Additional Empirical Results from "Eliminating Uncertainty in Market Access: The Impact of New Bridges in Rural Nicaragua"

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March 2020

This document provides a number of different empirical results to provide additional context for the main results.

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A More Results

A.1 Occupations Held By Village Members

Table 1 shows the set of all jobs held by village members. It includes all jobs that make up at least 5 percent of either inside or outside-village jobs at baseline, while the remaining fraction is various other jobs.

Table 1: Occupations (as %)

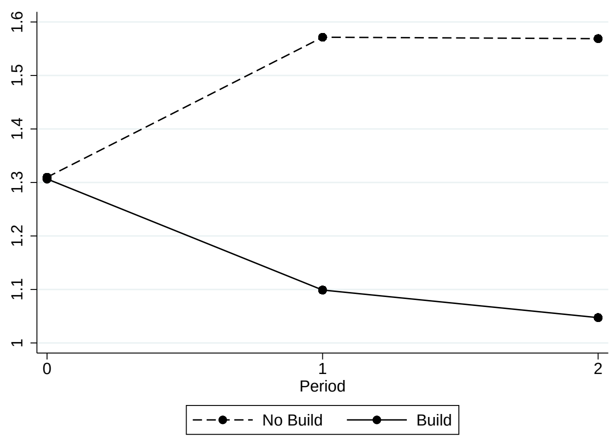
	Inside Village	Outside Village
Farmhand	71.24	42.51
Contractor, Carpenter	11.95	8.99
Teacher	1.77	8.38
Brick layer	1.33	6.59
Manufacturing	0.44	5.99
Maid, helper	1.77	5.99
Cigar roller	0.44	5.39
Total	**88.94**	**83.83**

Table Notes: An entry in the table is the percentage share of the location's jobs taken up by that occupation. Occupations are ordered in their prevalence in outside village work.

A.2 Wage Convergence over Time

Figure 1 shows the ratio of the average daily male wage net of year fixed effects in treatment and control. As implied by the regression results in the main text, this relative wage converges in treatment villages.

Figure 1: Relative Male Wage Outside Village to Inside Village



A.3 Using "current storage" as a direct measure of stored crops

Table 2 shows storage levels using a direct measure of storage. The measure of storage used here is

$$\frac{\text{Current Quantity Stored in Household}}{\text{Total Quantity Harvested}}.$$

This does not measure the total amount of harvest stored, as some was presumably consumed prior to the survey. Nevertheless, the results are similar to those in the main text. The average effect for maize storage becomes insignificant, though the magnitude (-0.113, $p = 0.150$) is still similar to that in the main text. The same result emerges that farming households at baseline see the majority of the effect. This is consistent with both the theory and the empirical results in the text.

Table 2: Direct Measure of Farm Savings

	Maize		Beans	
	(1)	(2)	(3)	(4)
Build	-0.113		-0.084*	
	(0.150)		(0.092)	
Build × Farm		-0.210**		-0.163*
		(0.042)		(0.088)
Build × No Farm		0.005		0.011
		(0.858)		(0.696)
Observations	1,507	1,507	1,507	1,507
Time F.E.	Y	Y	Y	Y
Village F.E.	Y	Y	Y	Y
Intra-cluster correlation	0.082	0.082	0.061	0.061

Table notes: These results define savings as the response to the question "How much of crop X do you currently have stored?" p-values in parentheses are clustered using the wild cluster bootstrap-t with 1000 simulations. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

A.4 Output Prices for Sold Crops

If bridge construction decreases trade costs, prices may decline and cause increased fertilizer use. Our survey includes data on the realized prices of sold crops, and we find no evidence on changes in the sale price of maize or beans.[1]

Table 3: Output Prices

	Maize Price	Bean Price
	(1)	(2)
Build	18.183	78.012
	(0.880)	(0.654)
Control mean, $t = 0$	189.333	871.429
Observations	176	184
Time F.E.	Y	Y
Village F.E.	Y	Y
Intra-cluster correlation	0.129	0.016

Table notes: p-values in parentheses are clustered at the village level using the wild cluster bootstrap-t with 1000 simulations. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

[1] Recall that the floods under consideration in this context last for days or weeks, but not for a period of time such that these staple crops would experience significant spoilage. As such, although it is true that transportation costs are very high during a flood, farmers can wait for the flood to subside without significant cost and realize the outside market price for their goods.

A.5 Land Use and Farming

Another possibility is that land is reallocated across farmers in response to bridge construction. While land transactions are rare in these villages, there do exist informal rental arrangements among households by which the amount of land that they farm can increase or decrease. This could also imply increased agricultural investment and yield, and thus be consistent with our main results. We find no evidence of such changes.

Table 4: Land Use and Farm Size

	Total Land Owned	Total Land Cropped	Rent out any land?	Any farming?
	(1)	(2)	(3)	(4)
Build	-0.333	-0.092	-0.018	-0.077
	(0.520)	(0.538)	(0.478)	(0.320)
Control mean, $t = 0$	2.636	1.074	0.067	0.488
Observations	1,496	1,495	1,507	1,507
Time F.E.	Y	Y	Y	Y
Village F.E.	Y	Y	Y	Y
Intra-cluster correlation	0.088	0.112	0.021	0.052

Table notes: Regressions one and two are measured in manzanas (1.73 acres), while regression three is an indicator for whether or not you rent land to someone else, including formal and informal arrangements. p-values in parentheses are clustered at the village level using the wild cluster bootstrap-t with 1000 simulations. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

A.6 Household Size

One possibility is that a bridge may make it easier for individuals to live in the urban center and commute back home as necessary. Below we test whether a bridge has any impact on number of individuals living in the household, and find that it does not.

Table 5: Household Size

	Total	Total ≤ 15	Males 16+	Females 16+
	(1)	(2)	(3)	(4)
Build	0.082	0.060	0.033	-0.010
	(0.528)	(0.514)	(0.528)	(0.798)
Control mean, $t = 0$	4.177	1.299	1.451	1.427
Observations	1,507	1,507	1,507	1,507
Time F.E.	Y	Y	Y	Y
Village F.E.	Y	Y	Y	Y
Intra-cluster correlation	0.036	0.038	0.046	0.021

Table notes: p-values in parentheses are clustered at the village level using the wild cluster bootstrap-t with 1000 simulations. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

A.7 IHS Specification for Income and Expenditures

In this section, we present the main results on income and expenditures using the inverse hyperbolic sign transformation for all dependent variables. The results show the same pattern as in the main specification.

Table 6: Main Empirical Results with IHS

	Earnings			Farm Expenditures			Farm Profit	
	Total Earnings	Outside Earnings	Inside Earnings	Intermediates	Fertilizer	Pesticide		
	(1)	(2)	(3)	(4)	(5)	(6)	(11)	(12)
Build	0.955^{**}	1.859^{***}	0.230	0.965^{*}	0.910^{**}	0.838	1.738^{**}	1.360^{*}
	(0.026)	(0.000)	(0.554)	(0.064)	(0.030)	(0.110)	(0.022)	(0.072)
Control mean, $t = 0$	1025.73	357.18	616.27	612.50	405.60	176.45	2351.69	2559.20
Time F.E.	Y	Y	Y	Y	Y	Y	Y	Y
Village F.E.	Y	Y	Y	Y	Y	Y	Y	Y

Table notes: This table reproduces the main results from the paper, but reports all outcome variables with an inverse hyperbolic sine transformation. Control means are given as untransformed levels. Farm profit (11) includes only production of maize and beans, the two most common crops. Regression (12) adds sorghum and coffee also. See Table **??** for the comparison in levels. p-values in parentheses are clustered using the wild cluster bootstrap-t with 1000 simulations. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

A.8 Crop Planting Decisions

We look at planting decisions, where we consider the two key staple crops maize and beans along with the main cash crop in Northern Nicaragua, coffee. We considered other cash crops as well, and find similar results to coffee. The outcome variable here is an indicator equal to one if the crop is planted (not necessarily harvested), and the results are in Table 7.

Table 7: Planting Decisions

	Maize	Beans	Coffee
	(1)	(2)	(3)
Build	0.007	0.080	0.004
	(0.886)	(0.170)	(0.736)
Observations	1,507	1,507	1,507
Time F.E.	Y	Y	Y
Village F.E.	Y	Y	Y
Intra-cluster correlation	0.072	0.111	0.071

Table notes: p-values in parentheses are clustered using the wild cluster bootstrap-t with 1000 simulations. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

A.9 Other Potential Savings Vehicles

We also consider the fact that there are many ways to save, that are perhaps more prevalent for non-crop producers. We look at: an indicator equal to one if a household has recently purchased a pig, goat, or cow, the level of debt owed to local stores (a common form of credit in these villages) or other households, and the value of household durable expenditures in the past year. These durables include radios, irons, tvs, bikes, motos, and refrigerators.

Table 8: Other Savings Decisions

	Indicator for recent purchase			Debt Level		HH Durable
	Pig	Cow	Goat	Store	Personal	Expenditures
	(1)	(2)	(3)	(4)	(5)	(6)
Build	-0.027	-0.004	0.003	-35.687	1.200	72.915
	(0.528)	(0.652)	(0.414)	(0.642)	(0.864)	(0.134)
Control mean, $t = 0$	0.049	0.003	0.009	288.659	29.619	115.83
Observations	1,507	1,507	1,507	1,497	1,494	1,492
Time F.E.	Y	Y	Y	Y	Y	Y
Village F.E.	Y	Y	Y	Y	Y	Y
Intra-cluster correlation	0.014	0.000	0.000	0.052	0.033	0.027

Table notes: p-values in parentheses are clustered using the wild cluster bootstrap-t with 1000 simulations. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Variation in observations is due to a small number of missing values.

The one metric that shows economically, though not statistically significant changes in in household durable expenditures. Here, we find an increase of 63 percent ($p = 0.134$) over the control mean. Though not statistically significant, it highlights the fact that households have other technologies available other than farming. Thus, one possibility is that households are decreasing savings and replacing it with durable consumption, though the results are not precise enough to claim this with much confidence.

A.10 Directly asking why households use a bridge

In the final wave of the survey, we asked households "When the river floods, which of the following is the most common way in which you or your family members cross the river?" The choices were (1) swim, (2) use a bridge, (3) find a place to cross, or (4) wait. Responses based on control and treatment are in Table 9.

Table 9: Coping with a Flood

	Control	Treatment
Bridge	11.6	32.1
Find a place to cross	6.2	4.9
Swim	0.4	0.0
Wait	81.9	63.0

Table notes: Responses measured as percentages. Note that we did not specify the type of bridge and thus one should not read control group answers of "bridge" as any indication that they are using a B2P-constructed bridge.

Eighty-two percent of the control group waits for a flood to subside, and that number falls to 63 percent in the treatment group. That 19 percentage point decline is almost entirely made up for by an increase in using a bridge, which increases by 20 percentage points.

If the household answers that they use a bridge, they receive the followup question "If the river is flooded, what does your family use the bridge for?" The choices are (1) to work, (2) to buy goods, (3) to go to school, (4) to access health services, and (5) to sell goods. They can choose any that apply.

Table 10: Qualitative Responses on Bridge Use (Treatment Group only)

	Treatment
For work	71.7
To buy goods	66.0
Health services	35.9
School	28.3
Sell goods	11.3

Table notes: Responses measured as percentages. Ordered in magnitude.

While the bridge is used among multiple dimensions, nearly 3 of 4 households who use the bridge to cross claim it is used to get to work during floods.

A.11 Per-Period Effects

To what extent to the results hold year-by-year? We re-run the regressions as

$$
\begin{aligned}
y_{ivt} &= \alpha + \beta B_{vt} + \delta_v + \varepsilon_{ivt} \qquad \text{for t = 0,1} \\
y_{ivt} &= \alpha + \beta B_{vt} + \delta_v + \varepsilon_{ivt} \qquad \text{for t = 0,2.}
\end{aligned}
$$

Table 11 shows the main results for each period. All of the main results hold period-by-period. Total earnings from $t = 0$ to $t = 2$ is not statistically significant ($p = 0.188$), but the point estimate is still in line with the estimates at $t = 1$.

Table 11: Main Empirical Results by Period

Panel A: t=1	Earnings			Farm Expenditures			Farm Outcomes				Storage	
	Total Earnings	Outside Earnings	Inside Earnings	Intermediates	Fertilizer	Pesticide	Maize Harvest	Maize Yield	Bean Harvest	Bean Yield	Maize	Beans
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Build	404.14**	308.95***	-63.17	659.96	378.69*	220.58	2.03	11.59***	0.56	1.01	-0.090**	-0.127***
	(0.036)	(0.000)	(0.694)	(0.108)	(0.054)	(0.290)	(0.200)	(0.000)	(0.458)	(0.660)	(0.016)	(0.006)
Control mean, $t = 0$	1025.73	357.18	616.27	612.50	405.60	176.45	1.58	9.03	0.98	3.94	0.936	0.937
Time F.E.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Village F.E.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y & Y	Y	

Panel B: t=2	Earnings			Farm Expenditures			Farm Outcomes				Storage	
	Total Earnings	Outside Earnings	Inside Earnings	Intermediates	Fertilizer	Pesticide	Maize Harvest	Maize Yield	Bean Harvest	Bean Yield	Maize	Beans
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Build	362.62	305.08***	18.11	682.59*	415.84*	98.28	1.72	11.22***	1.62*	3.24*	-0.082	-0.048
	(0.208)	(0.000)	(0.956)	(0.064)	(0.056)	(0.484)	(0.354)	(0.008)	(0.064)	(0.082)	(0.120)	(0.302)
Control mean, $t = 0$	1025.73	357.18	616.27	612.5	405.60	176.45	1.58	9.03	0.98	3.94	0.937	0.937
Time F.E.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Village F.E.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Table notes: This table reproduces the main results from the paper, but reports them period-by-period instead of pooled. p-values in parentheses are clustered using the wild cluster bootstrap-t with 1000 simulations. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$