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What Matters (and What Does Not) in Households' Decision to Invest in Malaria Prevention?

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This paper examines the take-up of a new malaria-control device by rural households in Kenya, and tests whether the demand curve for the device varies with the framing of marketing messages and with the gender of the person targeted by the marketing.

Previous research suggests that the demand for malaria prevention is highly price-sensitive (Jessica Cohen and Dupas 2008), even though the private returns to preventing malaria are very large (Christian Lengeler 2004). In the standard model of investment in human capital, individuals invest in a health product if the expected benefits from the product outweigh its costs (Michael Grossman 1972). In this framework, the low take-up observed at relatively moderate prices by Cohen and Dupas (2008) could be due to people underestimating the expected benefits of investing in prevention; or due to people being credit-constrained and unable to pay the cost up front. It is also possible that the standard model does not apply, because people have time-inconsistent preferences or because they are uncertain about their own preferences and rely on external cues to resolve their own uncertainty when they need to make a decision.

An extensive literature in psychology and marketing suggests that decision-making can be affected by frames or cues that do not add information about a product, but can be effective at persuading individuals to invest in it. For example, in a recent field experiment in South Africa, Marianne Bertrand et al. (2008) found that the demand for credit can be manipulated to some extent through unrelated advertising content, such as pictures. What's more, social psychology suggests that asking individuals whether they plan to take an action that appears desirable (e.g., invest in a health product) can make it more likely that they go through with it. Most people answer "yes," and in so doing acquire an image of themselves ("self-perception") that can then trigger them to go through with the action (Daryl Bem 1967). Based on this theory of self-perception, marketing specialists have designed what's called the "foot-in-the-door" marketing technique. This consists in getting people to first agree to do something "easy" in relation to a product (for example, answer a few questions about what they think about it), before asking them if they want to buy it (Mark Snyder and Michael Cunningham 1975). Men and women might respond differently to these framing and marketing techniques, particularly when it comes to health products: existing research suggests that women spend a higher share of their income to improve child health, nutrition, and development (Duncan Thomas 1990), and they might be particularly responsive to marketing for preventive health products.

This paper tests the effects on the take-up of a preventative health product of two interventions based on behavioral models derived from psychology: varying the framing of the perceived benefits; and having people verbally commit to purchase the product. I find that none of these interventions had a significant effect (whether economically or statistically) on take-up, and that the gender of the household member targeted was also irrelevant. In contrast, I find that take-up is sensitive to price, as in Cohen and Dupas (2008), and is correlated with indicators of household's wealth.

I. Experimental Design

The health product studied in this paper is the long-lasting insecticide-treated bednet

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(LL-ITN). Insecticide-treated bednets (ITNs) have been shown to bring important health benefits to malaria-endemic areas: regular use of an ITN reduces overall child mortality by around 18 percent and reduces morbidity for the entire population (Lengeler 2004). However, the insecticide on regular ITNs wears off quickly, causing ITNs to lose their potency within six months unless they are retreated. In contrast, LL-ITNs maintain their health impact over four years. Since retreatment rates of ITNs appear to be extremely low, even in the presence of public retreatment programs, the World Health Organization (WHO) recommends LL-ITNs over ITNs.

The experiment was conducted in eight rural markets in a district in Western Kenya with endemic malaria. In each market area, a list of 150 to 200 households was compiled from school registers. Single-headed households were excluded. Remaining households on the list were randomly assigned to: a subsidy level; one of three "marketing" groups; one of two "commitment" groups; and one of three "targeting" groups (described below).

After the random assignment (performed in office), trained enumerators visited each sampled household to administer a baseline survey. At the end of the interview, the household was given a voucher for an LL-ITN at the randomly assigned subsidy level. The subsidy level varied from 40 percent to 100 percent; there were 22 corresponding final prices faced by households, ranging from 0 to 300 Ksh (US $4.60). Vouchers could be redeemed within three months at participating local retailers (one per area).[1] The voucher indicated (1) its expiration date, (2) where it could be redeemed, (3) the final (post-discount) price to be paid to the retailer for the net, and (4) the amount discounted from the recommended retail price.

At the time they received the voucher, households were exposed to a randomly assigned marketing message. In the "health framing" group, morbidity and mortality due to malaria were emphasized. In the "financial framing" group, households were asked to think about the financial gains they would realize (from averting medical costs and loss of daily income) if they could prevent malaria. The remaining third of households did not receive any marketing message. Also, at the time they received the voucher, half the households were asked if they intended to buy the LL-ITN and who would sleep under it after they had bought it. Overall, 92 percent of the 613 households sampled for this "verbal commitment" intervention said they would buy the product. Finally, the gender of the household head to whom the voucher was given and to whom the various marketing interventions were made was randomly chosen. The marketing was directed to the female head for a third of households, to the male head for another third, and to both of them jointly in the last third.

A. *Data*

Household-level data were collected at baseline and at follow-up. The baseline survey was administered at the enrollment (voucher distribution) visit, conducted between April and October 2007. The baseline assessed household demographics, socioeconomic status, and bednet ownership and coverage. Summary statistics from the baseline survey are presented in Table 1. Table 1 also presents, for each baseline characteristic X, the p-value of the test $\beta = 0$, where beta was estimated as follows: $X_i = \beta price_i + \varepsilon_i$, where $price_i$ is the experimental LL-ITN price household i was randomly assigned to. All the p-values are large (well above 0.10), which suggests that the randomization was effective.

The average household is quite large, with more than seven members, and relatively poor, with $400 worth of assets (including furniture). Only 4 percent of households have electricity and 17 percent have a bank account. Most households own at least one bednet at baseline, and close to a third of households received a free bednet in the past.[2] However, coverage is

[1] The eight participating retailers were provided with a stock of blue, extra-large, rectangular LL-ITNs. At the time of the study, this type of LL-ITNs was not available to households through any other distribution channel. The participating retailers were not authorized to sell the study LL-ITNs to people without a voucher.

[2] In 2002, the NGO Population Services International (PSI) started implementing a county-wide cost-sharing campaign in Kenya. Since 2004, PSI-subsidized ITNs have been sold at health facilities to pregnant women and parents of children under the age of five for Ksh50 ($0.75) and to the general population through the retail sector at prices starting at Ksh100 ($1.50). In July 2006, the government of Kenya distributed 3.6 million free LL-ITNs, mostly in Western Kenya, during the Measles Initiative, a week-long

Table 1—Baseline Characteristics of Study Sample

	Mean	Standard deviation	*p*-value (price)
Household size	7.43	2.76	0.69
Number of HH members under 18	5.68	2.89	0.43
Number of HH members under 5	0.77	0.90	0.97
Years of education of male head	8.23	4.05	0.36
Years of education of female head	5.75	3.99	0.68
HH assets index value (in US$)	397	387	0.36
Electricity at home	0.04	0.19	0.80
At least one member of the household has a bank account	0.17	0.38	0.69
HH owns at least one bednet	0.85	0.36	0.40
Number of bednets owned if HH owns at least one	2.35	1.67	0.68
Share of HH members who slept under a net the night preceding the survey	0.47	0.37	0.52
HH ever received a free bednet	0.33	0.47	0.31
Has heard of LL-ITNs	0.42	0.49	0.48
Thinks that malaria can be transmitted by something other than mosquitoes	0.24	0.43	0.82
Has ever shopped at shop where voucher has to be redeemed	0.66	0.47	0.57
Distance from shop where voucher has to be redeemed (in km)	1.86	1.57	0.73
Declared willingness to pay for a bed net (in Ksh)	111	111	0.57
Declared willingness to pay for a bed net (in US$)	1.71	1.71	0.57

Note: Data from 1,289 households enrolled in the study.

still imperfect, with only about half of household members regularly sleeping under a net, on average.

Households that redeemed their LL-ITN voucher were sampled for a follow-up survey, administered during an unannounced home visit between July and December 2007.[3] The follow-up was conducted 2 to 15 weeks after voucher redemption (1 to 5 months after the baseline survey). During the follow-up visit, the enumerator asked to be shown the study LL-ITN, ascertained that it was a study-supplied net, and recorded whether the net was observed hanging above a bed. The household was also asked if members had started using the net, and if they had, which had slept under it the night preceding the survey.

nationwide campaign to vaccinate all children age 9 to 60 months. At the time of the study there were no ongoing or planned free distribution programs in the area.

[3] Logs kept by participating retailers suggest that 95 percent of the vouchers redeemed were redeemed by a member of the household that had received the voucher. None of the individuals who redeemed a voucher declared having paid to acquire the voucher. Finally, 100 percent of the households that redeemed their vouchers and participated in the follow-up survey declared having paid the assigned price when they redeemed their voucher. In particular, none of the households assigned to a free net declared having had to pay to redeem their voucher and acquire the net.

II. Results

Table 2 summarizes the results. (Each column corresponds to a different outcome.) The first column presents nonexperimental evidence on the correlates of baseline bednet coverage in the sample. It shows that wealthier and more educated households had a significantly higher share of their members sleeping under a bednet at the onset of the study. Columns 2 and 3 show whether the household redeemed the voucher and acquired the experimental LL-ITN. Column 2 includes only experimentally controlled right-hand-side variables, while column 3 conditions on baseline characteristics. The coefficients on the experimental variables are insensitive to the addition of baseline controls. The demand for the experimental net appears price-sensitive. In contrast, the other experimental variables had small and, in most cases, insignificant effects.

An increase in price from $0 to $1 leads to a drop of 35 percentage points in take-up, and an increase from $1 to $2 leads to a further drop of 25 percentage points. Though large, these price effects do not suggest a particularly large elasticity of demand around zero price: in contrast to Michael Kremer and Edward Miguel (2007), who observed a 62 percent drop in take-up of deworming drugs when the price increased from $0 to $0.15, here such a drop in take-up requires a price increase from $0 to $2. The

TABLE 2—DETERMINANTS OF BASELINE COVERAGE AND TAKE-UP OF EXPERIMENTAL NET

	Share of HH members sleeping under net at baseline	Purchased experimental net		If purchased: experimental net seen hanging at follow-up		Used by child(ren)	Used by head(s)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Mean of dependent variable	0.465	0.360	0.360	0.577	0.577	0.349	0.409
Experimentally varied:							
Net price in US$	0.010	−0.398	−0.399	−0.129	−0.155	−0.133	−0.120
	(0.033)	(0.040)***	(0.040)***	(0.085)	(0.088)*	(0.085)	(0.088)
(Net price in US$) squared	0.001	0.048	0.049	0.022	0.028	0.017	0.022
	(0.007)	(0.009)***	(0.009)***	(0.024)	(0.025)	(0.024)	(0.025)
Voucher given to female head	0.024	−0.069	−0.056	0.085	0.088	0.044	0.008
	(0.023)	(0.028)**	(0.028)**	(0.057)	(0.060)	(0.058)	(0.059)
Voucher given to male head	−0.008	−0.075	−0.075	0.007	−0.007	0.040	−0.055
	(0.024)	(0.028)***	(0.029)***	(0.058)	(0.060)	(0.058)	(0.060)
Health framing	0.013	0.041	0.024	0.022	0.057	0.011	0.046
	(0.024)	(0.028)	(0.030)	(0.058)	(0.063)	(0.061)	(0.063)
Financial framing	0.016	0.009	0.006	−0.018	0.003	−0.025	−0.026
	(0.024)	(0.028)	(0.029)	(0.059)	(0.064)	(0.062)	(0.063)
Verbal commitment	0.020	0.019	0.017	−0.040	−0.040	−0.035	−0.042
	(0.019)	(0.023)	(0.023)	(0.048)	(0.050)	(0.048)	(0.049)
Baseline characteristics:							
Household size	−0.018		0.001		−0.001	0.016	0.003
	(0.004)***		(0.004)		(0.009)	(0.009)*	(0.009)
Years of education of male head	0.012		0.002		0.003	0.005	−0.001
	(0.003)***		(0.004)		(0.008)	(0.008)	(0.008)
Years of education of female head	0.009		0.001		−0.006	0.011	−0.011
	(0.003)***		(0.004)		(0.007)	(0.007)	(0.007)
Natural log of household assets index value in US$	0.049		0.038		0.007	−0.059	0.016
	(0.009)***		(0.012)***		(0.028)	(0.027)**	(0.028)
At least one member of HH has a bank account	0.091		0.080		0.010	0.056	0.010
	(0.027)***		(0.033)**		(0.067)	(0.065)	(0.066)
Share of HH member sleeping under a net at baseline			−0.037		−0.061	0.059	−0.060
			(0.035)		(0.073)	(0.070)	(0.072)
HH ever received a free bednet	0.154		−0.005		−0.051	−0.068	−0.035
	(0.021)***		(0.026)		(0.055)	(0.054)	(0.055)
Thinks that malaria can be transmitted by something other than mosquitoes	−0.033		0.010		−0.014	−0.025	0.040
	(0.028)		(0.034)		(0.072)	(0.070)	(0.071)
Declared willingness to pay for a bed net at baseline (US$)			0.016		0.022	0.007	0.005
			(0.007)**		(0.015)	(0.014)	(0.014)
Distance from retail shop where voucher could be redeemed	−0.003		0.011		−0.017	−0.007	−0.014
	(0.006)		(0.008)		(0.014)	(0.014)	(0.014)
Observations	1,242	1,289	1,242	433	415	415	415
R^2	0.160	0.170	0.200	0.020	0.040	0.060	0.040

Notes: OLS regressions with area fixed effects. Price varies from 0 to US$4.6. All other experimental variables are dummy variables. The omitted category is: voucher given to both heads jointly, no marketing, no verbal commitment. Some baseline characteristics are missing for some households. Columns 4 to 7: sample restricted to households that redeemed their voucher and acquired the experimental net.

***Significant at the 1 percent level.
**Significant at the 5 percent level.
*Significant at the 10 percent level.

price-elasticity observed here is also lower than that observed in Cohen and Dupas (2008), which found a drop in take-up of 60 percent when the price increases from $0 to $0.60. This is probably because households in this experiment had up to three months to redeem their voucher, and therefore time to save for it. The time taken to redeem the voucher increased with the price

of the net: from 3 days on average in the free net group to 35 days in the 70–90 Ksh price group, and to 54 days in the highest price group.

Handing out the voucher in the presence of both household's heads (the omitted category in the regressions) increases take-up by about 7 percentage points compared to targeting either of them alone. While significant, this effect is relatively small, especially in comparison with the price effect: a similar increase of 7 percentage points in take-up can be achieved with a 18 percent ($0.27) decrease in price from the current price at which nets are subsidized on the retail market by PSI (100 Ksh or $1.5).

Neither of the two framing options (health or financial) had any impact at all (the coefficients are very close to zero, and the standard errors are also small, which rules out even small effects). Coefficients on the interaction between framing and gender targeting are also indistinguishable from zero (data now shown). Likewise, the verbal commitment treatment had no impact, a result consistent with the findings of Kremer and Miguel (2007) regarding the take-up of deworming drugs. Interestingly, the education level of the household members does not predict take-up. In contrast, baseline wealth and financial access significantly predict higher take-up.

While none of the experimental targeting and marketing manipulations had meaningful *average* treatment effects, they could have had an effect on some portion of the demand curve.

To test this, Figure 1 shows the demand curve separately for each targeting group (panel A) and each marketing group (panel B). The 22 prices were grouped into 6 price groups. The evidence on each of the two panels is quite clear: the demand curve appears insensitive to any of the interventions. The demand curve is also completely unaffected by the verbal commitment intervention (figure not shown). Overall, these results suggest that the presence of liquidity constraints may be the main barrier to take-up.

The experimental targeting and marketing manipulations did not have any meaningful effect on the take-up of the experimental net, but they might have had an impact on the *usage* the household made of the experimental net, if they acquired one. Columns 4 and 5 of Table 1 present whether the experimental net could be seen hanging (above a bed) by enumerators during the unannounced follow-up visit, for the subsample of households that redeemed their voucher. For the same subsample, column 6 presents whether the household declared that at least one child slept under the experimental net the night prior to the survey, and column 7 presents whether the household reported that at least one of the household heads slept under the experimental net the previous night.

The experimental net was seen hanging in 57.7 percent of the households visited at follow-up, and the fraction is not significantly higher in any of the experimental groups.[4] Interestingly, usage is not higher among those who paid a higher price—if anything, higher prices seem associated with lower usage rates, suggesting that higher prices did not select those who needed the product more, but rather those for whom the marginal utility of cash is lower, presumably the wealthier. This result is consistent with the result observed among pregnant women in Cohen and Dupas (2008), suggesting that their result holds for the general population and over a larger price range. This result, however, is in sharp contrast with the results in Nava Ashraf, James Berry, and Jesse Shapiro (2008), who find that households that paid more for a water-treatment product are more likely to put it to use within two weeks than those who paid a lower price.

What's more, I find that the intrahousehold allocation of the net was not affected by any of the treatments. The likelihood that the experimental net is used by at least one child is higher the cheaper the net, but the same is true for the likelihood that the experimental net is used by at least one household head. Targeting female heads somewhat increases the likelihood that a child sleeps under the net, but does not decrease the likelihood that a household head sleeps under it, suggesting that women are more likely to share the net with a child than men (or more likely to report they do), though insignificantly.

[4] A higher fraction, 64.7 percent, self-reported using the net. The results are completely unchanged when I use self-reported usage (an upper bound for actual usage) instead of observed hanging of the net (a lower bound for actual usage, since some people take their net down during the day). Also note that retention was much higher than usage: 95 percent of households could show the study net during the unannounced follow-up visit. The most common reason given by households that had retained their LL-ITN but had not started using it was that they were waiting for another net to wear out (71 percent).

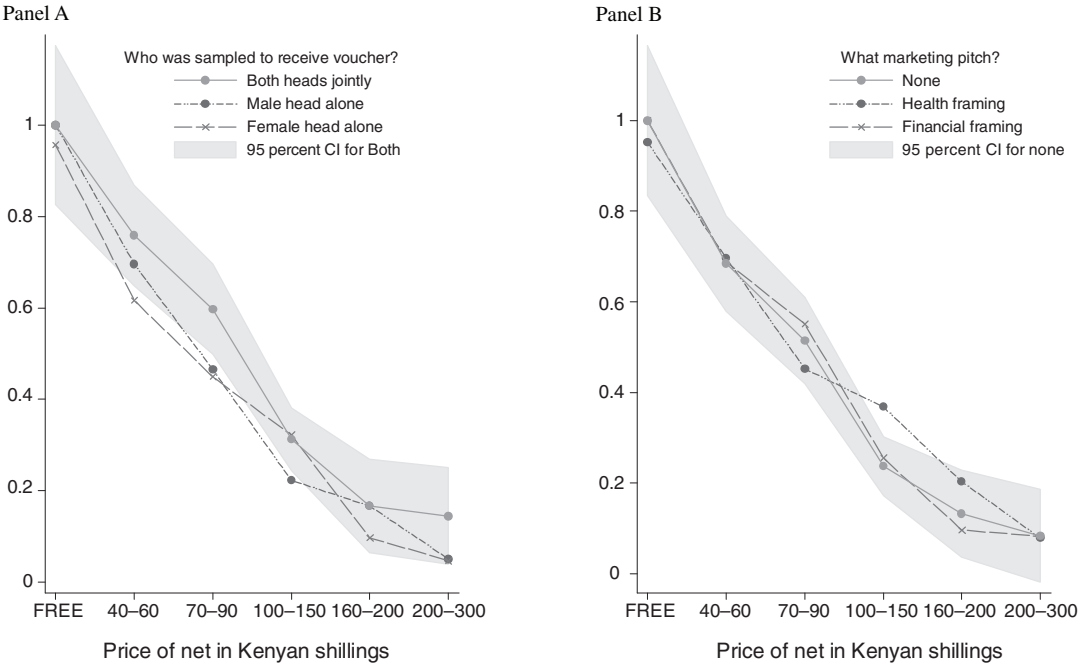

FIGURE 1. TAKE-UP OF NET, BY PRICE GROUP

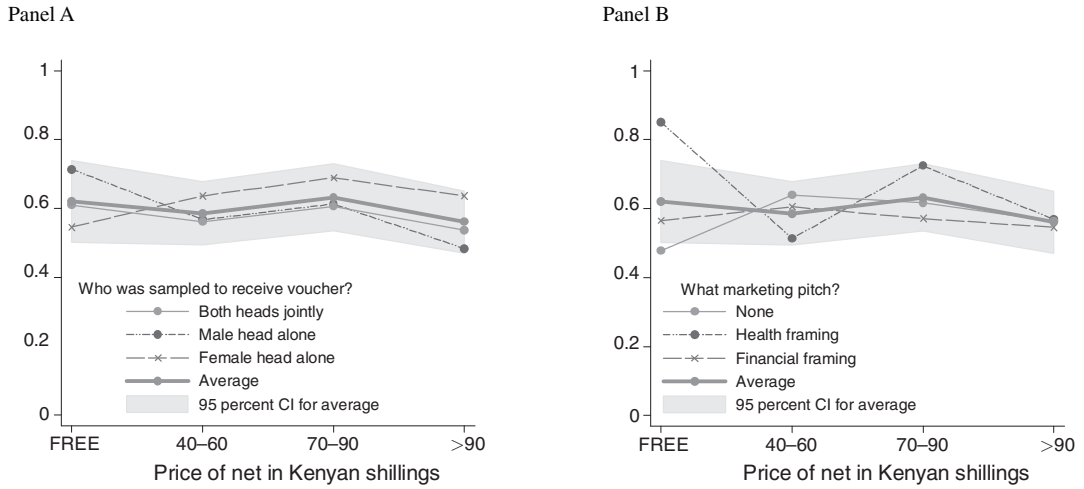

FIGURE 2. SHARE OF HOUSEHOLDS USING THE EXPERIMENTAL NET AT FOLLOW-UP

Notes: Sample restricted to households that redeemed their vouchers and acquired an experimental net. The measure of usage is a dummy equal to one if the net was observed hanging during an unannounced visit conducted 2 to 15 weeks after the voucher had been redeemed.

Figure 2 looks at how the targeting and marketing strategies interact with price to affect usage. Given the low take-up at higher prices, the last three price groups presented in Figure 1 are combined in Figure 2, to avoid having "treatment cells" with fewer than 20 observations. Except for an outlying value for recipients of free nets subject to the health framing, the two

panels in Figure 2 show flat curves, suggesting that usage (conditional on take-up) is insensitive to the experimental treatments.

III. Conclusion

Using experimental variation in prices interacted with experimental variation in framing and targeting strategies, this paper finds that the demand for malaria-preventing bed nets in Western Kenya is sensitive to price, but quite insensitive to other things tested. Women do not appear to have a different price elasticity than men, and neither women nor men respond to framing. Asking people to verbally commit to investing in the net does not affect their actual investment behavior. These results are not surprising given the (deadly) stakes involved in the decision to invest or not in malaria prevention, and suggest that liquidity constraints may be the main barrier to investments in malaria prevention, consistent with recent research in India showing that while 2 percent of households purchase an ITN in cash, 59 percent purchase at least one when ITNs are offered on credit (Alessandro Tarozzi et al. 2009).

Given the private returns to usage of LL-ITNs, it is surprising that households do not manage to overcome their liquidity constraint and invest in the product even at moderate prices. This puzzling observation has been made for other human capital investments in other contexts (reviewed in Alaka Holla and Kremer 2008), and suggests that households are highly saving-constrained or highly present-biased (or both), causing them to underinvest in health compared to what would be privately optimal. More research is needed to understand the respective role of these factors.

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