Appendix: When Redistribution Exacerbates Poverty: Evidence from Gamal Abdel Nasser's Land Reforms

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1 Summary Statistics

Table 4: Summary Statistics
(Cluster-level Variables in *Italics*)

	Mean	Median	Std. Dev.	Min	Max
Own Age	34.321	34	8.341	15	49
Family Wealth	.003	-.044	.941	-6.405	6
Child Sex Balance	.1	0	1.86	-10	11
HH Head Age	41.206	40	9.785	16	97
Male HH Head (0/1)	.944	1	.229	0	1
Cropland	.171	.211	0	.463	
Kafr Density	1.469	0	2.549	0	27
Pastureland	.039	.04	.013	.001	.069
'Izba Density	13.319	10	13.409	0	80
Rural (0/1)	.537	1	.499	0	1
Major Road (M, Log)	10.44	10.583	1.88	0	12.876
Distance to Historic Canal (M, Log)	8.342	8.269	1.615	.646	13.056

Each observation comprises one family (n = 69,400)
69,400 families nested in 6,278 *clusters*.
6,278 clusters nested in 21 governorates.

2 Correlation Matrix

	(1)											
	Family Wealth	Izba Density	Kafr Density	Distance to Canal (M, log)	Rural (0/1)	Pastureland	Cropland	Child Sex Balance	Major Road (M, Log)	HH Head Age	Age	Male HH Head (0/1)
Family Wealth	1											
Izba Density	-0.0762	1										
Kafr Density	-0.00941	0.302	1									
Distance to Canal (M, log)	0.0698	-0.365	-0.249	1								
Rural (0/1)	-0.616	0.131	0.160	-0.147	1							
Pastureland	0.142	0.134	0.332	-0.359	-0.0787	1						
Cropland	0.244	0.356	0.377	-0.362	-0.0625	0.218	1					
Child Sex Balance	-0.0177	-0.00205	0.000558	0.00150	0.00653	0.00103	-0.00664	1				
Major Road (M, Log)	0.362	0.0454	0.0426	-0.0906	-0.392	0.307	0.190	-0.00461	1			
HH Head Age	-0.00761	-0.0304	-0.0337	0.0252	-0.0490	-0.0285	-0.0216	0.0164	0.0349	1		
Age	0.0318	-0.0219	-0.0102	0.0134	-0.0859	-0.00353	0.0262	0.0162	0.0599	0.803	1	
Male HH Head (0/1)	0.0392	-0.00303	-0.00249	0.0166	-0.000761	-0.00275	-0.00712	-0.000903	-0.00799	0.00511	-0.197	1

3 The *'Izba*

Figure 4 depicts an *'izba* belonging to the Royal Family in Gharbia, Lower Egypt circa 1930 (Lozach and Hug 1930, Plate VIII).

Figure 4: Royal *'izba* in Lower Egypt

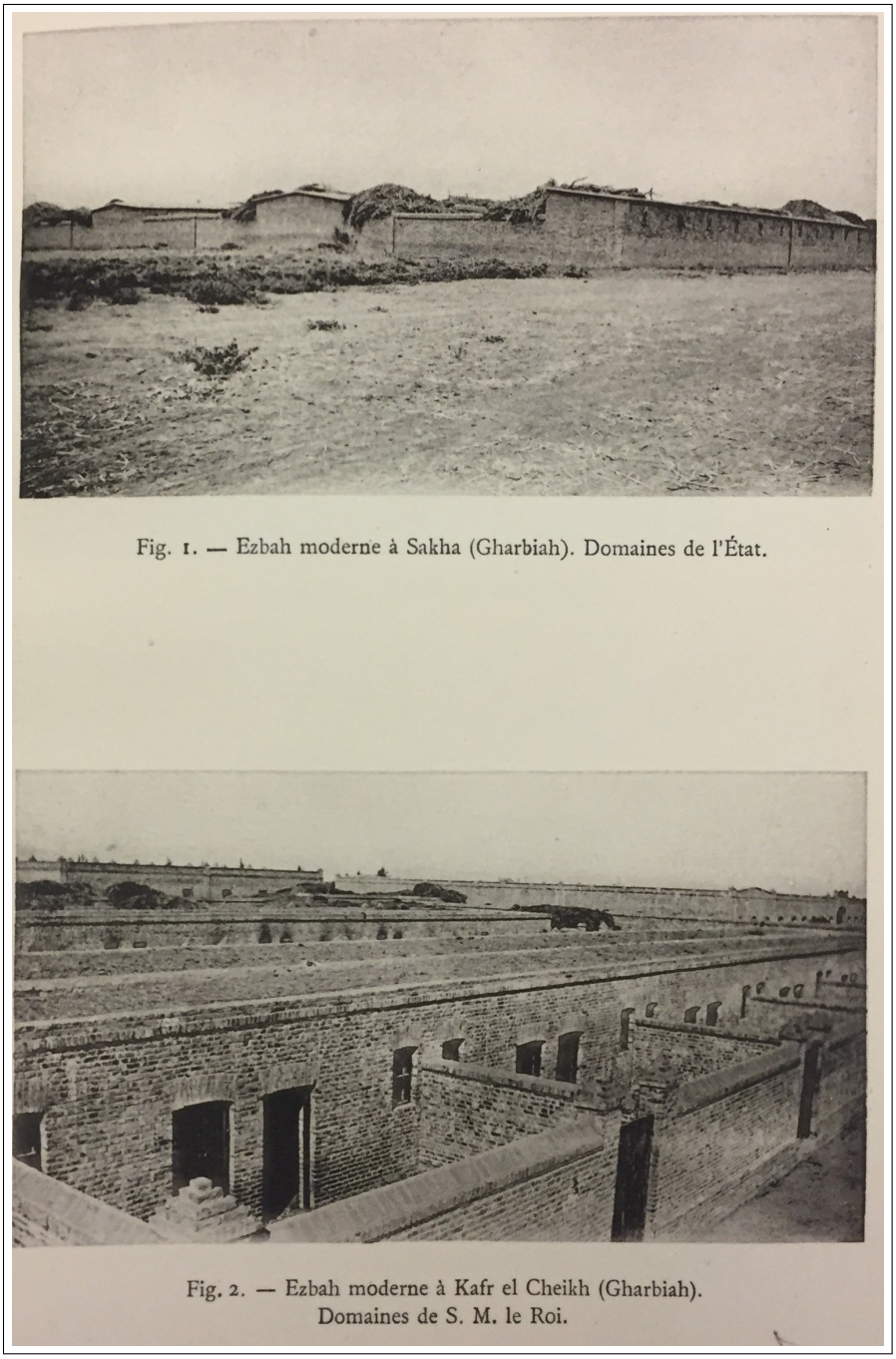


Fig. 1. — Ezbah moderne à Sakha (Gharbiah). Domaines de l'État.

Fig. 2. — Ezbah moderne à Kafr el Cheikh (Gharbiah).
Domaines de S. M. le Roi.

4 Spatial Autocorrelation

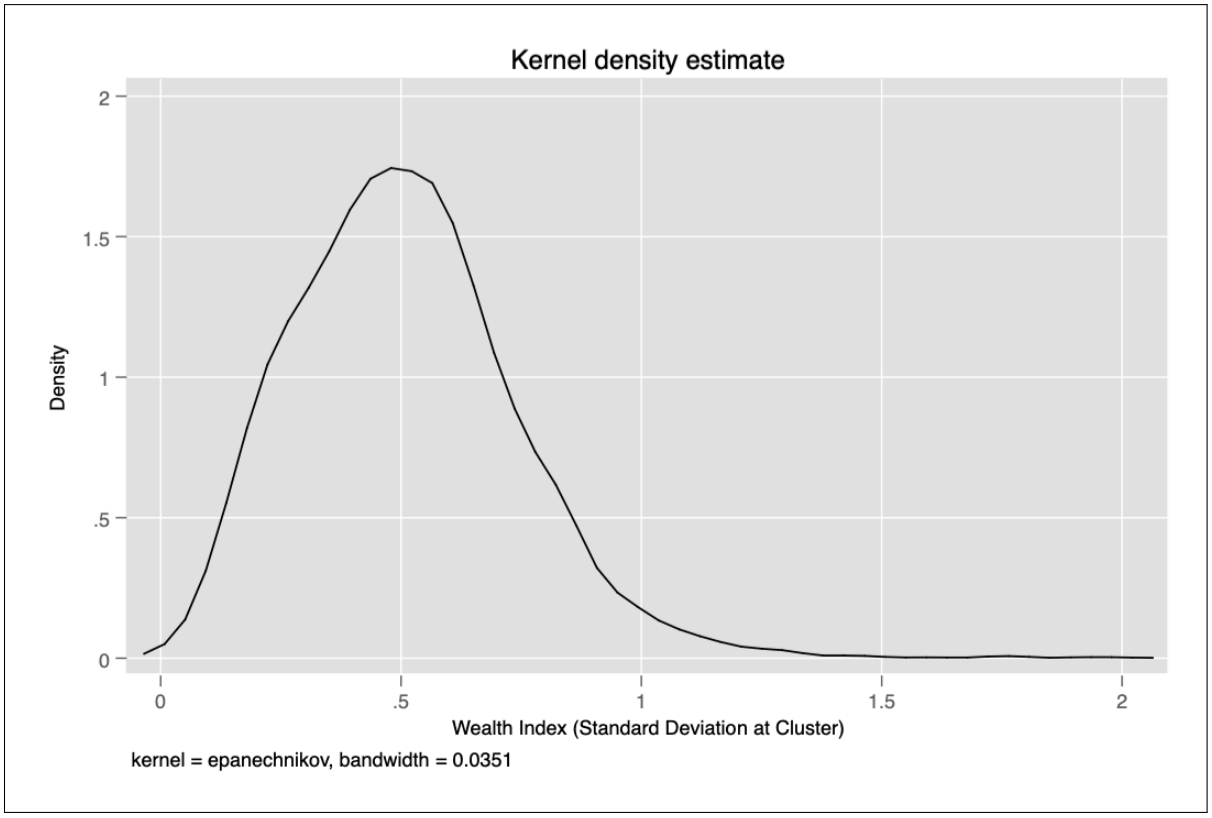
A clear concern is the possible existence of spatial autocorrelation in our data. If this were severe enough, it would trigger a Type I error. Indeed, this shortfall has been flagged as a particular problem in the type of cross-sectional historical persistence study as ours (Kelly 2019). Unfortunately, a natural check for the severity of spatial autocorrelation, Moran's I, is not possible due to the structure of our data. First, the size of our dataset— nearly 70,000 individuals— renders computing a k-nearest neighbor matrix extremely intensive computationally, to the extent that the program (`ape`) hangs. Second, even if the computational demands could be met, the nature of the DHS geolocation would render the measure effectively meaningless. Recall that small sampling areas ("clusters") are randomly selected and proximate families are randomly selected for interviews. To protect their privacy, each family is assigned the same latitude and longitude: the central point of the cluster. Effectively, then, every family is perfectly spatially correlated with every other family in the sampling cluster.

There is likely some degree of spatial autocorrelation in our data and skepticism over the results are warranted based on this alone. However, we would flag two points indicative of the likelihood that our results are more than just artifacts. First, our placebo test based on distribution of the *kafr* does not show the same correlation to wealth as the *'izba*. The *kafr* was a similarly agricultural community, but not based on the coercive, sharecropping-style of production that marked the *'izba*.[23] To the extent that our results do not explain something our theory predicts they should not, concerns that our results are spurious should be somewhat mitigated.

Second, there is considerable within-cluster variation in families' wealth and poverty. Figure 5 displays a kernel density plot of each cluster's standard deviation of family-level

[23]In effect, our *kafr* is a placebo check for our independent variable. We also substitute our dependent variable (the wealth index) for two variables we take as plausibly uncorrelated with *'izba* density: the birth month of the female respondent, and the month that marriage co-habitation began. As expected, neither show a strong correlation: $p = .907$ and $p = .503$, respectively.

Figure 5: Individual-Level Variation in Outcome



wealth indices (our dependent variable):

In fact, the interclass correlation of the null model (see below for full mixed-effects specifications) indicates that individual-level factors account for over 40% (.4098) of the variation in wealth (while cluster-level factors account for approximately 59% (.5902) percent of the variation). That we see a fair amount of within-cluster variation we would expect concerns about spatial autocorrelation to be lessened.

5 The *'Izba*-Canal Relationship

In the body of the paper we adduced historical evidence that Egypt's historic system of irrigation canals are a plausible instrumental variable for *'izba*. Our measure of canal proximity comes from georefererencing the major canals on a Nicohsoff map roughly contemporaneous to the gazetteer (1932). Figures 6 and 7 and show portions of the georeferencing and original map, respectively.

Figure 6: Historic Canal Network (Geolocated)

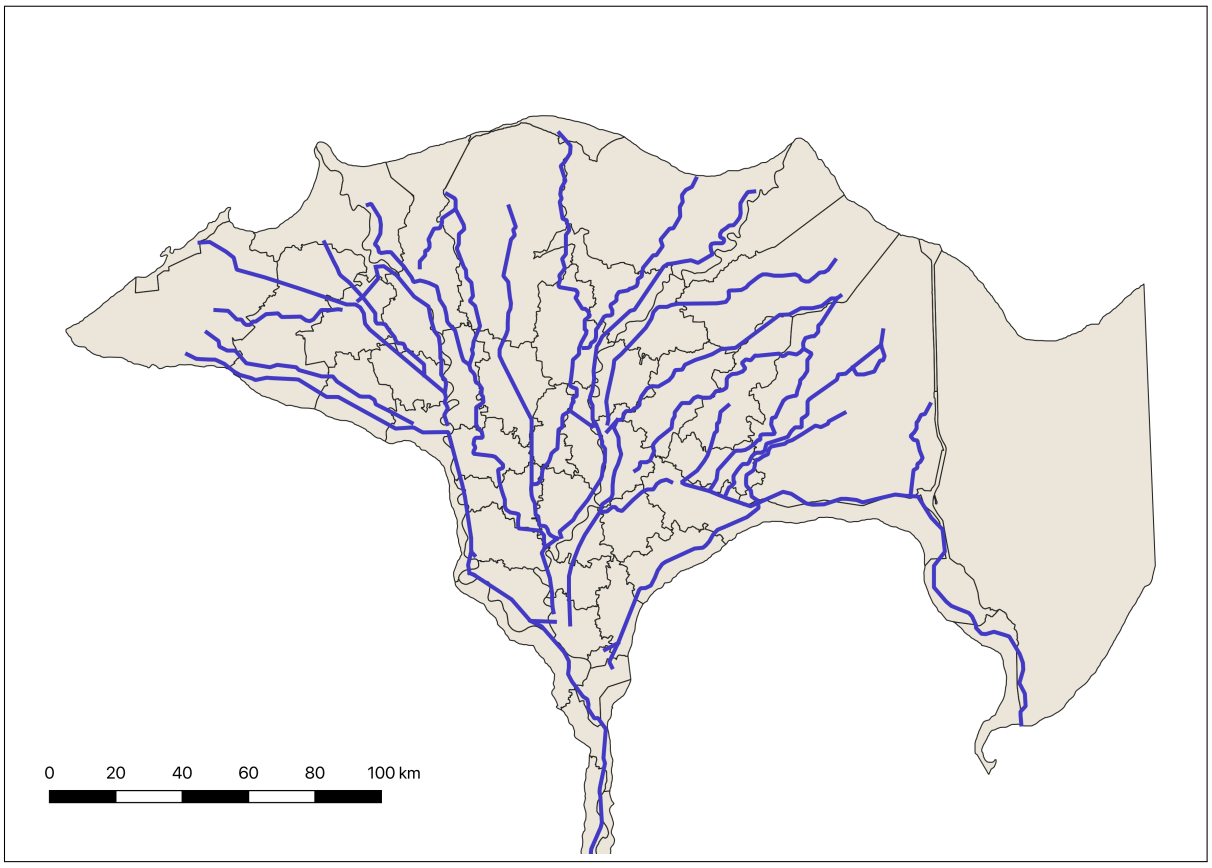
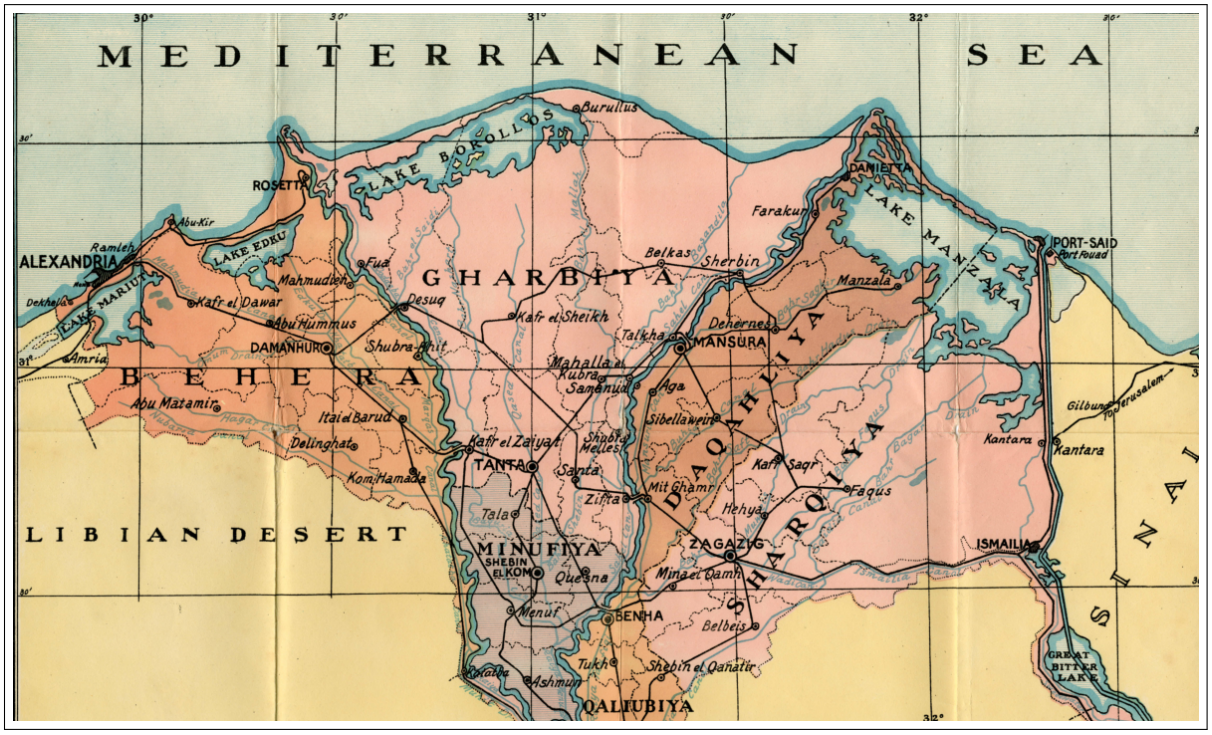
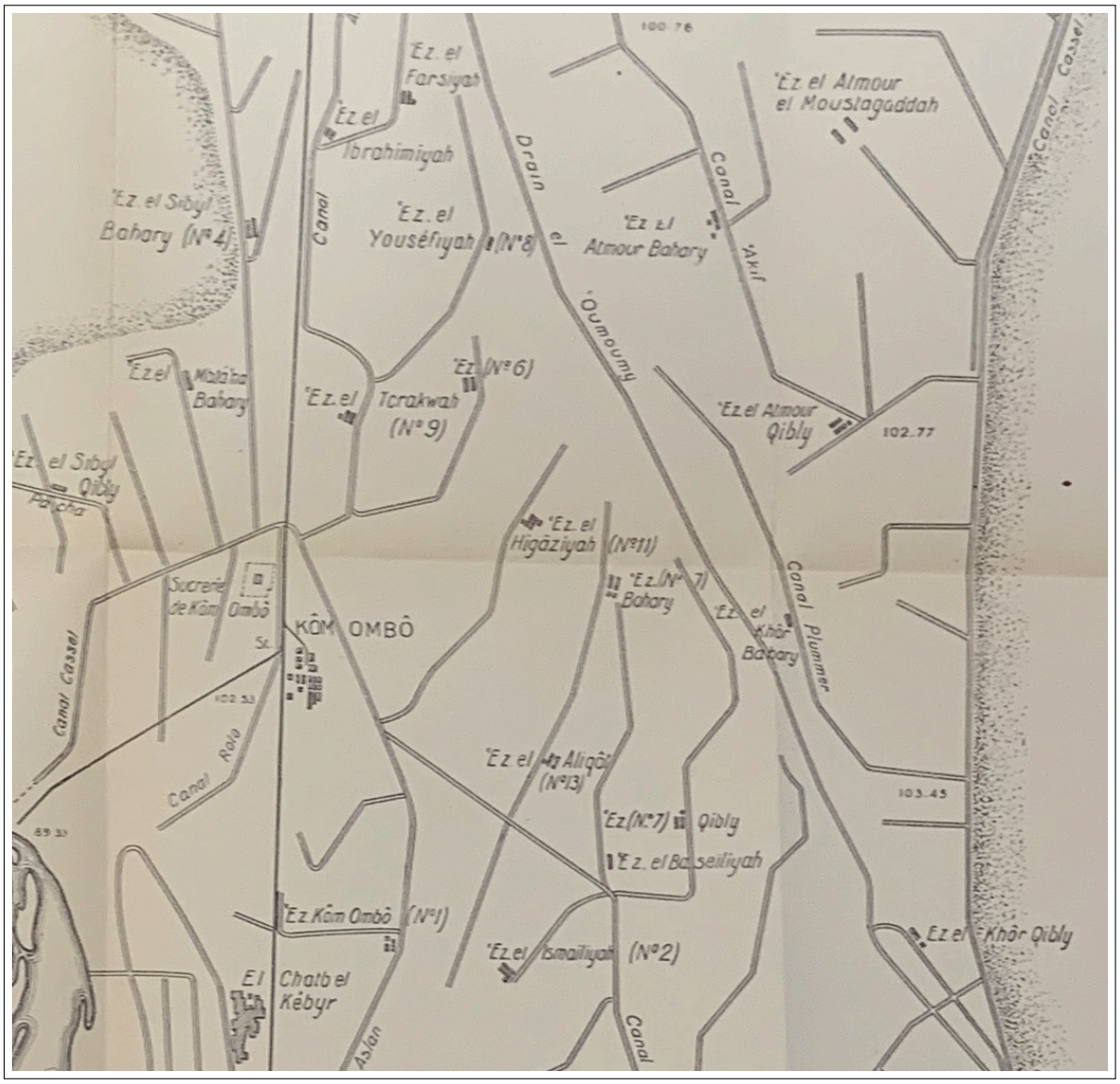


Figure 7: Historic Canal Network (Original)



As noted, our first stage results show a strong relation between proximity to historic canals and *'izba* density. Figure 8 reproduces a map from Lozach and Hug's study of the Egyptian countryside that helps illustrate the tendency of *'izba* to cluster around canals (1930, Carte hors text I).

Figure 8: Clustering of *'Izba* and Canals



IV Correlation Test

Table 1 in the main text reported a condensed series of results for a plausibility probe whether or not there may exist a backdoor path between canal proximity and wealth running through exposure to waterborne disease (as opposed to *'izba* density). Table 5 presents the full results of those regressions.

Table 5: Correlation Test, Historic Canal Proximity and Child Health Outcomes

	Model 1 *Fever*	Model 2 *Diarrhea*	Model 3 *Anemia*	Model 4 *Stunting*	Model 5 *Mortality*
Distance to Canal (M, log)	0.0000644	-0.00215	0.00176	10.62	0.000689
	(0.00210)	(0.00164)	(0.00107)	(18.97)	(0.000689)
Rural (0/1)	-0.0000112	0.00225	0.00935**	3.136	0.00923***
	(0.00572)	(0.00437)	(0.00312)	(51.86)	(0.00180)
Pastureland	-0.301	0.0196	-0.667***	7980.6**	-0.0119
	(0.289)	(0.211)	(0.166)	(3001.9)	(0.103)
Cropland	-0.00115	-0.0978	-0.0810	943.3	0.00150
	(0.0901)	(0.0571)	(0.0550)	(784.4)	(0.0272)
Child Sex Balance	0.00117	0.00115	-0.000145	-37.36***	0.000306
	(0.00103)	(0.000776)	(0.000594)	(8.066)	(0.000410)
Major Road (M, Log)	-0.00157	-0.000587	-0.00112	-48.73***	-0.0000989
	(0.00145)	(0.00112)	(0.000745)	(13.70)	(0.000483)
HH Head Age	0.0000633	-0.0000200	-0.0000844	1.604	0.000129
	(0.000367)	(0.000288)	(0.000214)	(2.838)	(0.000140)
Age	-0.00115*	-0.00264***	-0.00000478	-2.513	0.000341*
	(0.000453)	(0.000359)	(0.000266)	(3.571)	(0.000172)
Male HH Head (0/1)	-0.0163	-0.00618	0.00605	152.4	-0.00258
	(0.0141)	(0.0108)	(0.00731)	(109.8)	(0.00550)
Observations	40,818	40,818	40,818	40,818	41,397
Survey Year FE	Yes	Yes	Yes	Yes	Yes
Governorate FE	Yes	Yes	Yes	Yes	Yes
Adjusted r^2	0.047	0.025	0.074	0.055	0.014

Cluster robust standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

6 Full Main Models

Table 6 presents the full results of the main models (Table 2 in the body of the paper).

Table 6: Relationship Between *'Izba* Density and Contemporary Wealth

	Model 6	Model 7	Model 8	Model 9	
	Reduced	*Full*	*Falsification*	*1st Stage IV*	*2nd Stage IV*
	OLS	*OLS*	*OLS*	*OLS*	*2SLS*
Izba Density	-0.00342***	-0.00422***			-0.0155***
	(0.000765)	(0.000594)			(0.00325)
Kafr Density			0.000489		
			(0.00287)		
Meters to Historic Canal (Log)				-1.890313***	
				(0.1433417)	
Rural (0/1)		-0.934***	-0.938***	0.720436*	-0.922***
		(0.0175)	(0.0176)	(0.335633)	(0.0182)
Pastureland		0.733	0.623	5.523952	1.000
		(0.968)	(0.979)	(10.87172)	(0.968)
Cropland		0.794***	0.591**	35.09237***	1.335***
		(0.194)	(0.193)	(4.366018)	(0.248)
Child Sex Balance		-0.00536***	-0.00525***	-0.02177166	-0.00564***
		(0.00149)	(0.00150)	(0.190763)	(0.00150)
Major Road (M, Log)		0.0376***	0.0346***	0.6219637***	0.0454***
		(0.00419)	(0.00427)	(0.0923311)	(0.00490)
HH Head Age		-0.00562***	-0.00561***	-0.00194	-0.00566***
		(0.000515)	(0.000516)	(0.007058)	(0.000523)
Age		0.00264***	0.00266***	-0.006676	0.00258***
		(0.000623)	(0.000624)	(0.0081687)	(0.000629)
Male HH Head (0/1)		0.188***	0.188***	-0.1364311	0.186***
		(0.0126)	(0.0126)	(0.1629035)	(0.0127)
Observations	69,400	69,400	69,400	69,400	69,400
Adjusted r^2	0.275	0.467	0.465		

Cluster robust standard errors in parentheses
* p<0.05, ** p<0.01, *** p<0.001

7 Alternative Specifications, Main Models

Table 7 presents alternative specifications in order to assess possible errors in our analysis. Model 12 drops from the analysis all respondents in our survey who report having moved from their place of birth. Because our analysis assumes that patterns of wealth and poverty are tied to particular places, we take this step to account for the possibility that either poorer Egyptians disproportionately move to *'izba* areas, or wealthier residents systematically moving away from them.

Model 13 drops from the analysis all respondents living in Frontier governorates (North and South Sinai, Red Sea, Western Desert, and Matrouh). We do this because these areas have particular characteristics (such as political instability, tourist economies, military governors, etc...) that have changed since the interwar period. Because almost no *izba* existed in these areas, we may worry that they are significantly richer than the rest of Egypt and thus exacerbate the *izba* effect.

Model 14 drops from the analysis all urban areas. Despite controlling for Urban/Rural status in our model, we may worry that systematic differences between urban and rural inhabitants in our model are still influencing results.

Model 15 uses an alternative strategy to control for possible measurement error tied to the definition of *'izba*, and thus a longer explanation is in order. Beyond the coercive industrial-style farm that our analysis relies upon, *'izba* has an older meaning that captures a temporary settlement far from home where animals are kept and agriculture cultivated during harvest time (Lozach and Hug 1930, 156). Crary's study of a farming community in Upper Egypt, for instance, includes an in-depth description what appears to be this type of *'izba* (Crary 1949). Entries in the Gazetteer simply record the name of the location and do not provide any categorical variable distinguishing one type of *'izba* from the other. The obvious risk is that our measurement strategy conflates these relatively innocuous *'izba* with the institutionalized systems of coercion and violence that mark the production farm discussed by Mitchell and others.

We do not think this is likely for two reasons. First, the types of temporary dwellings studied by Crary are precisely that— temporary, only for the harvest season (1949). The gazetteer, in contrast, tracks "inhabited places," which seemingly would not apply to these seasonal dwellings. Second, a 1913 law stipulated that *'izba* status would not be granted to new properties less than 50 feddans, (21 hectares). This provides us with some reassurance that the locations enumerated in the Gazetteer, published in 1932, are not the small seasonal encampments that worry us.

However, because *'izba* properties were given the name of their owners, we can use properties that include an obvious formal title as a subset of our data. In these cases, we are extremely confident that *'izba* properties owned by individuals with a formal title (e.g. "Pasha") were *not* seasonal encampments but rather the type of estate in which we are interested. In the gazetteer, 1,500 of 7,000 entries are titled.

Finally, model 16 uses a linearly-transformed $(n + 1)$ logged count of *'izba* as the independent variable instead of the straight count.

Table 7: Additional Specifications

	Model 12 *No Movers*	Model 13 *No Frontier*	Model 14 *No Urban*	Model 15 *Titled 'Izba*†	Model 16 *Log 'Izba*††
Izba Density	-0.00215**	-0.00412***	-0.00185**	-0.0117***	-0.05437***
	(0.000771)	(0.000592)	(0.000691)	(0.00207)	(0.00749)
Rural (0/1)	-0.898***	-0.932***		-0.931***	0.928 ***
	(0.0228)	(0.0175)		(0.0175)	(0.0176)
Pastureland	-1.194	0.196	-4.003**	0.806	0.761
	(1.314)	(1.347)	(1.437)	(0.970)	(0.967)
Cropland	0.774+	0.912***	0.672*	0.661***	0.877***
	(0.406)	(0.195)	(0.330)	(0.192)	(0.197)
Child Sex Balance	-0.00408*	-0.00536***	-0.00172	-0.00532***	-0.0053
	(0.00205)	(0.00148)	(0.00182)	(0.00149)	(0.0015)
Major Road (M, Log)	0.0659***	0.0325***	0.0216***	0.0361***	0.039***
	(0.00663)	(0.00426)	(0.00388)	(0.00421)	(0.0042)
HH Head Age	-0.00353***	-0.00521***	-0.00435***	-0.00562***	-0.0056***
	(0.000771)	(0.000519)	(0.000640)	(0.000516)	(0.00515)
Age	0.000617	0.00220***	-0.00469***	0.00264***	0.00265***
	(0.000910)	(0.000632)	(0.000779)	(0.000623)	(0.000622)
Male HH Head (0/1)	0.192***	0.189***	0.118***	0.188***	0.187***
	(0.0175)	(0.0126)	(0.0165)	(0.0126)	(0.0126)
Observations	34,084	65,650	37,740	69,400	69,400
Survey Year FE	Yes	Yes	Yes	Yes	Yes
Governorate FE	Yes	Yes	Yes	Yes	Yes
r^2	0.476	0.477	0.191	0.466	0.468

Cluster robust standard errors in parentheses

+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001

†Independent variable is a count of *'izba* with titled owners.

††Independent variable is a log transformed $(n + 1)$ count of *'izba*.

8 Robustness, Multilevel Models

Table 8 reports results from a multilevel mixed-effects linear regression.[24] Random intercepts account for variability at the level of the cluster.

Table 8: Alternative Modeling Strategy

	Model 17 *Multilevel*	Model 18 *Multilevel*
Izba Density	-0.00327***	-0.00397***
	(0.000720)	(0.000557)
Rural (0/1)		-0.979***
		(0.0136)
Pastureland		0.257
		(0.655)
Cropland		1.233***
		(0.121)
Child Sex Balance		-0.00336**
		(0.00118)
Major Road (M, Log)		0.0394***
		(0.00349)
HH Head Age		-0.00491***
		(0.000401)
Age		-0.000623
		(0.000475)
Male HH Head (0/1)		0.160***
		(0.0102)
Random Effects Parameter	0.3710634***	0.1671215***
	(0.0076347)	(0.0036281)
Observations	69,400	69,400
Survey Year FE	Yes	Yes
Governorate FE	Yes	Yes
AIC	131623.0	125955.0

Standard errors in parentheses
+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001

[24]The significant ($p < .000$) random effects parameter denotes considerable cluster-by-cluster (between group) variation in family wealth, leading us to fit a multilevel model.

9 Full Models: Mechanisms

Table 3 in the body of the paper presented a reduced version of Table 9.

Table 9: Relationship Between *'Izba* Density and Landownership

	Model 19 *Agricultural Landowner*	Model 20 *Works Other's Land*
Izba Density	0.000660**	-0.00235
	(0.000208)	(0.00122)
Cropland	-0.0851	-0.0625
	(0.0673)	(0.564)
Pastureland	-1.095***	-2.017
	(0.307)	(1.424)
Rural (0/1)	0.195***	-0.0262
	(0.00468)	(0.0401)
Child Sex Balance	0.00118	-0.00161
	(0.000727)	(0.00324)
Major Road (M, Log)	-0.0111***	0.000972
	(0.00159)	(0.00502)
HH Head Age	0.00339***	-0.00572***
	(0.000255)	(0.000995)
Age	0.000391	0.00393**
	(0.000296)	(0.00134)
Male HH Head (0/1)	0.0493***	-0.0552
	(0.00553)	(0.0285)
Observations	76,925	4,259
Survey Year FE	Yes	Yes
Governorate FE	Yes	Yes
Adjusted r^2	0.138	0.058

Cluster robust standard errors in parentheses
+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001