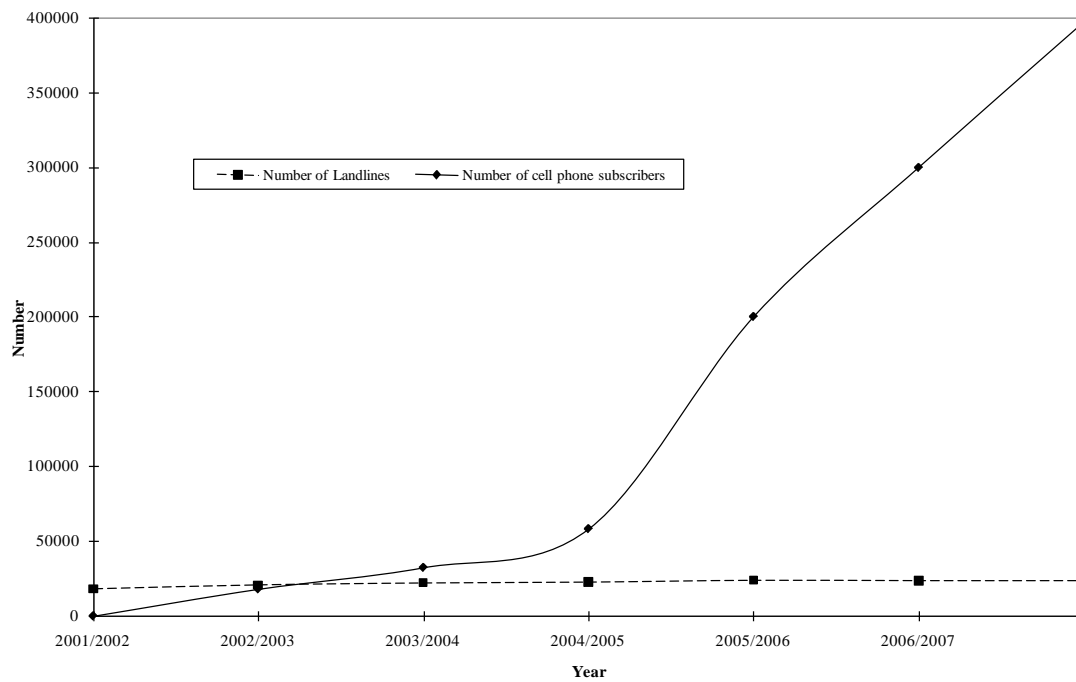
Notes: Data from the Niger trader survey and secondary sources collected by the author. For market pairs, mobile phone dummy =1 in period t when both markets have mobile phone coverage, 0 otherwise. Columns with "PSM" include the propensity score as an additional control in the regression. Columns with "WLS" are run using the propensity score as a weight. Additional covariates include CFA/kg transport costs for millet at time t and the presence of drought in one market. Huber-White robust standard errors clustered by market pair are in parentheses. * is significant at the 10% level, ** significant at the 5% level, *** is significant at the 1% level. All prices are deflated by the Nigerien Consumer

Table A7. Tests of the Conditional Independence AssumptionDependent variable: $|P_{it} - P_{jt}|$ in 1999-2001 (Pre-Treatment)

Estimation Method	Coeff(s.e.)	T-statistic
Unconditional difference in means	-.117 (2.12)	-0.05
Conditional difference in means	.126 (1.92)	0.07
Propensity score regression	-.987 (2.01)	-0.49
Propensity score regression with demeaned propensity score	-.987 (2.02)	-0.49
Weighting and regression	.669 (1.20)	0.56
Weighting and regression with additional covariates	1.65 (1.03)	1.6

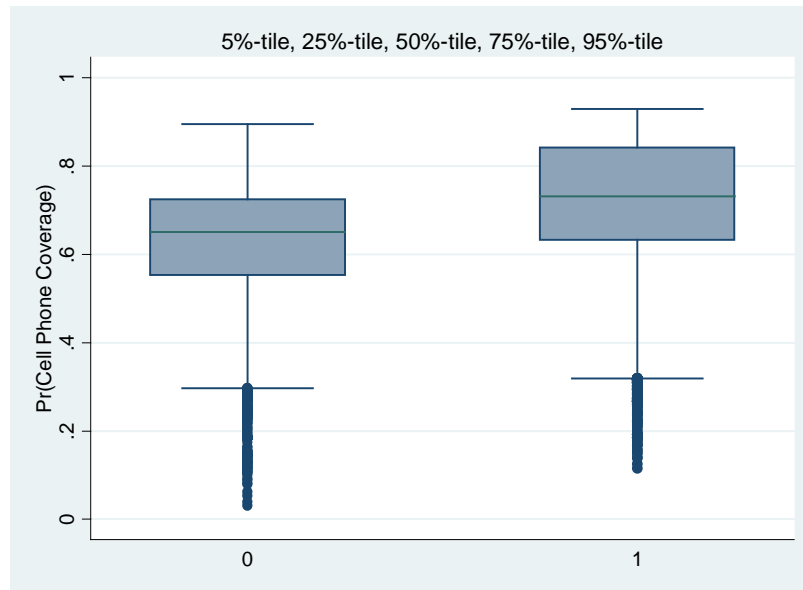
Notes: Data from the Niger trader survey and secondary sources collected by the author. Mobile phone dummy =1 for those market pairs that ever received mobile phone coverage between 2001-2006, 0 otherwise. Huber-White robust standard errors clustered by market pair-month are in parentheses. * is significant at the 10% level, ** significant at the 5% level, *** is significant at the 1% level. All prices are deflated by the Nigerien Consumer Price Index.

Figure A1. Number of Mobile Phone Subscribers and Landlines in Niger, 2000-2006



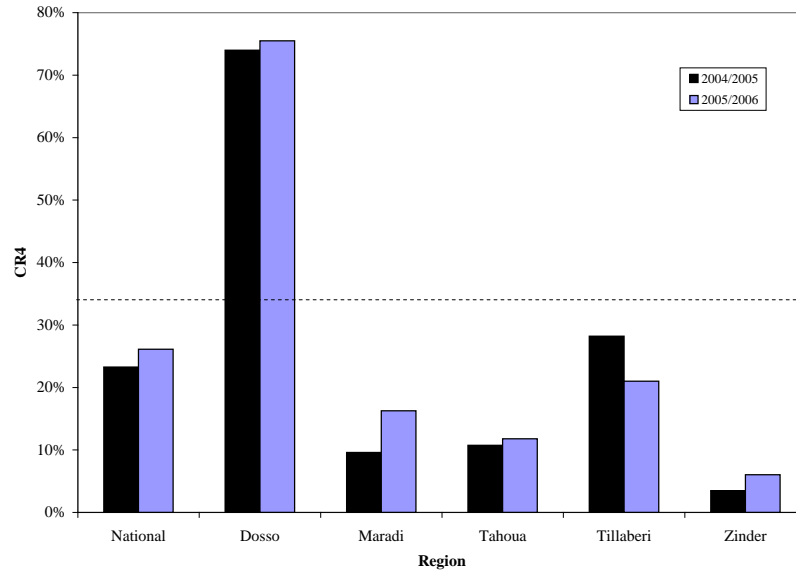
Source: Data collected by the author from the *Société Nigérienne des Télécommunications* (SONITEL) and mobile phone companies in Niger (Celtel, Telecel and Sahelcom). Between 2000 and 2006, landline coverage only increased in two markets.

Figure A2. Comparison of Box Plots of the Propensity Score by Mobile Phone Coverage



Notes: The propensity scores are estimated using a parsimonious probit, regressing treatment assignment (a cell phone tower) on pre-treatment covariate regressors, including transport costs, distance, drought, road quality, urban center and interaction terms between these covariates.

Figure A3. Four-Firm Concentration Ratio (CR4) per Market Aggregated by Region, 2004-2006



Notes: Four-firm concentration ratios calculated by the author based upon the 2005/2006 Niger trader census data and survey, with retrospective questions on 2004/2005. The CR4 was calculated for each market in the sample (N=35). The regional CR4 was then obtained by an unweighted average of the market-specific CR4s. Kohls and Uhl (1985) suggest that a CR4 of less than or equal to 33 percent is generally indicative of a competitive market structure, while a concentration ratio of 33 to 50 percent and above 50 percent may indicate a weak and strongly oligopolistic market structures, respectively. Based upon these criteria, markets in Niger appear to be competitive, with the exception of the Dosso region. However, this was primarily due to the non-competitive structure of one market located on the border with Nigeria.