The Effects of Health Facility Access and Quality on Family Planning Decisions in Urban Senegal - Cronin, Guilkey, Speizer

Web Appendix

A. Survey Details

Data for this study come from baseline household and facility data collected in 2011 by the Measurement, Learning & Evaluation (MLE) project for the evaluation of the Initiative Sénégalaise de Santé Urbaine (ISSU) in Senegal. Data were collected from six urban sites: Dakar, Guédiawaye, Pikine, Mbao, Mbour, and Kaolack. In each site, a multi-stage sampling design was used to select a representative sample of women ages 15-49. In the first stage, using information from the 2002 census classification of primary sampling units (PSU) or clusters (updated in 2009), 32-64 PSUs were selected with probability proportional to population size of the urban site. Prior to selection, PSUs were classified as poor or non-poor based on neighborhood characteristics; the list of characteristics was based on UN-HABITAT (2003) classifications. Half of the selected PSUs in each site were classified as poor, which permitted oversampling of poor women; weights were adjusted so that the data were representative of the sites in the descriptive analyses. In the second stage, a random sample of 21 households was selected from each PSU and all women aged 15-49 from selected households were eligible for interview. Eligible women were asked to give written consent to participate in the study. For eligible women under age 18, the household head was asked for consent to approach the teenager prior to requesting participation and consent. A total of 4950 households were surveyed from 263 primary sampling units. The final sample includes 9614 women from the six urban sites; the response rate was 88.9% (MLE, ISSU, 2012a).

Facility data were also collected from the six sites; this included high volume public and private health facilities as well as lower volume public and private health centers and pharmacies. The goal was to undertake a census of facilities that offer FP based on a master list of health facilities and pharmacies. Of a total of 269 health facilities on the master list, data were collected from 205 of the facilities. Of the 64 facilities not interviewed, 17 were on strike at the time of the survey; 3 were joined with another facility by the time of interview; and the remaining did not offer FP (11), refused (9), were closed/destroyed (18), or the person was not available (6). Of 576 pharmacies on the master list, data were collected from 518. Of the 58 pharmacies not interviewed, 7 were duplicates, 8 were refusals, 14 closed/destroyed/moved, 22 were not found, and 7 were not available at the time of interview. At each health facility, a facility audit and provider interviews (with up to 4 providers per facility depending on the size of the facility) were undertaken. At each pharmacy, a pharmacy audit was undertaken.

B. Model Specification Tests

In the paper, we briefly describe a number specification tests performed on our model. These tests are described here in greater detail.

B.1 Endogenous Health Facility Characteristics

The main goal of this research is to determine the effect that local health facility access and quality have on family planning decisions. Estimating a causal effect is complicated by the potential for program targeting. For example, health facilities in areas with low contraceptive usage rates may increase their family planning outreach, training, etc. in an effort to improve usage. Failure to account for program targeting could bias predicted effects. To test for program targeting, we perform preliminary estimations with and without district-level dummies in reduced form models of the up to God, number of ideal children, and family planning usage variables. For each dependent variable, we then calculate the joint covariance matrix (see Mroz, 1987 for details) of the two sets of estimated coefficients (with and without the district dummies) to test whether the inclusion of district-level dummies alters the effects of the independent variables.[1]

For the up to God equation, a joint (Wald) test of the null hypothesis that all coefficients are the same with and without district dummies can be rejected at a 1% level of significance. A joint test of the null hypothesis that all of the health facility coefficients are the same with and without district dummies is also rejected at a 1% level of significance. We also test these health facility coefficients individually, finding significant differences between the two models only for the coefficients on number of facilities with delivery services and any outreach programs, each at a 1% level.

We perform each of these tests for the models featuring ideal number of children as the dependent variable. None of the tests reveal a significant difference between the coefficients found in the models with and without district dummies.

We also perform these tests for the models featuring family planning usage as the dependent variable. A joint test of the null hypothesis that all coefficients are the same with and without district dummies cannot be rejected, nor can a joint test that all health facility

[1] Parameter estimates for the three models without district-level dummies can be seen in Table A below. Parameter estimates for the contraceptive use, ideal number of children, and up to God equations with district-level dummies can be seen in the left-most columns of Tables 5, 6, and 7, respectively.

coefficients are the same. We also test each health facility coefficient individually and find three significant differences between the two models. The model without district dummies yields a coefficient of 0.252 on the variable probability that a pharmacy has multiple pharmacists (see Table A below), while the model with district-level dummies yields a coefficient of 0.902 (Table 5). This difference is significant at the 5% level and is consistent with program targeting, as the model without district-level dummies under predicts the positive effect that multiple pharmacists within a pharmacy have on contraceptive use. We also find a significant difference in the coefficients on number of private facilities and any family planning protocol (at the 10% level), though the change in coefficients is not consistent with program targeting.

In total, we find some evidence of endogenous health facility variables due to strategic program targeting; therefore, our final model specification includes district-level fixed effects. We feel that this specification is preferable to treating community unobservables as purely random effects.

B.2 Identification

The family planning equation contains two endogenous right hand side variables: up to God and ideal number of children. The coefficients on these variables are technically separately identified due to their non-linearity (Mroz 1999), though valid exclusion restrictions can improve the efficiency of the estimator. Therefore, we allow home characteristics (i.e., number of bedrooms, presence of running water, indoor toilet, and employing help in the home) and number of facilities with delivery services to enter the up to God and ideal number of children equations, but not the family planning equation. Thus, the model is overidentified on the basis of exclusion restrictions.

To validate these assumptions, we perform several tests (see Angrist and Pischke, 2009 for a detailed discussion of identification in instrumental variables models). First, in order for our exclusion restrictions to be valid, they must have a significant effect in the up to God and ideal number of children equations. Joint tests of the null hypotheses that these five coefficients have no effect on the up to God equation and the ideal number of children equation are each rejected at a 1% level of significance. However, Tables 6 and 7 reveal that the coefficients on the variables employs help in the home and has running water in the home are not individually significant (at a 10% level) in either equation.

A second condition for the validity of the restrictions is that they have no direct effect on contraceptive use. There are two ways to test this assumption. First, we can use the fact that the model is technically identified without exclusion restrictions to verify that the excluded variables do not have direct effects on the family planning decision. To do so, we simply include the excluded variables in the family planning equation. We fail to reject a joint test of the null hypothesis that the five coefficients are equal to zero at a 1% level of significance. Table B (below) reveals further that none of the five exclusion restrictions has an individually significant effect on the family planning decision. In addition, note that even when we include the identifying variables in the family planning equation and rely solely on the nonlinear nature of the model to provide identification, the coefficient estimates on the up to God and ideal number of children variables are quite stable (i.e., joint and individual Wald tests reveal no significant difference between the up to God and ideal number of children coefficients in the two models at 1% level of significance). This finding is consistent with Mroz's (1999) Monte Carlo results, which found that the discrete factor model produced relatively stable results even when relying solely on nonlinearities to identify the model.

While the above test is valid, it requires that the model be identified by functional form which some may consider problematic. Therefore, we conduct a second test to provide further evidence that the five identifying variables should be excluded from the family planning equation. Specifically, we re-estimate the model five times, including one and only one of the identifying variables in the family planning equation. Because the model is over-identified, these models are still identified by exclusion restrictions alone. Each of these five models yields a zero coefficient on the lone identifying variable in the family planning equation, again suggesting that these variables are valid exclusion restrictions.

All of the above results suggest that our model is identified and our results are quite robust.

B.3 Endogeneity

The statistically significant random effects discussed in Section 5 suggest that there are unobserved factors which affect all three outcome variables. An important question for empiricists is whether or not controlling for this endogeneity actually leads to significantly different point estimates and model predictions.

We first examine whether controlling for endogenous selection into a numeric ideal number of children response has a significant effect on point estimates. Table 6 contains point estimates for the simple model and the preferred model. We find significant and important differences in several coefficients, including those on age, education, and income. Controlling for selection flips the sign on the age coefficients from negative and insignificant to positive and significant. This result is important, as the simple model suggests a potential generational shift towards smaller family sizes, while the model that controls for selection suggests just the opposite. The simple model also suggests that the role that education and high income play in reducing a woman's ideal number of children is slightly overstated when selection is not controlled for.

Next, we examine how the coefficients on the endogenous up to God and ideal number of children variables in the family planning equation are affected by controlling for unobserved heterogeneity (Table 5). In both the simple model and the model with unobserved heterogeneity, unmarried women responding "up to God" and reporting a higher ideal number of children are significantly less likely to use family planning methods than those reporting that they desire only a small number of or no children; however, the point estimates in the two models are different. For married women, these negative relationships are somewhat diminished in the simple model, while the relationships are intensified in the full model.

While comparing the point estimates across these two models gives us a general idea of the role that unobserved heterogeneity is playing, a statistical test is needed to determine whether or not the differences are statistically significant. However, because a logit-type model imposes an error variance of $\pi^2/3$ and the heterogeneity terms are subsumed into the logistic error in the simpler model, we cannot directly compare point estimates from the two estimation procedures. Thus, we use simulations to test for differences between the simple and preferred model. Specifically, we test whether or not controlling for unobserved heterogeneity in the main model cause the endogenous variables to have different marginal effects on the family planning decision.

Using the procedure described in the text, we first simulate a family planning decision in the simple model, assuming all women leave their family size “up to God”.[2] We then simulate the simple model again, assuming all women respond “zero” to the question of ideal number of children. The model predicts that shifting the population in this way increases the probability of using family planning by 8.5 percentage points (s.e. 0.00063). We then repeat this exercise using the full model, which controls for unobserved heterogeneity. The full model predicts a 12.6 percentage point (s.e. 0.0023) increase in the probability of using family planning. We use a t-test to verify that this difference is significant at a 0.001% level of significance.

We conduct a second set of simulations that are similar to the above, except the population of women is first assumed to have an ideal family size of one child and then zero children. The simple model predicts that this shift would increase the likelihood of family planning usage by 1.13 percentage points (s.e. 0.00017); the full model by 0.98 percentage point (s.e. 0.00022). We use a t-test to verify that this difference is significant at a 0.05% level of significance.

These findings provide clear evidence of the need to control for the endogenous response to the ideal number of children question.

[2] Note that the parametric bootstrap procedure that we employ in simulation requires sampling parameters from a multivariate normal distribution centered at the point estimates of the coefficients, which utilizes the estimated covariance matrix. Since the focus is on whether or not simulated effects are significantly different with and without the corrections for unobserved heterogeneity, we use the joint covariance matrix for parameters estimated with and without unobserved heterogeneity in order to explicitly control for the covariance between these two sets of results (see Mroz, 1987).

Table A: Results with No District Fixed Effects

	Up to God			Ideal Kids			Family Planning Use		
	Coef		SE	Coef		SE	Coef		SE
Individual Variables									
Constant	-1.979	***	0.257	4.719	***	0.149	-1.692	***	0.392
Ideal number of kids							-0.174	***	0.067
Number of kids is left "up to God"							-1.198	***	0.392
Ideal number of kids * married							0.121	*	0.071
Number of kids is left "up to God" * married							0.525		0.413
Age (reference: 40+)									
15-19	-0.469	***	0.121	-0.014		0.095	-2.135	***	0.211
20-24	-0.519	***	0.113	0.011		0.092	-0.712	***	0.129
25-29	-0.284	***	0.106	-0.016		0.090	-0.435	***	0.115
30-34	-0.592	***	0.106	-0.092		0.087	-0.058		0.105
35-39	-0.462	***	0.106	-0.068		0.091	0.053		0.106
Highest level of education (reference: none)									
Primary school	-0.359	***	0.067	-0.486	***	0.053	0.333	***	0.079
Middle school	-0.604	***	0.113	-0.677	***	0.067	0.590	***	0.119
High school or higher	-0.604	***	0.152	-0.767	***	0.078	0.406	***	0.143
Ethnicity (reference: other)									
Wolof	0.157	*	0.085	0.030		0.054	-0.092		0.089
Poular	0.135		0.094	-0.086		0.059	-0.068		0.100
Serer	-0.025		0.097	0.118	**	0.059	-0.144		0.101
Socioeconomic status (reference: 1st quintile)									
2nd quintile	0.124		0.089	-0.112	*	0.067	0.069		0.104
3rd quintile	0.069		0.093	-0.137	**	0.068	0.060		0.105
4th quintile	-0.072		0.105	-0.213	***	0.072	0.008		0.109
5th quintile	-0.062		0.124	-0.209	***	0.081	-0.125		0.113
Muslim	0.676	***	0.187	0.491	***	0.067	-0.348	**	0.151
Worked last week	0.010		0.061	0.036		0.043	0.238	***	0.065
Listens to radio	-0.390	***	0.061	-0.028		0.047	0.010		0.072
Reads the newspaper/magazines	-0.251	***	0.093	-0.125	***	0.047	-0.051		0.089
Has a cell phone	0.098		0.064	0.014		0.047	0.008		0.077
Has internet access	-0.692	***	0.142	-0.129	**	0.054	-0.102		0.127
Married	-0.420	*	0.244	0.296		0.201	1.641	***	0.395
Partner: other wives	0.121		0.080	-0.045		0.068	-0.179	**	0.081
Partner: age	0.132	***	0.046	0.058		0.041	-0.121	**	0.048
Partner: age is not known	0.868	***	0.212	0.193		0.183	-0.810	***	0.229
Partner: highest education (reference: none)									
Primary school	-0.310	**	0.130	-0.107		0.095	0.477	***	0.114
Middle school	-0.823	***	0.177	-0.187	**	0.094	0.152		0.133
High school or higher	-0.128		0.127	-0.153	*	0.087	0.264	**	0.116
Educated, but unsure of grade	-0.089		0.083	-0.281	***	0.072	0.241	***	0.087

Partner: works	0.191	*	0.115	-0.068		0.103	0.086		0.117
Number of beds in the home	0.016		0.012	0.041	***	0.009			
Employ help in the home	-0.027		0.089	-0.100	*	0.052			
Running water in the home	-0.113	*	0.064	0.013		0.040			
Toilet in the home	0.336	***	0.097	-0.146	**	0.060			
Health Facility and Pharmacy Variables									
Number of public facilities							-0.034		0.032
Number of private facilities							0.065		0.041
Number of high volume facilities							0.028		0.034
Number of pharmacies							-0.002		0.010
No facilities/pharmacies participate in survey							-0.296		0.238
Average number of doctors at facility							-0.006		0.073
Average number of nurses at facility							-0.005		0.025
Average number of midwives at facility							-0.017		0.051
Prob. pharmacy has mult. pharmacisits							0.252		0.281
Prob. facility has a family planning protocol							0.506	**	0.223
Prob. pharmacy requires FP training							-0.120		0.161
Prob. pharmacy allows staff to advise on FP							-0.008		0.182
Average FP methods sold at health facility							0.029		0.037
Average FP methods sold at pharmacy							0.007		0.051
Any facility has an FP social program							-0.052		0.100
Any pharmacy has a FP social program							0.264	**	0.109
Any facility has a health social worker	-0.340	***	0.068	-0.118	***	0.043	0.020		0.095
Any facility has IEC outreach program	-0.075		0.081	0.080		0.054	-0.114		0.109
Any facility hosts health talks for the comm.	0.081		0.109	0.003		0.074	-0.229	*	0.140
Prob. FP advice given during non-FP visit	0.843	***	0.148	-0.045		0.100	-0.246		0.203
Average number if IEC FP materials at facility	-0.111	***	0.032	-0.030	*	0.019	0.021		0.046
Number of health facilities with delivery services	0.034		0.022	0.027	*	0.016			
District Fixed Effects		No			No			No	
Observations		9272			7519			9272	

* statistically significant at the 10% level.
** statistically significant at the 5% level.
*** statistically significant at the 1% level.

Table B: Family Planning Use, Including Exclusion Restrictions

	Coef		SE
Individual Variables			
Constant	-13.040	***	2.032
Ideal number of kids	-0.203	**	0.090
Number of kids is left "up to God"	-1.625	***	0.583
Ideal number of kids * married	-0.132		0.120
Number of kids is left "up to God" * married	-1.650	*	0.903
Age (reference: 40+)			
15-19	-2.978	***	0.362
20-24	-1.273	***	0.258
25-29	-0.793	***	0.224
30-34	-0.147		0.214
35-39	0.103		0.213
Highest level of education (reference: none)			
Primary school	0.510	***	0.161
Middle school	1.024	***	0.235
High school or higher	0.434		0.287
Ethnicity (reference: other)			
Wolof	-0.280		0.193
Poular	-0.272		0.211
Serer	-0.361	*	0.208
Socioeconomic status (reference: 1st quintile)			
2nd quintile	0.047		0.193
3rd quintile	0.122		0.198
4th quintile	-0.049		0.220
5th quintile	-0.331		0.249
Muslim	-0.930	***	0.297
Worked last week	0.361	***	0.123
Listens to radio	0.015		0.130
Reads the newspaper/magazines	-0.227		0.177
Has a cell phone	0.126		0.139
Has internet access	-0.090		0.229
Married	4.024	***	0.838
Partner: other wives	-0.195		0.180
Partner: age	-0.160	*	0.092
Partner: age is not known	-1.094	**	0.443
Partner: highest education (reference: none)			
Primary school	1.114	***	0.366
Middle school	0.388		0.358
High school or higher	0.652	**	0.268
Educated, but unsure of grade	0.482	***	0.180
Partner: works	0.183		0.248
Number of beds in the home	-0.008		0.024
Employ help in the home	0.023		0.165
Running water in the home	-0.092		0.131
Toilet in the home	0.106		0.202
Health Facility and Pharmacy Variables			
Number of public facilities	0.001		0.094

Number of private facilities	-0.059		0.115
Number of high volume facilities	0.039		0.118
Number of pharmacies	-0.030		0.029
No facilities/pharmacies participate in survey	-0.316		0.554
Average number of doctors at facility	-0.134		0.226
Average number of nurses at facility	0.087		0.076
Average number of midwives at facility	-0.079		0.127
Prob. pharmacy has mult. pharmacisits	2.056	***	0.779
Prob. facility has a family planning protocol	0.792	*	0.465
Prob. pharmacy requires FP training	-0.536		0.464
Prob. pharmacy allows staff to advise on FP	-0.854	*	0.478
Average FP methods sold at health facility	-0.029		0.095
Average FP methods sold at pharmacy	0.190		0.133
Any facility has an FP social program	0.231		0.260
Any pharmacy has a FP social program	0.393		0.294
Any facility has a health social worker	0.161		0.267
Any facility has IEC outreach program	-0.182		0.239
Any facility hosts health talks for the comm.	-0.566		0.390
Prob. FP advice given during non-FP visit	0.385		0.530
Average number if IEC FP materials at facility	0.016		0.118
Number of health facilities with delivery services	-0.013		0.106
DFRE Variables			
Point 1 (Normalized to Zero)	0		0
Point 2	12.159	***	2.071
Point 3	12.836	***	1.996
District Fixed Effects	Yes		
Observations	9272		

* statistically significant at the 10% level.
** statistically significant at the 5% level.
*** statistically significant at the 1% level.