Unblurring the Market for Vision Correction: A Willingness to Pay Experiment in Rural Burkina Faso

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Abstract — We assess the willingness to pay (WTP) for eyeglasses in an adult population in rural Burkina Faso using a variant of the Becker-DeGroot-Marschak (BDM) method. We combine the BDM approach with video and deferred payment options to analyze the role of information and liquidity constraints. Furthermore, we exploit variation in reservation and transaction prices to study potential screening and sunk cost effects. Our main results show that, consistent with the over-exclusion perspective documented for essential health products, the willingness to pay for glasses is low, amounting to 20% of the current market price. However, it is high compared to the mean per capita income. Information provided through a video raises the willingness to pay for corrective glasses by 16%. In contrast, deferred payment does not affect the willingness to pay. Finally, we find no evidence of screening or sunk cost effects. Overall our results lend support to subsidization of eyeglasses in a resource poor setting.

Key words — Eyeglasses, Information Constraint, Liquidity Constraint, Willingness to Pay, Burkina Faso.

***JEL* codes** — D11, D12, D83, I15.

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1 Introduction

Following the articles by Kremer and Miguel (2007), Cohen and Dupas (2010) and Ashraf et al. (2010), there has been a mounting debate on cost sharing and over-inclusion vs. over-exclusion of the poor in new product markets. So far, the literature concentrated on preventive health products, such as insecticide-treated bed nets (ITNs), point of use water treatments and improved cook stoves (Ahuja et al., 2010, 2015; Ashraf et al., 2010; Bates et al., 2012; Beltramo et al., 2015; Cohen and Dupas, 2010; Devoto et al., 2012; Dupas, 2014; Tarozzi et al., 2014).[1] Preventive health products contributing to lower disease transmission and mortality have positive externalities which in turn provide a strong argument for subsidization particularly when product uptake has been sub-optimally low (Bates et al., 2012).

However, the case for product subsidies is not an obvious one because subsidization may have various, potentially opposing welfare effects. As already mentioned, positive externalities may provide the strongest argument for subsidization. Liquidity constraints may be another. Particularly when the lack of liquidity prevents the uptake of welfare improving products leading to over-exclusion of the poor (Tarozzi et al., 2014). A third argument in favor may be learning effects. Subsidies may reduce the cost of experimenting and thus enable households to learn (faster) about the product benefits (Bryan et al., 2014).[2] When information and consequently adoption expands the need for subsidies may reduce over time.[3] On the other hand, product subsidies are also heavily contested. At the macro level, subsidies may lead to welfare losses if the cost of financing outweigh the benefits.[4] By lowering net prices, subsidies undermine the allocative mechanism of prices. This may lead to over-inclusion and skew the pool of buyers towards individuals with a low willingness to pay and low use intensity (the so called 'screening effect'). Another argument against subsidies are sunk cost effects. Sunk cost effects are based on the idea that people appreciate a product more and consequently use it more if they paid a higher price for it (Bagwell and Riordan, 1991; Thaler, 1980). A fourth counterargument are anchoring effects (Koszegi and Rabin, 2006; Dupas, 2014). When buyers have reference-dependent preferences and anchor expected prices on the lower (subsidized) price experienced in the past they have a lower utility of purchasing the same product in the future. Hence, strong anchoring may prevent product markets from taking off.

The empirical evidence on these effects particularly for preventive health products has been accumulating rapidly. However, evidence from curative health products and

[1] More recently, it also extended to other domains, such as sustainable energy. See Meriggi et al. (2017) for an example.

[2] Learning effects could also extend to social or geographic networks and affect the adoption decision of other households (Conley and Udry, 2010).

[3] Note that, as information spreads, information and learning effects could also depress the willingness to pay if products turn out to render fewer benefits than initially expected (Fischer et al., 2014).

[4] We refrain from the macro level analysis and debate in this paper.

products outside the health domain is still scarce. For preventive health products such as ITNs, studies show that the demand, is very price elastic (Ahuja et al., 2010, 2015; Bates et al., 2012; Cohen and Dupas, 2010; Dupas, 2014). But, relaxing liquidity constraints through micro loans and time payments increases uptake (Beltramo et al., 2015; Devoto et al., 2012; Tarozzi et al., 2014). Evidence on screening effects are mixed. For ITNs Cohen and Dupas (2010) find no evidence of screening effects. Ashraf et al. (2010) on the other hand show that households with a greater willingness to pay are also more likely to use the water disinfectant studied. Concerning sunk cost and anchoring effects, the existing literature does not find any support – neither for preventive health products (Ashraf et al., 2010; Dupas, 2014), nor for products outside the health domain (Meriggi et al., 2017).

Building on this literature we study the introduction of a new, curative health product. More specifically, we study the adoption of low-cost eyeglasses (see Figure A1 in the Appendix) among an adult population in rural Burkina Faso. Thus far there is very little evidence on the WTP for eyeglasses for adults. The only other study that has looked into this is by Glewwe and Schaffer (2014) who study the productive effects of eyeglasses among basket weavers in Rwanda. In contrast to the approach we are using in this paper, Glewwe and Schaffer (2014) rely on self-reported WTP, which ranges between 1,300 and 10,000 RWF (4.9 to 37.9 international $).[5] Another aspect, which makes this an interesting product to study is the potentially high demand for eyeglasses, particularly in developing countries: The World Economic Forum (2016) estimates that currently one third of the world population – 2.5 bn people – are in need of glasses with 80% of them living in developing countries.[6] Concerning the economic implications of the potential under-supply of eyeglasses Smith et al. (2009) estimated that in 2007 uncorrected refractive error – which can be cured through eyeglasses – resulted in a global economic productivity loss of 268.8 bn international $. Even under the most conservative assumptions, this estimated productivity loss is about one thousand times greater than the number of cases they assumed which led them to conclude that there would be a net economic gain, if each affected individual would be provided with appropriate glasses for less than 1,000 international $ (Smith et al., 2009). Taking a more detailed look, Reddy et al. (2018) show in a randomized control trial in India that providing eyeglasses to tea pickers with presbyopia increases their productivity by 39%. The current under-supply and the estimated productivity gain might provide a strong case for subsidization. However, the productive effects are second order and the importance of these effects might also depend on the severity of impairment. Productivity gains from mild impairment might

[5]We use the 2013 conversion factor of 264 from the World Bank International Comparison Program database.

[6]Bourne et al. (2017) provide more moderate figures, estimating that 405.1 mio suffer from visual impairment worldwide. The leading cause is uncorrected refractive error (>50%) Flaxman et al. (2017). Despite these more moderate estimates, the authors do expect rapid growth in the prevalence of refractive error in the next years. For 2020 they predict a 20% increase (Flaxman et al., 2017).

be negligible. Therefore, these effects might only gain importance at higher degrees of impairment and thus also apply to a much smaller group.[7]

Eyeglasses do primarily have a curative purpose. Compared to preventive health products, such as ITNs and water filters, where the benefits, i.e. a reduction in malaria and diarrhea are only experienced with a delay, the benefit of the glasses in form of better vision is experienced immediately but concentrated on the user. Hence, in the absence of positive externalities or being unable to quantify them, it might still be debatable if and to what extend eyeglasses should be subsidized or how viable it is to sell this product through the market in a highly resource constrained setting.

In this paper we aim to present an integrated approach to study over-inclusion vs. over-exclusion of a new, curative health product from a micro level perspective. Our specific objective is threefold: First, to study over-exclusion we use a Becker-DeGroot-Marshak (BDM) design to illicit the willingness to pay for eyeglasses. This approach enables us to trace out the full demand schedule and compute uptake rates for a broad range of prices rather than uptake for different prices (Berry et al., 2015). Second, given that our study is conducted in rural Burkina Faso – a highly resource constrained context – we augment the BDM mechanism with video and deferred payment options in order to also assess the role of information and liquidity constraints – arguably two of the most important constraints – in this setting. Third, inspired by Ashraf et al. (2010), we use the initial willingness to pay and the actual transaction price which was randomly drawn at the village level to study screening and sunk cost effects.

This study has two contributions. It is one of the few studies that have applied the BDM method in the field in a developing country context. Other examples are studies by Berry et al. (2015) and Guiteras et al. (2016) in Ghana and Bangladesh respectively eliciting the WTP for water filters and Grimm et al. (2017) and Meriggi et al. (2017) for off-grid solar technologies in Rwanda and Cameroon. In contrast to these other studies, we combine the BDM approach with an information and a liquidity treatment to study the interaction between the willingness to pay and information and liquidity constraints in more detail.[8] Furthermore, we contribute to the debate on cost sharing for health. While the debate has thus far largely concentrated on preventive health products, we are looking at a curative product and with eye health at an issue which has been understudied.

Our empirical results are as follows: The demand curve for eyeglasses is downward sloping and only a very small group of respondents would buy the glasses at the current market price. Hence overall the WTP is low but when compared to the income of the study participants it is sizable representing 28% of the mean monthly per capita income. We find that lifting information constraints through an educational video has a positive effect and increases the willingness to pay for corrective glasses by 16%. In contrast,

[7] Aside from productivity effects, social benefits could also arise from lower risk of accidents for which the same reasoning concerning the degree of impairment applies.

[8] Grimm et al. (2017) combine the BDM approach with a credit treatment but not with an information treatment.

lifting liquidity constraints by deferring payment does not affect the willingness to pay. We do not find evidence of a sunk cost effect, i.e. the price paid does not affect the use of eyeglasses. Similarly there is also no evidence of a screening effect, i.e. respondents with a low willingness to pay do not use the product less. Finally, we also do not find evidence for anchoring even though we only have indicative evidence on this aspect.

The remainder of this paper is organized as follows: Section 2 presents a conceptual framework linking the willingness to pay to information and liquidity constraints and other correlates of interest. In Section 3 we describe the context, experimental set-up and data. Section 4 contains the empirical results. In Section 5 we discuss the factors which might explain the neglect of the deferred payment option and Section 6 concludes.

2 Conceptual framework

The conceptual framework aims to guide our empirical analysis and outlines how we think about different factors influencing the willingness to pay for eyeglasses and their subsequent use.

2.1 Factors influencing the willingness to pay for eyeglasses

2.1.1 Information constraint

It is assumed that the consumer has initial expectations about the benefits of the product. These benefits are positively correlated with the price the consumer is willing to pay. We further assume that the consumer does not have full information and thus does not know the true benefit of the product or doubts the claims of the vendor. Such a lack of information would drive a wedge between the market price and the willingness to pay. It is assumed that consumers rather underestimate than overestimate the benefits. Formally, this could be presented by a factor γ with $0 < \gamma < 1$ with which the consumer discounts the market price p^*. The willingness to pay in the presence of an information constraint p^{ic} would thus be defined as $p^{ic} = \gamma p^*$. Hence, lifting the information constraint would imply that γ approaches one, narrowing the gap between the willingness to pay and the market price.[9]

2.1.2 Liquidity constraint

A liquidity constrained consumer is unable to purchase eyeglasses if the disposable income, i.e. the income that remains after all subsistence expenses have been made, all taxes paid

[9]If the consumer overestimates the potential benefits as consequence of the information constraint γ should be bigger than one. This could be the case if, for example, the consumer expects that eyeglasses cure illnesses other than refractive error such as cataract or blindness. If this would be the case, the WTP would be above the efficient price p^* and the higher price would increase the producer surplus. In our setting it is unlikely to apply. The opticians in our experiment clearly communicated that in the case of cataract eyeglasses cannot cure the illness but only increase comfort for the user.

and all transfers received, y^d is less than the market price p^*. Thus, in the absence of credit, the disposable income marks the upper bound of the willingness to pay. Previous research has shown that lifting liquidity constraints through micro loans and time payments has a positive effect on the willingness to pay and product uptake (Beltramo et al., 2015; Devoto et al., 2012; Tarozzi et al., 2014). Hence, we expect that also for eyeglasses, lifting the liquidity constraint by offering a payment delay increases the willingness to pay for glasses.

2.1.3 Other factors

Apart from information and liquidity constraints we expect that a number of other factors also influence the willingness to pay. Closely related to the liquidity constraint, proxies for income, y, and wealth, W, should also be closely related to the stated willingness to pay, i.e. we expect income richer and wealthier consumers to exhibit a higher willingness to pay. Similarly, educated or rather literate consumers should also exhibit a higher willingness to pay. This could be driven by different underlying factors: We might expect literate consumers to have better (access to) information to begin with. Furthermore, given that they are able to read and write their expected benefits might be higher than for consumers where eyeglasses would not affect their ability to read. Related to this latter point, we would also expect that the extent of the vision problem matters for the willingness to pay. Consumers with require major correction might be willing to pay more for eyeglasses than consumers with low refractive errors and whose vision is therefore only marginally affected. Similarly, consumers who have experienced eye infections and related illnesses in the past, for which they might also have incurred health costs, H, might be willing to pay more for eyeglasses if they expect the incidence of illness and health costs incurred to reduce when wearing eyeglasses. Coming back to the initial expectations about the benefits of eyeglasses, another aspect that might influence the stated willingness to pay for eyeglasses are expectations about productivity and in consequence income gains due to eyeglasses. Eyeglasses may allow the consumer to work more hours, increase the speed of production, commit less errors and thus improve the quality of their work or product which might result in higher prices, sales and income. In consequence, a consumer who expects positive productivity effects due to the glasses may also be willing to pay more. Finally, if the consumer expects that the risk of breaking of the eyeglasses is low, they might be willing to pay more. Hence, we expect a positive relationship between the WTP and the (expected) durability of the glasses.

2.2 Factors influencing the use of eyeglasses

In the following we are briefly outlining some key factors affecting the use of eyeglasses.

2.2.1 Degree of the vision problem

First and foremost we expect that the use of eyeglasses is strongly determined by the degree of the refractive error. Consumers with higher dioptric correction are expected to wear glasses more often or permanently compared to consumers with minor corrections.

2.2.2 Screening and sunk costs

When screening effects are present, the marginal consumer is less likely to use eyeglasses than the average consumer. In consequence optimal subsidy levels would be lower. Empirically, if selection is taking place we would expect a statistically significant relationship between the willingness to pay and the use of eyeglasses.

If the consumer suffers from the sunk cost fallacy, subsidies might distort the use of eyeglasses and thus reduce their productive potential. Such a situation would lend support to lower levels of subsidization. Thus, empirically, if sunk costs are present we should see a statistically significant relationship between the transaction price and the use of eyeglasses.

3 Experimental set-up

3.1 Context

This study was conducted in the rural area of the municipality of Kaya. Kaya is the seventh largest city in Burkina Faso. The city is located 100 km northeast of the capital Ouagadougou in the Centre North region. The municipality covers seven urban sectors and 71 villages and has a total population of 117,122 (Institute national de la statistique et de la démographie, 2016). The region is dominated by subsistence agriculture. There is no major industrial activity but the city of Kaya is known for its crafts sector, particularly leather goods. Given the economic structure, the region is poor. In 2014, 47% of the population lived below the national poverty line (Institute national de la statistique et de la démographie, 2016). This is seven percentage points above the national average. The community was chosen because of its accessibility and because there is an under-supply of opticians. The municipality has currently only two opticians, both located in the city of Kaya.

So far there are no national statistics on eye health and the prevalence of vision impairment in Burkina Faso. A study assessing the degree of avoidable blindness in the population aged 50 years and older conducted in the Centre West region in 2011 is the only source providing insights into the potential prevalence of vision impairment. Among this population, the prevalence of moderate to severe visual impairment amounts to 14.5% and only every fourth patient (27%) wears corrective glasses (Ministry of Health of Burkina

Faso, 2014).[10] At the national level, the Ministry of Health of Burkina Faso recognized the need to promote eye health and included the expansion of services to address vision and refractive errors as a focus area in the strategic plan for 2016-2020 (Ministry of Health of Burkina Faso, 2016).[11]

3.2 Design and implementation

We study the willingness to pay for low cost eyeglasses produced and distributed by the NGO OneDollarGlasses (ODG). ODG is the umbrella organization registered in Germany. The local entities of ODG run under the name GoodVisionGlasses (GVG). The glasses are locally produced, meaning that GVG employees produce the frames; the lenses are imported and then fitted into the frames on site (see Figure A1 in the Appendix).

The first stage of this study was conducted in October and November 2017 in partnership with GVG. GVG provided trained opticians for eye testing and was in charge of informing the selected villages about the upcoming visit offering free vision screening and a subsequent sale.[12]

The study was conducted in 21 out of the 71 villages of the municipality of Kaya. Villages were selected based on four criteria: Accessibility by road; availability of a room to conduct the vision screening; not subject to marketing events and free distribution of glasses by GVG or other NGOs; not in close proximity to each other or villages which have been subject to marketing events and free distribution in the past. At the village level, participants for our study were not randomly selected but self-select into participating in the vision screening. Given the sample selection our study does not pretend to be representative of the overall population in the study area.[13]

With each participant we conducted a Becker-De-Groot-Marschack bidding game (Becker et al., 1964). Using the BDM method, participants make a bid for the product but can only purchase the product if the stated price is at or above a randomly drawn price. The random price is also the price to be paid in the end. We opted for the BDM approach, because unlike stated WTP approaches, it provides us with an incentive compatible measure of maximum willingness to pay, which is also a credible measure of the consumer's expected utility associated with purchasing the product.[14] If the bidder overstated his or her real reservation price, he or she would have to buy the product at a price

[10] In our study, about 30% of the people that attended the vision screening were in need of glasses. This however is a selective group and not representative.

[11] Prior to the strategic plan from 2009 to 2013 the Ministry planned to implement 15 programs. By 2016 2 were ongoing; 13 have not been realized (Ministry of Health of Burkina Faso, 2016).

[12] During the implementation of the study we only referred to the local subsidiary GoodVisionGlasses and have not used the name of the NGO OneDollarGlasses to avoid any priming on the potential price.

[13] For representative data of the region see Kouanda et al. (2013).

[14] Given the incentivized nature the approach should yield revealed preferences. However, in light of the particular nature of the experiment the bid could also be seen as a stated preference. Revealed preferences could be observed after the game in the sense that people approach the experimenters with the wish to buy the product once the collective price has been drawn. We only had two such cases occurring after the experiment.

higher than his or her actual valuation. In contrast, by understating the real reservation price, he or she might miss a purchase opportunity at a price that was less than or equal to his or her valuation. Another useful feature of the BDM approach is, that it allows for observing exact point-of-purchase prices, i.e. it allows for drawing a detailed demand curve. It yields more precise, high resolution data on the households WTP compared to a take it or leave it approach, which provides only WTP bounds. Compared to the Vickery second-price auction the BDM set-up prevents collusion between bidders because they do not bid against each other but against a random price. The BDM method, however, has been criticized for its complexity. To ensure that participants fully understand the bidding game and consequences, we conducted hypothetical practice rounds with a common product in the local context - a sack of rice.[15] Responses to the practice rounds did not point to problems in understanding the task at hand.

Furthermore, we combined the BDM approach with two treatments to which participants have been randomly assigned: An information treatment and a deferred payment treatment. The information treatment consisted of a three-minute video showing people in different situations of daily life wearing glasses. It further included accounts of five people on their experience with glasses and the impact they had on their life.[16] The deferred payment treatment consisted of an extension of the payment period to one week. More precisely the deferred payment option required an upfront payment of 25% of the price drawn at the day of the vision screening. The remainder would be collected one week later. Only once the second installment was paid respondents would receive their glasses. The idea behind the delayed payment option was to provide participants with additional time to acquire funds either through saving or from other sources such as intra-family transfers.

In each village, the experimental process was as follows: The free vision screening and sale was publicly announced in the villages two to three days prior to the event. On the day itself, all people present were tested. After the eye-test, each participant was informed of their results, i.e. if they suffered from ametropia and/or cataract and the required dioptric adjustment. In our sample, participants were prescribed two kinds of glasses depending on their vision impairment: corrective glasses or sunglasses in case the participant suffered from cataract.[17] Following the eye-test, participants which were prescribed the glasses were randomly assigned into one of four groups (Figure 1) representing the different treatments and assigned to an enumerator. Depending on the assigned group, participants were shown the video and/or informed about the deferred payment option prior to making their bid. Moreover, prior to their bid, participants were given a pair of glasses to have the physical experience, look at them in detail and try them on. Hence, participants could immediately experience the benefit of better vision. Before the bid it

[15]For more discussion on the BDM methods see Berry et al. (2015).

[16]The video is in the local language Moorè and available from the authors upon request.

[17]The sunglasses for cataract patients do not substantially improve their vision, this can only be done with an operation, but they increase comfort because they reduce glare and restrain on the eye.

was carefully explained that the bid made was non-negotiable and that bids could not be changed retrospectively. In addition the bidding mechanism was illustrated using a product familiar to the participant – a sack of rice – as mentioned above. Throughout this process, enumerators repeatedly inquired if the participant understood the mechanism. Furthermore, they were given instructions to not continue to the bid until the participant understood the mechanism. Following their bid, each participant was administered a short questionnaire to collect information on his or her socio-economic background, problems with eyesight and other health conditions, experiences with glasses and perceptions on the product, perceived benefits and disadvantages.[18] The survey was intentionally conducted after the bid was made. This was done to avoid distorting effects on the participant's behavior. We were very careful not to give the participants any hint concerning the current market price of the eyeglasses. During the bidding and the survey the participants were separated and enumerators worked in parallel to avoid communication between participants so that price statements would not be influenced by other people's statements and views. Furthermore, neither the enumerators nor participants were informed about the price range in the draw in order to avoid strategic bidding and thus bias the willingness to pay. The strike price was drawn in the presence of all participants, after all interviews were finalized. We decided to draw prices at the village level to avoid social tensions when two or more people in the same village would have had to pay different prices. If anything, the draw at the village level does add salience to the price level, which could bias the results towards sunk cost and anchoring effects.

[Figure 1 here]

The study comprised in total of 412 participants split over the four groups. The study population included all participants that attended the vision screening and were prescribed glasses. It represents 30% of the population that attended the vision screening. GVG glasses sell for 5,000 CFA F in the GVG shop in Kaya. This amount however does not reflect the full costs involved for people in our study area who want to buy the glasses. The (public) transport costs between the villages selected in this study and Kaya range between 400 and 1,000 CFA F. The prices in the draw ranged between 400 and 2,500 CFA F. The prices actually drawn lay between 400 and 1,500 CFA F. Hence, prices were heavily subsidized compared to the market price. Participants were not informed of the subsidy they received and only learned about the price they should pay for the glasses. Of the 412 participants 310 (75.2%) made a bid at or above the drawn price. All participants eligible to buy the glasses did so. Given that no participant declined to pay for the glasses

[18] All participants were asked for their informed consent to participate in the biding game and the survey. Authorization from the Ministry of Health of Burkina Faso has been obtained prior to the study implementation. The study has also received the approval of the ethics committee of the University of Passau.

after the prices were drawn we have no reason to believe that the bids did not represent their true willingness to pay.

While the initial bidding experiment comprised of participants needing corrective glasses (N=217) and those receiving sunglasses, the second stage of this study conducted in April 2018 – six months after the initial stage – concentrated only on participants receiving corrective glasses. Furthermore, since we are interested in studying screening and sunk cost effects, the sample was further reduced to only those participants which actually received the glasses, i.e. which offered a price at or higher than the randomly drawn price (N=171). The 171 participants are distributed across the 21 villages initially sampled. Out of 171 participants targeted we managed to revisit and interview 130 (76%) (see Table A1 for a detailed breakdown of the participant status in the follow-up). In the second stage, the visits to the villages and participants were unannounced. The main intention was to verify if participants were wearing their glasses usually. In addition we administered another short questionnaire and collected information on the current condition of the glasses, their use (self-reported but also reported by a family member and a neighbor), and satisfaction with the glasses. The survey further also included a question on the self-reported willingness to pay now that they have had the glasses for half a year and if they recommended the glasses to other people in their social network.

3.3 Sample characteristics and balance

Tables 1 to 3 summarize the key characteristics of our sample population included in the initial stage of the study. Our full sample is 60% male, 40% female. The average age is 57.5 years. This is quite high and suggests a particular high demand among older cohorts. Likewise, it could also reflect that younger cohorts are unable to attend the vision screenings due to other (productive) engagements. The majority of participants are married (83%) and live mostly in polygamous unions. Households are large with 12.5 members on average. The sample is 95% Mossi – the dominant ethnicity in Burkina Faso. Literacy is low. 81% never attended school and only 17% of the respondents are able to read and write. The study population is mainly engaged in subsistence agriculture: 72% are farmers, 5% are agricultural workers, 16% are inactive, only 2% are in formal employment (detailed split not shown in Table 2). The study population is poor. The average reported monthly cash income amounts to 28,000 CFA F (ca. 128 international $)[19] or 3,600 CFA F in per capita terms. Based on the reported monthly income 43% of the sample live below the 2014 poverty line.[20] Financial penetration is low. Only 25% of the sample population have a bank account. Access to formal bank credit is low.

[19] We use the 2016 PPP conversion factor for private consumption amounting to 218.37 from the World Bank International Comparison Program database.

[20] For the households in our sample for which we have information on income, poverty is lower than the regional average, which is estimated at 47% but above the national average of 40.1% (Institute national de la statistique et de la démographie, 2016).

Informal borrowing from family and friends is the rule. The study population reports productive losses associated with their vision problem. 63% state that they think that their work is negatively affected by their vision problem. In the months prior to the survey, respondents were unable to work for at least one day due to eye related problems. The reported revenue lost due to their incapacity to work is high and might be overstated as it is almost equivalent to the reported average monthly income. Awareness of defective vision is high. 87% of the study participants said that they knew they had a vision problem prior to taking the test (Table 3). In addition, other eye related illnesses are common and respondents suffered from infections (44%), trachoma and dry or watery eyes in the past.

[Tables 1-3 here]

Table 4 displays the main summary statistics of the sample and the analysis of the randomization. Column 1 displays again means of the characteristics of the full sample. Columns 2 to 7 display the p-values testing for differences in means between the treatment groups. We observe only one marginally significant difference between group 1 (the control group which did not see the video and were not offered the deferred payment option) and group 3 (the group that was offered the deferred payment option but did not see the video). While in group 1 33.6% of the participants report at least one chronic illness, in group 3, the share is 22.8% ($p<0.1$). In light of this difference only, we consider the sample to be balanced.

[Table 4 here]

Table 5 shows the summary statistics of the participants that received corrective glasses included in the follow-up. Participants in the follow-up are clearly different from the average participant of the full sample. For example, they are on average more often male and younger. Comparing the baseline characteristics of those that we could trace in the second stage of the study and those that could not be re-interviewed, the only significant differences noted are in the marital status and literacy of the participants. We formally tested for attrition within a regression framework and differences persist (see Table A2 for detailed results). The difference in literacy is a concern for our variables of interest, particularly considering the use of the glasses and we control for literacy status in all our regressions.

[Table 5 here]

3.4 Econometric specification

In the following we present the econometric models we estimate as part of our analysis. In a first step, we use the data from the first stage of the experiment to look at the treatment effects and correlates of the willingness to pay within a regression framework coherent with the conceptual framework presented in Section 2. The estimation equation is as follows:

$$WTP_{ij} = \alpha + \beta_1 V_i + \beta_2 L_i + X_{ij}^{'}\beta_3 + \epsilon_{ij} \tag{3.1}$$

The dependent variable in our first model is the stated bid of respondent i in village j. To analyze the role of our information and liquidity treatments we include two dummy variables V_i and L_i respectively. Furthermore, we include a vector of controls X_{ij}. This vector includes controls for socio-economic characteristics of the respondent: gender, age, literacy, chronic illness, occupation, household size and wealth proxied by vehicle ownership. Furthermore, we also include controls on the respondents eyesight and covariates to proxy other potential benefits. These include variables if the participant experienced eye infections previously as indicator of potential previous health costs, the expected durability of the glasses as indicator for the risk of breaking and an index on expected work related benefits. The survey included a module on expected work related benefits of eyeglasses. The respondents were asked to rate different statements related to the speed, accuracy and overall quality of work (see Table A3 in the Appendix for details). Based on the answers to these 4 questions, we ran a factor analysis to build an index on the expected productive benefits. It has to be noted that the work related questions were only asked to participants which were still active. Hence, including the benefits index in the regression reduces the sample size. We cluster standard errors at the village level.

The rest of the analysis concentrates on the sub-sample of the respondents that have received corrective glasses and combines data from both stages of the experiment. To probe the sunk cost effect, we investigate whether the paid price P_j which was randomly drawn at the village level affects the use of the glasses. The outcome of interest is U_{ij} and measures the use by the number of days the respondent has been wearing the glasses in the seven days preceding our visit.[21] Similarly, we probe the screening effect by analyzing the relation between the frequency of eyeglass use and the initial willingness to pay (WTP_{ij}). Again, standard errors are clustered a the village level. The model we estimate reads as follows:

$$U_{ij} = \alpha + \beta_1 P_j + \beta_2 WTP_{ij} + \beta_3 V_i + \beta_4 L_i + X_{ij}^{'}\beta_5 + \epsilon_{ij} \tag{3.2}$$

Since our use variable is censored we run OLS as well as tobit regressions.

[21] To test the robustness of our results we re-run the estimates with the use reported by a family member and a neighbor as alternative. Furthermore, we also estimated regressions with the indicator variable if the respondent has always been wearing glasses as outcome.

Our design does not allow us to properly identify anchoring effects since we only have self-reported information on the willingness to pay in the second stage of the experiment. Hence, we can only provide descriptive evidence on this aspect.

4 Results

This section presents the results of our BDM approach on eliciting the individual willingness to pay. It presents the demand curves and price elasticities, the effect of the information and liquidity treatments and further correlates of the willingness to pay. After discussing the findings from the first stage of the experiment we also discuss the effects of the transaction and strike prices on usage and potential anchoring.

4.1 Willingness to pay

The bids range from 100 CFA F to 5,000 CFA F. The distribution is highly skewed to the left. The median willingness to pay is 1,000 CFA F. The average willingness to pay over the full sample, irrespective of the treatment group and type of glasses is 1,136 CFA F (5.2 international $). This represents about one third (28%) of the monthly per capita income of the average household in our study population and represents a significant amount in this respect. Furthermore, it is equivalent to about 20% of the current market price of 5,000 CFA F in Burkina Faso. The bids made did not surpass the current market price. Hence, at least in the rural context this price really marks the upper limit.

If we look at the willingness to pay by the different treatment groups, we see that Group 2 (video and direct payment) made on average the highest bids with 1,270 CFA F (Figure 2). The price statements of the deferred payment groups are the lowest.[22] Even though it was offered, no participant has been taking up the option. The fact, that the deferred payment option was not taken does not rule out income constraints as factor influencing the willingness to pay. However, it suggests that it is not due to a pure liquidity constraint. We will come back to this in Section 5 when discussing reasons why the deferred payment option was not used.

Differentiating by the type of glasses, the average willingness to pay for corrective glasses is 1,263 CFA F. The price that cataract patients are willing to pay is significantly lower at 995 CFA F (p=0.0004) (Figure 3).

[Figures 2-3 here]

[22] There is no statistically significant difference between the groups (p=0.213).

4.2 Demand

Figure 4 shows the demand curve across all 21 villages using data from the 412 respondents. Figures 5 and 6 show the demand curves by type of glasses and the groups seeing the video and not seeing the video respectively. There are several features of the demand curve worth noting. First, the demand curve for eyeglasses is, as expected, downward sloping meaning that the probability of purchasing glasses is decreasing in the price. The WTP is low, relative to the market price of the glasses: The median bid corresponds to 20% of the market price. This result is consistent with the relatively low willingness to pay for water treatment and other health products found in other studies (Ahuja et al., 2015; Berry et al., 2015). Furthermore, such price elastic demand is also consistent with concerns about over-exclusion of the poor. If 90% of the respondents would have to be catered for through the 'market', the price would have to be as low as 600 CFA F (2.7 international $). Put differently, with the current market price, subsidies of 4,400 CFA F would be necessary to achieve this level of uptake. Figure 5 shows that the demand curve for corrective glasses lies above the curve for cataract patients. Cataract patience who just received sunglasses are not willing to pay as much as other respondents. To some extent this might also be correlated with age. Cataract patients are on average older (60 vs 55 years) and also more commonly economically inactive (20.5 vs. 11.5%) and might thus also have less financial resources which they control. Figure 6 shows that the video shifts the demand up, i.e. uptake is higher for any price. For example, for a price of 1,500 CFA F, the uptake among respondents not being exposed to the video is just 30%. For respondents that saw the video it is 40%.

[Figures 4-6 here]

Figure 7 displays the price elasticity of demand calculated from the willingness to pay data. The figure suggests that demand is inelastic at low prices and that demand decreases drastically once prices increase. This has also been observed by Berry et al. (2015), for example. But generally evidence from other health products is mixed: Cohen and Dupas (2010) find that demand falls sharply at any positive price; Ashraf et al. (2010) and Cohen et al. (2015) find less sensitivity at zero.

[Figure 7 here]

4.3 Treatment effects and correlates of the willingness to pay

In the following we are presenting the regression results on the video and payment treatment. Furthermore, we are also investigating which other factors influence the WTP.

These results aim to test the hypotheses outlined in the conceptual framework. Moreover, they provide information on the over-exclusion concern and can inform potential pricing policies.

Tables 6 and 7 present the regression results for the full sample and by the type of glasses, respectively.

Over the full sample (Table 6), the WTP is negatively related to age and illiteracy and chronic illness and occupation. An additional year of age reduces the WTP by 0.4%. As hypothesized in the conceptual framework literacy increases the WTP by 29 to 35%. Chronically ill show on average a 10 to 12% lower WTP. In line with expectations, the results also show that, at least in this context, households' wealth proxied by the occupation of the participant and wealth influences the willingness to pay for the product. Subsistence farmers show a 10 to 24% lower WTP than others. Having a motorcycle compared to only owning a bicycle for transport raises the WTP by just over 20%.

Looking at the covariates proxying different aspects of the potential benefits of wearing eyeglasses we see that the degree of refractive error is positively associated with the willingness to pay. However, the coefficient is not statistically significant. Participants with severe refractive error do thus not exhibit a higher willingness to pay for glasses than those with minor corrections. Previous eye infections, which might be an indicator of previous health care costs incurred however do have a positive and significant effect on the WTP. Similarly, the expected durability also shows a positive correlation, however the effect is economically small. The expected productive benefits (Column 4) do not affect the price bids.

The treatments do not have a significant influence in the overall sample. Table 7 shows the regression results separately for the two types of glasses prescribed. For corrective glasses, the video treatment has a positive and statistically significant effect on the WTP. These results suggest that the video increases the willingness to pay for corrective glasses by 11 to 16%. While the other covariates keep their sign, they loose significance, likely due to low power in the split sample. Nevertheless, wealth seems to play an important role for the willingness to pay. Wealth proxied by motorcycle ownership remains positive and statistically significant in both sub-sample analyses. For corrective glasses, the willingness to pay is further influenced by the literacy status of the respondent. For cataract patients, previous experience of eye infections seem to remain an important factor influencing the stated WTP.

The results from our treatment interventions are in contrast to the findings documented in other studies. Concerning information constraints Beltramo et al. (2015), for example, find no improvements in the WTP for fuel efficient cookstoves when providing households with simple marketing messages. In comparison to their approach, our video treatment not only comprised of a one-sentence message but also provided participants with a visual image and first hand user accounts which might render the information provided more salient. Concerning the role of liquidity constraints, the studies by Tarozzi

et al. (2014) and Beltramo et al. (2015) both show that lifting liquidity constraints through micro loans and time payments can have positive effects on WTP and adoption. We however do not find any effect of the payment delay on the WTP.

[Tables 6-7 here]

4.4 Sunk costs, screening and anchoring

Our results on the willingness to pay and the demand for eyeglasses are consistent with the over-exclusion perspective for essential health products i.e. poor people may be unable to purchase the product they value and which brings significant benefits to them. The inability to pay might be due to a liquidity or wealth constraint. Taking the results of our payment treatment at face value it would suggest that this is not the case. An alternative explanation for a low willingness to pay might be screening effects. People might bid less because they expect to use the glasses less frequently anyways. To probe whether this is the case we regress the variation in eyeglass usage on the willingness to pay as detailed in Section 3. The results are reported in Table 8. The results indicate a weak negative effect of the WTP on usage meaning that people with a higher willingness tend to use the eyeglasses less. This differs from the findings by Ashraf et al. (2010) and Meriggi et al. (2017).

The results in Table 8 also give information on potential sunk costs effects. Since our design creates exogenous variation in the prices paid orthogonal to the WTP, we can explore weather the prices paid have an effect on the use of eyeglasses holding WTP constant. This is not the case. We do not find any statistically significant effect of the price paid on use and thus also no evidence for the existence of sunk cost effects. The results also hold when we use the usage rates reported by family members and neighbors instead of the self-reported one.[23]

Since our sample on eyeglass usage comprises of only 130 observations the absence of screening and sunk cost effects might be due to small sample size.[24] Back of the envelope power calculations suggest that with a sample of 130 and standard assumptions on power and significance (0.8 respectively 0.05) the minimum detectable effect size in our case would be 0.24.

[Table 8 here]

[23]The self-reported use and use reported by a family member are very similar. Neighbours report on average a lower use and hence present a lower bound. Detailed results on these alternative outcomes are available from the authors upon request.

[24]Note that Cohen and Dupas (2010) also only have a sample of maximum 120 observations when testing for these effects in their study.

Looking at the other covariates suggest that the elder and illiterate are less likely to use their eyeglasses. Also wealthier participants are found to have used their glasses less. In line with expectations we see that participants with higher refractive error are significantly more likely to use glasses than those with minor corrections. Figure 8 shows this difference also graphically.

[Figure 8 here]

Our design does not allow us to formally test anchoring effects but we have information on the willingness to pay, although self-reported, from the follow-up survey conducted in April 2018. Six months after receiving the glasses, participants report a higher WTP for eyeglasses than they proclaimed with their initial bid. In October/November 2017 the follow-up participants stated a willingness to pay of 1,499 CFA F. This compares to an average self-reported WTP of 2,703 CFA F six months later which represents an 80% increase compared to the initial willingness to pay. The reported increase speaks against potential anchoring effects. However, given the self-reported nature of the follow-up data, this conclusion has to be taken with a pinch of salt. Nevertheless, we have reason to believe that anchoring is not a concern in our setting. 97% of the participants stated they would buy the glasses again which provides further indicative evidence that the development of the market for eyeglasses might not be suppressed. Another interpretation of the higher self-reported WTP be that the participants underestimated the benefit of eyeglasses. This suggest that letting people try the eyeglasses for a certain time, then pay or give them back could be a promising alternative marketing strategy.

5 Why did the respondents not make use of the deferred payment option?

To better understand why participants have not made use of the delayed payment option we conducted in-depths interviews with a smaller sub-sample. There are a number of aspects which could have been driving the decision to forego the deferred payment option offered. First, it could be that the transaction prices drawn did not require participants to ask for cash from other sources. A second explanation could be informal borrowing. Even if formal credit is offered, participants might prefer to borrow informally from family and friends. Given that the deferred payment option required an upfront payment of 25% of the price drawn at the village on the day, with the glasses given out a week later when the full amount was paid, a lack of trust in the provider coming back could be a third explanation. Forth, since the design of the deferred payment option required participants to wait one week until their receive the eyeglasses, the neglect of the deferred payment

option might be due to impatience, i.e. participants not willing to wait to receive the product.

Based on field observations and reports during the in-depth interviews participants indeed stated to prefer borrowing from family and friends rather than from a formal provider particularly at small amounts, such as the ones required in our setting. Furthermore, during the fieldwork, of five people that considered to delay payment a family member or neighbor immediately offered to pay for the participant once the price was drawn at the village level.[25]

Participants clearly indicated that not using the deferred payment option was is not related to a lack of trust in us as 'credit' providers. The main reason why they have preferred not to accept the deferred payment is impatience. Participants consistently stated that given the opportunity to buy glasses with the NGO actually coming to their village and after having tried the glasses and experienced the vision improvement, they preferred to own the glasses immediately rather than waiting for another week. The stated impatience is also in line with the responses to the different time preference questions. In our setting the future is heavily discounted. In the survey over 90% stated that they are generally impatient and consistently also preferred to take the money in a multiple price list (MPL) game immediately. In light of the impatience, the before mentioned trial period or handing out glasses and allowing for a payment in installments might be more fruitful options to cater for liquidity constrained households. Due to a lack of resources, such an approach however was impossible to operationalize for the NGO.

6 Conclusion

In this paper we assess the willingness to pay for eyeglasses among an adult population in rural Burkina Faso using a variant of the Becker-DeGroot-Marschak method. Our study aims to contribute to the emerging literature on over-exclusion and over-inclusion of the poor in new product markets. Given the resource constrained context, we combined the BDM approach with two treatments, an information treatment and a deferred payment treatment to probe into the role of information and liquidity constraints. The information treatment consists of a video with testimonies by other people which have obtained glasses. The liquidity treatment consists of an option to defer payment by one week. Following the initial experiment we also collected information on eyeglass usage six months later in order to investigate potential screening and sunk cost effects.

Our results show that the demand curve for eyeglasses is downward sloping and that less then one percent of the respondents in our sample would purchase the glasses when traded at the market price. The average willingness to pay for glasses is just 20% of the market price. This situation is consistent with the over-exclusion perspective documented

[25]Note, that the respondents were only with the interviewer when they made made their bids. Other villagers could only join once the price was drawn at the village level and the payments had to be made.

for essential health products and lends support for subsidization. The low willingness to pay found in our study might be due to liquidity or wealth constraints. However, our treatment – an option to defer payment – which was intended to lift this constraint was not taken up by our study population. Qualitative evidence suggests that this is driven by the impatience of the participants to own the glasses. We also investigated into the role of information as alternative explanation. Here, in contrast to other studies, do we find positive evidence. Our video treatment raises the willingness to pay for corrective glasses by 11 to 16%.

Responding to the critics of subsidization we do not find evidence of screening and sunk cost effects. People bidding a low price do not use the glasses less than those with higher bids. Likewise the price paid does not affect usage. The absence of such effects however could be due to small sample problems. Furthermore, subjects do also not show evidence of anchoring. Even though we only have self-reported information on this aspect, the indicative evidence suggests that the WTP increases rather than decreases once the respondents had some time to test and experience the benefits of the glasses. This latter point suggests that trial periods for eyeglasses could be an interesting avenue to market the product. Overall our findings strengthen rather then refute the argument for subsidization of eyeglasses in a resource poor setting as investigated here.

This work provides first insights into marketing eyeglasses in resource poor settings in order to address the potentially large under-supply in developing countries at the moment. In order to gain a more comprehensive view more research is necessary. Investigating alternative marketing concepts, such as trial periods, the productive effects of eyeglasses and potential externalities in more detail provides promising avenues for future research.

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Figure 1: Sample composition

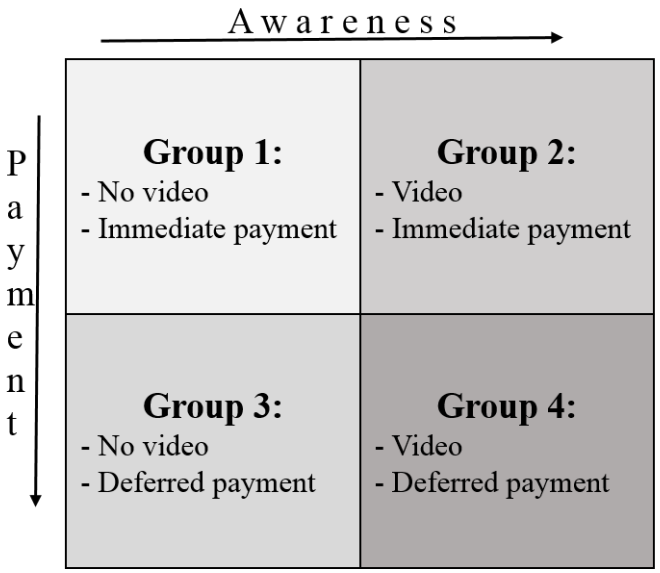


Figure 2: Willingness to pay by group

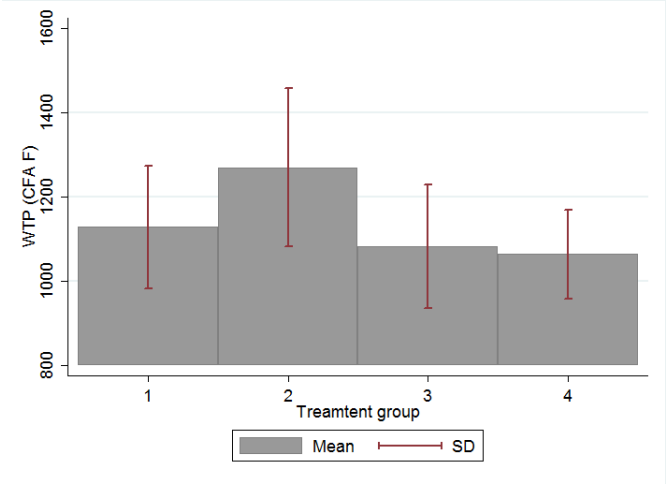


Figure 3: Willingess to pay by type of glasses prescribed

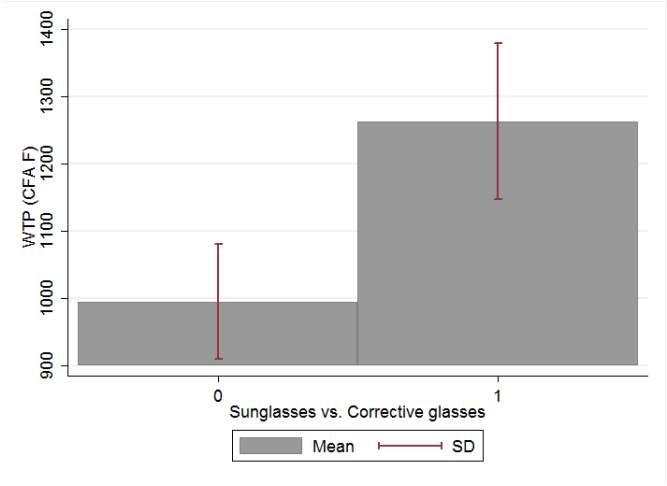


Figure 4: Demand curve

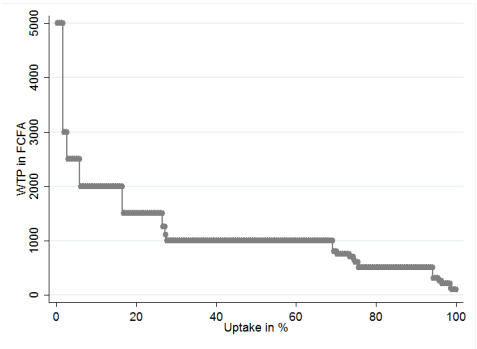


Figure 5: Demand curves by type of glasses prescribed

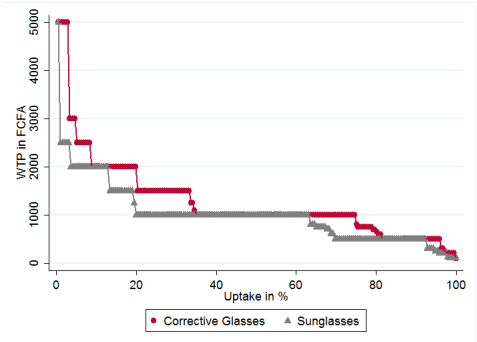


Figure 6: Demand curves of treatment groups seeing the video

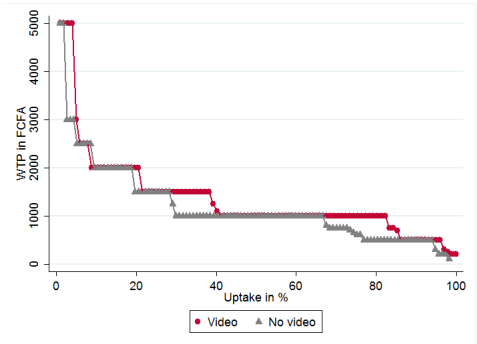
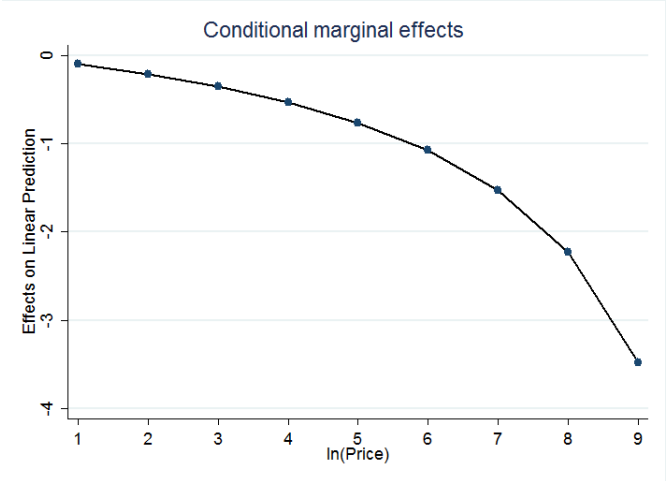


Figure 7: Price elasticity of demand



Note: Approximation based on the reported change in quantity over the change in the bids.

Figure 8: Eyeglass usage by degree of correction necessary

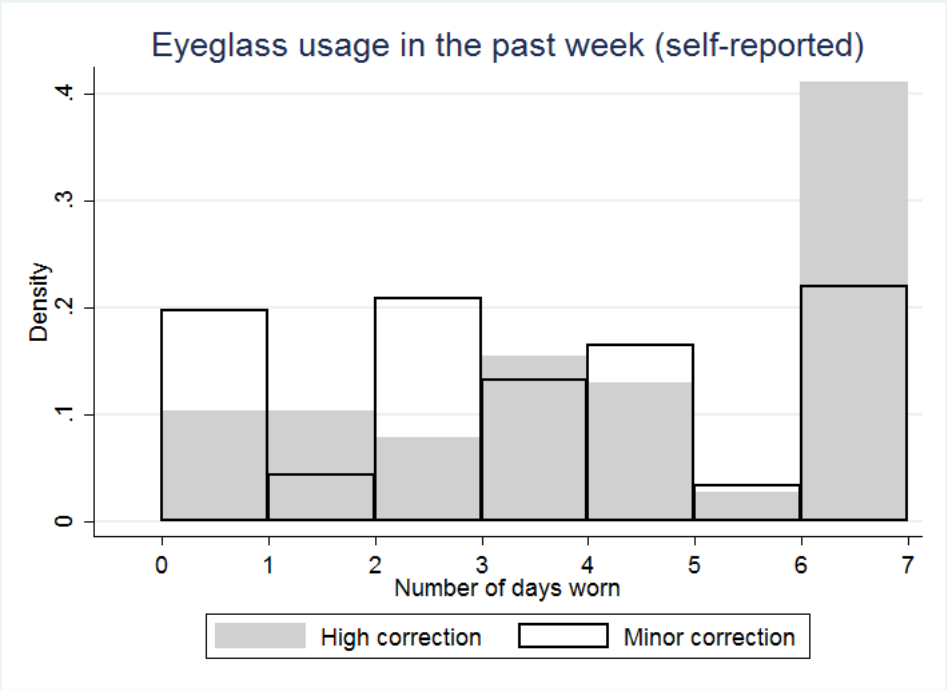


Table 1: Socio-demographic characteristics (N=412)

	Mean	S.D.
Personal characteristics		
Sex (Male=1)	0.60	
Age (yrs.)	57.51	14.96
Married monogamous (=1)	0.33	
Married polygamous (=1)	0.50	
Single/widowed (=1)	0.16	
Mossi (=1)	0.95	
Moslem (=1)	0.66	
Illiterate (=1)	0.83	
No schooling (=1)	0.81	
Household characteristics		
# of members	12.50	7.59
# of children (0-5 yrs.)	2.57	2.56
# of children (6-18 yrs.)	4.28	2.99
# of elderly (65+ yrs.)	0.86	0.83

Table 2: Socio-economic characteristics (N=412)

	Mean	S.D.
Occupation & Income		
Subsistence framer (=1)	0.72	
Inactive (=1)	0.16	
Other employment (=1)	0.12	
Breadwinner (=1)	0.35	
Monthly income (CFA F)	27,997.46	33,991.73
Per capita monthly income (CFA F)	3,642.99	9,526.70
Income insufficient to cover needs (=1)	0.84	
Has a vehicle (=1)	0.68	
Of which have a car (=1)	0.01	
Of which have a motorcycle (=1)	0.55	
Of which have a bicycle (=1)	0.71	
Access to finance and credit		
Bank account (=1)	0.25	
Difficult to obtain credit (=1)	0.56	
Person of confidence for support (=1)	0.71	
Productive implications of vision impairment		
Work negatively affected by vision problems (=1)	0.63	
Days inactive due to vision problems last months	1.35	5.24
Revenue lost due to inability to work	22,736.84	81,667.09

Table 3: Health characteristics (N=412)

	Mean
Chronic illness (=1)	0.28
Of which chronic pain (=1)	0.35
Of which hypertension (=1)	0.18
Of which other illness (=1)	0.60
Suffering from headache (=1)	
Often (=1)	0.15
Sometimes (=1)	0.41
Never (=1)	0.45
Aware of vision problem (=1)	0.87
Had eye infection (=1)	0.44
Has other eye problems (=1)	0.31
Of which bad eyesight (=1)	0.36
Of which cataract (=1)	0.05
Of which watery eyes (=1)	0.24
Of which trachoma and dry eyes (=1)	0.14

Table 4: Balance

	Mean (1)	p-value Group 1 vs. 2 (2)	p-value 1 vs. 3 (3)	p-value 1 vs. 4 (4)	p-value 2 vs. 3 (5)	p-value 2 vs. 4 (6)	p-value 3 vs. 4 (7)
Sex (Male=1)	0.60	0.440	0.530	0.328	0.887	0.840	0.731
Age (yrs.)	57.51	0.864	0.768	0.714	0.647	0.844	0.517
Married monogamous (=1)	0.33	0.753	0.657	0.846	0.457	0.618	0.808
Married polygamous (=1)	0.50	0.980	0.189	0.600	0.207	0.625	0.442
Single/widowed (=1)	0.16	0.653	0.231	0.632	0.465	0.976	0.485
Mossi (=1)	0.95	0.651	0.891	0.846	0.758	0.529	0.746
Moslem (=1)	0.66	0.775	0.893	0.945	0.882	0.729	0.843
Illiterate (=1)	0.83	0.538	0.538	0.696	1.000	0.826	0.826
Chronic illness (=1)	0.28	0.542	0.081*	0.299	0.265	0.673	0.491
Subsistence farmer (=1)	0.72	0.861	0.420	0.155	0.536	0.221	0.543
# of HH members	12.50	0.394	0.952	0.549	0.451	0.866	0.604
Has a car	0.01	0.952	0.952	0.342	1.000	0.321	0.321
Has a motorcycle	0.55	0.435	0.628	0.468	0.772	0.958	0.813
Has a bicycle	0.71	0.205	0.487	0.104	0.576	0.723	0.361
Aware of vision problem (=1)	0.87	0.403	0.853	0.701	0.318	0.235	0.845

Notes: * p<0.10, ** p<0.05, *** p<0.01.

Table 5: Characteristics of participants receiving corrective glasses and those traced back in the follow-up survey

	Corrective glasses (N=171) Mean	Follow-up (N=130) Mean	Other (N=41) Mean	p-value Follow-up vs. Other
Sex (Male=1)	0.69	0.71	0.66	0.573
Age (yrs.)	54.46	54.43	54.59	0.948
Married monogamous (=1)	0.44	0.48	0.29	0.035
Married polygame (=1)	0.47	0.44	0.56	0.185
Single/widowed (=1)	0.09	0.08	0.15	0.191
Mossi (=1)	0.97	0.97	0.98	0.828
Moslem (=1)	0.65	0.64	0.71	0.404
Illiterate (=1)	0.72	0.69	0.83	0.083
Chronic illness (=1)	0.24	0.22	0.27	0.570
Subsistence farmer (=1)	0.70	0.70	0.71	0.907
# of HH members	12.92	12.56	14.05	0.276
Has a car	0.01	0.02	0.00	0.426
Has a motorcycle	0.49	0.47	0.54	0.480
Has a bicycle	0.51	0.49	0.59	0.282
Aware of vision problem (=1)	0.89	0.89	0.90	0.844

Notes: *** p<0.01, ** p<0.05, * p<0.10.

Table 6: Correlates of the willingness to pay (full sample, OLS regression)

	(1)	(2)	(3)	(4)
Treatment				
Video (=1)	0.066	0.089	0.091	0.097
	(0.056)	(0.059)	(0.061)	(0.057)
Deferred payment (=1)	-0.069	-0.059	-0.048	-0.074
	(0.088)	(0.072)	(0.071)	(0.065)
Socio-economic characteristics				
Sex (Male=1)		0.120	0.107	0.109
		(0.074)	(0.073)	(0.080)
Age (yrs.)		-0.004*	-0.004*	-0.004*
		(0.002)	(0.002)	(0.002)
Illiterate (=1)		-0.346***	-0.344***	-0.294***
		(0.076)	(0.079)	(0.090)
Chronic illness (=1)		-0.105*	-0.120**	-0.095
		(0.052)	(0.052)	(-0.056)
Subsistence farmer (=1)		-0.098*	-0.114*	-0.236***
		(0.055)	(0.057)	(0.077)
# of HH members		-0.001	0.000	-0.002
		(0.003)	(0.003)	(0.004)
Has a car (=1)		0.307	0.241	0.156
		(0.249)	(0.266)	(0.243)
Has a motorcycle (=1)		0.232***	0.222***	0.208**
		(0.076)	(0.075)	(0.089)
Has a bicycle (=1)		Ref.	Ref.	Ref.
Eyesight characteristics and expectations				
Aware of vision problem (=1)			-0.006	-0.018
			(0.064)	(0.066)
Dioptric correction (>= +/- 2)			0.046	0.013
			(0.083)	(0.093)
Eye infection (=1)			0.110*	0.130*
			(0.059)	(0.072)
Duration (months)			0.003*	0.003*
			(0.001)	(0.001)
Expected benefits (index)				0.022
				(0.037)
Constant	6.883***	7.313***	7.205***	7.253***
	(0.092)	(0.143)	(0.166)	(0.190)
Pseudo R-squared	0.138	0.272	0.280	0.310
Observations (N)	412	412	412	341

Notes: Village fixed effects included in all specification. Standard errors in parenthesis. Standard errors are clustered at the village level. *** p<0.01, ** p<0.05, * p<0.10.

Table 7: Correlates of the willingness to pay (by type of glasses, OLS regression)

	Corrective Glasses		Sunglasses (cataract)	
	(1)	(2)	(3)	(4)
Treatment				
Video (=1)	0.112*	0.158**	0.001	-0.003
	(0.062)	(0.069)	(0.095)	(0.107)
Deferred payment (=1)	-0.001	0.000	-0.077	-0.047
	(0.092)	(0.070)	(0.138)	(0.130)
Socio-economic characteristics				
Sex (Male=1)		0.038		0.096
		(0.098)		(0.112)
Age (yrs.)		-0.002		-0.003
		(0.006)		(0.002)
Illiterate (=1)		-0.357***		-0.235
		(0.121)		(0.180)
Chronic illness (=1)		-0.089		-0.107
		(0.095)		(0.109)
Subsistence farmer (=1)		-0.166		-0.009
		(0.103)		(0.101)
# of HH members		0.002		-0.003
		(0.004)		(0.004)
Has a car (=1)		0.413		-0.274
		(0.411)		(0.190)
Has a motorcycle (=1)		0.242***		0.218*
		(0.078)		(0.119)
Has a bicycle (=1)		Ref.		Ref.
Eyesight characteristics and expectations				
Aware of vision problem (=1)		-0.036		(0.047)
		(0.076)		(0.112)
Dioptric correction (>= +/- 2)		-0.009		
		(0.086)		
Eye infection (=1)		0.127		0.147*
		(0.078)		(0.083)
Duration (months)		0.002		0.001***
		(0.002)		(0.000)
Constant	6.796***	6.915***	6.638***	6.776***
	(0.062)	(0.284)	(0.138)	(0.263)
Pseudo R-squared	217	217	195	195
Observations (N)	0.143	0.283	0.128	0.178

Notes: Village fixed effects included in all specification. Standard errors in parenthesis. Standard errors are clustered at the village level. *** p<0.01, ** p<0.05, * p<0.10.

Table 8: Eyeglass usage and prices

	OLS		Tobit	
	(1)	(2)	(3)	(4)
Ln(Random price drawn (CFA F))	-0.238	0.715	-0.626	1.116
	(1.226)	(1.095)	(2.072)	(1.733)
Ln(WTP (CFA F))	-0.463	-0.746	-0.908	-1.452*
	(0.428)	(0.461)	(0.768)	(0.793)
Video (=1)		0.510		0.816
		(0.367)		(0.623)
Deferred payment (=1)		0.098		0.146
		(0.400)		(0.663)
Sex (Male=1)		0.412		0.644
		(0.495)		(0.810)
Age (yrs.)		-0.041**		-0.064**
		(0.016)		-0.029
Illiterate (=1)		-1.057*		-1.841**
		(0.598)		(0.923)
Chronic illness (=1)		0.426		0.919
		(0.585)		(1.044)
Subsistence farmer (=1)		-0.801		-1.363
		(0.594)		(0.966)
# of HH members		0.009		0.009
		(0.036)		(0.061)
Has a car (=1)		-3.352***		-5.426**
		(0.729)		(2.316)
Has a motorcycle (=1)		-0.693		-0.949
		(0.480)		(0.751)
Has a bicycle (=1)		Ref.		Ref.
Dioptric correction (>= +/- 2)		1.320***		2.238***
		(0.417)		(0.677)
Constant	8.424	6.788	14.440	11.040
	(7.117)	(7.210)	(12.284)	(11.513)
Sigma			4.121***	3.713***
			(0.279)	(0.289)
Adjusted R-squared / Pseudo R-squared	0.005	0.004	0.086	0.046
Observations (N)	130	130	130	130

Notes: Dependent variable is the number of days glasses used in the past week (self-reported). Standard errors in parenthesis. Standard errors are clustered at the village level. *** p<0.01, ** p<0.05, * p<0.10.

Appendix Figures & Tables

Figure A1: OneDollarGlasses eyeglasses

Table A1: Breakdown of participant status in follow-up survey

Status	N	%
Participants interviewed	130	76.02
Participants not visited because villages excluded	3	1.75
Deceased	1	0.58
Moved	3	1.75
Unavailable (due to work/travel)	11	6.43
Did not buy glasses in the end/sun glasses	8	4.68
Unknown	15	8.77
Total participants	171	100

Table A2: Sample selection probit estimates: Probability that participant was included in the follow-up

	Coef.	M.E.
Sex (Male=1)	-0.069	-0.020
	(0.272)	
Age (yrs.)	-0.005	-0.001
	(0.010)	
Married monogamous (=1)	-0.715**	-0.208
	(0.336)	
Married polygamous (=1)	-0.421	-0.123
	(0.396)	
Single/widowed (=1)	Ref.	Ref.
Mossi (=1)	0.046	0.013
	(0.567)	
Moslem (=1)	0.072	0.021
	(0.284)	
Illiterate (=1)	0.499*	0.145
	(0.269)	
Chronic illness (=1)	0.089	0.026
	(0.177)	
Subsistence farmer (=1)	-0.011	-0.003
	(0.270)	
# of HH members	0.007	0.002
	(0.015)	
Has a motorcycle	0.329	0.096
	(0.212)	
Aware of vision problem (=1)	0.093	0.027
	(0.322)	
Enumerator ID code	0.048	0.014
	(0.105)	
Group 1	-0.223	-0.065
	(0.240)	
Group 2	0.173	0.050
	(0.402)	
Group 3	-0.116	-0.034
	-0.406	
Group 4	Ref.	Ref.
Constant	-0.837	
	(1.341)	
Observations (N)	171	
adj. R-sq	0.063	

Notes: Standard errors in parenthesis. Standard errors are clustered at the village level. *** p<0.01, ** p<0.05, * p<0.10.

Table A3: Descriptive statistics of variables that enter expected benefits index (N=341)

	Yes	No	Very likely	Likely	Unlikely	Very unlikely
Quality of work negative influenced by vision problem	0.63	0.37				
In general, with glasses one would...						
... increase working hours			0.69	0.13	0.03	0.15
... reduce error			0.81	0.13	0.04	0.03
... have less difficulty to concentrate			0.46	0.14	0.11	0.28