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Aligning Subjective and Objective Poverty Measurements with Norm-Nudging

Abstract

Many economists have explored subjective measures of poverty in addition to objective ones, to understand economic phenomena better. Accurate assessments of subjective poverty can help policymakers gauge people's sentiment towards incumbent governments and reveal people's perceptions of their own financial well-being. Furthermore, citizens who perceive higher or lower subjective poverty compared to their objective financial status may adopt suboptimal financial habits, which is bad for their personal finances as well as the economy.

Unfortunately, empirical evidence suggests that subjective and objective poverty measures are rarely aligned, which is indicative of a policy failure. Since the misalignment of subjective poverty estimates is primarily a behavioral issue, this intervention applies behaviorally-inspired norm-nudging techniques to guide people to adopt a more accurate perception of their subjective poverty status, which is closely aligned to their objective poverty status. Participants will be nudged with monthly SMS updates, and the SMS content would be based on the literature on changing empirical and normative expectations to affect behavior. The study will also conduct monthly measurements of their subjective and objective poverty metrics like income and consumption. After the experiment concludes after three years, the Pearson correlation between subjective and objective poverty estimates will determine the effectiveness of the intervention. A correlation closer to 1 would imply a strong relationship between both poverty measures, which is desirable for both policymakers and citizens.

Motivation

Most economists agree that poverty needs to be reduced to achieve a better and more sustainable future for all. The United Nations has defined poverty reduction as its topmost Sustainable Development Goal (Desa, 2016). However, views on how to define poverty are far less unanimous. For many years, poverty was defined by the income level of households, and where it lay compared to a specific poverty threshold called the poverty line (Rowntree, 1901). However, economists realized that income was too crude a measure and that other objective factors must be considered, like how efficiently income is spent and in what form (i.e., cash or kind) is income received (Citro et al., 1995), all of which come under the consumption perspective.

Lately, contemporary economists have highlighted the importance of subjective measures of poverty in addition to objective measures, to understand economic phenomena better. A quote by Dr. Amartya Sen succinctly describes this perspective of understanding poverty based on one's capability:

In his book, Sen (1982) elaborated this perspective by providing an example of starvation — while the unavailability of food may be one reason for an individual to starve, an individual may also choose to starve or lack the capability to eat, even if food is accessible to them. Hence, the focus is more on a person's individual characteristics, rather than the availability of an economic commodity.

The subjective approach of measuring poverty starts by asking households how they evaluate their own situation in terms of verbal labels 'bad', 'sufficient,' 'good,' as described in the book by Van

and Ferrer-i-Carbonell (2008). The book further explains that by assigning these labels with numeric values and comparing them to household income, one can equate household income with subjective poverty and ultimately determine a subjective poverty line.

Unfortunately, according to Alem et al. (2014), objective and subjective poverty evaluations rarely coincide, and this gap is a policy challenge because policymakers generally wish to maximize not only citizens' material consumption but also their well-being in a broader sense. If poorer members of the population do not perceive themselves as better off now than they did ten years ago, despite higher material living standards, this represents a policy failure (Alem et al., 2014). Also, economists rely on accurate poverty measures to design public policies, and many of these policies are behaviorally-inspired (OECD, 2019). However, if there is a gap between subjective and objective poverty metrics, then economists do not have reliable data to design effective, evidence-based policies for the well-being of people. Furthermore, if people feel optimistic about their financial capabilities, then they might irresponsibly consume more than what their financial status allows. On the other hand, if they perceive themselves as less financially capable than they actually are, they may not engage in healthy economic activities (that could have been beneficial for them and the economy) because of behavioral biases like present bias, risk aversion, and attention deficiency (Bryan et al., 2017). Hence, this highlights the importance of identifying the factors that determine citizens' own view of their poverty status and finding ways to align subjective and objective poverty measurements.

Understanding the factors that shape subjective poverty can give policymakers useful information about a country's wellfare. For example, Papuchon and Duvoux (2019) revealed that subjective poverty measures were better than objective measures at predicting the widespread social

insecurity that manifested itself within the working class of France during the 'Yellow Vests' movement. Another study by Buttler (2013) highlighted that the prevailing practice by policymakers to use 60% of the medium income of the aggregated EU population as the "minimum acceptable standard of living in the EU" (European Commission, 2004) was suboptimal, rather, policymakers ought to have used subjective measures of poverty, specific to regions in the EU, as a more accurate proxy of the well-being of their citizens. Finally, an empirical analysis by Kuhn (2019) revealed that a high perceived level of inequality had the potential to undermine market outcomes, and individuals who perceived high inequality were less likely to believe that meritocratic principles drove wage differentials.

Several behavioral factors can shape people's subjective perception of their poverty status. For example, Castilla (2010) studied the effect of three behavioral factors on subjective poverty — income level of an individual's reference group, income level aspired by an individual at the current stage of their life, and the income they had three years ago. Similarly, Norton and Ariely (2011) showed that people are often optimistic about opportunities of social mobility, underestimate wealth inequality in the USA, and may hold a normative standard of equitable wealth distribution across economic groups.

Most studies have explored the factors that influence people's subjective perception of their poverty status and empirically demonstrated the existence of a gap between subjective and objective poverty. However, none of them go a step further to understand how people can be nudged to align subjective and objective poverty measurements to maximize the effectiveness of poverty-reducing policies. This policy intervention is designed to leverage a factor described in Castilla (2010) that is known to influence subjective poverty — an individual's reference group — and aimed at aligning

subjective and objective poverty measures using behaviorally-inspired norm-nudging techniques. Norm-nudging can be effective because subjective poverty is primarily a behavioral issue.

This intervention will use the short-message service (SMS) to administer norm-nudges to the treatment groups. The advantages of SMS-based policy interventions to facilitate behavior change have been summarized by Fjeldsoe et al. (2009), which include their wide population reach, possibility to customize messages for individuals and groups, and instant delivery without an internet connection. Finally, SMS-based interventions are among the cheapest ways to reach massive audiences. Also, this medium is trusted by most people (Susanto and Goodwin, 2010), and is a popular method of communication for governments around the world.

The intervention will be aimed at citizens living under the poverty line in India. The poverty threshold will be based on the definition specified by India's 61st National Sample Survey that includes all citizens with monthly per capita consumption expenditure below INR 356.35 (USD 4.7) for rural areas. Furthermore, the target location will be the states of Madhya Pradesh and Karnataka because they had a high Gross State Domestic Product growth rate in the years 2012 to 2018 (Ministry of Statistics and Programme Implementation, 2019). States with high economic growth will have actively changing objective poverty metrics, allowing us to monitor if subjective metrics follow the same trend. The intervention will be done in collaboration with the State Government of Madhya Pradesh and the Government of Karnataka because both institutions have an interest in measuring and improving the state of poverty in India. Finally, the cost of sending SMS text messages in India is among the lowest in the world, which reinforces the decision to use that as the nudge medium.

Background

Scientists have conducted numerous lab and field studies to throw light on how certain factors influence subjective poverty perceptions. For example, scientists have shown that people care about their relative position, in income and other domains, and not only with respect to others but relative to their own previous experiences and expectations (Carlsson et al. 2007; Falk and Knell 2004; Johansson-Stenman and Martinsson 2006; Solnick and Hemenway 2005). An investigation in India by Carlsson et al. (2009) on the importance of relative income within and between castes in the Indian caste system, using a choice experimental approach, revealed that that slightly more than half of the marginal utility of income comes from some kind of relative income effects, on average. Moreover, they showed that the negative welfare effect of having a reduced relative income compared to the own caste-average income dominates the positive welfare effect due to the increased relative income of the own caste compared to the income of other castes. Therefore, based on these findings, this intervention will use caste as the reference group in our field experiment.

Additionally, Stutzer (2004) empirically showed that higher income aspirations (which increase with time) reduce people's satisfaction with life. Also, the negative effect on well-being of an increase in the aspiration level is of a similar absolute magnitude to the positive effect on well-being of an equal increase in income suggesting that subjective well-being depends only on the gap between income aspirations and actual income and not on the absolute income level as such. This phenomenon will be observed and measured in the three-year longitudinal experiment described in the Design section.

Scientific literature can also give us insights on how subjective poverty deviates from its objective counterpart under different circumstances. For example, econometric analyses by Alam et

al. (2014), revealed that households that were poor in the past continued to perceive themselves as poor, even after their material wealth increased. On the other hand, the analyses showed that engaging in an income-generating job resulted in the reduction of the household's subjective poverty, even if they are objectively financially-challenged. Another finding by them was that families with more children perceived themselves as less poor, which is counterintuitive because raising more children requires more financial resources.

Psychological factors may also affect how citizens perceive the efficacy of existing political systems. For example, Kuhn (2019) revealed that a high perceived level of inequality had the potential to undermine market outcomes, and individuals who perceived high inequality were less likely to believe that meritocratic principles drove wage differentials. Also, studies show that individuals tend to underestimate the prevailing wealth inequality (Norton and Ariely, 2011), which is not good for a healthy democracy because policymakers ought to be judged by their ability to promote equitable distribution of national resources. Malul (2019) also showed that more than 80 percent of individuals surveyed in Israel overestimated the general poverty rate but underestimated it among minorities. The study also compared poverty-related perceptions to individual characteristics to find that people who considered themselves poor overestimated the country's poverty level. Age and being male were also correlated with accuracy in estimating the poverty line in the study by Malul (2019).

While these studies tell us how factors affect subjective poverty and widen the gap between subjective and objective poverty metrics, few tell us about specific strategies to reduce the gap. This intervention explores one potential strategy – leveraging the power of norm-nudges using principles of social norms. Social norms (i.e., group-based standards or rules regarding appropriate attitudes and

behaviors) play a crucial role in shaping how individuals interpret and act in their social worlds – and are closely linked to the aforementioned factors this intervention is attempting to study. This intervention borrows from existing norm-nudging literature to design the SMS messages. Bicchieri and Dimant (2019), for example, highlight the importance of social norm-driven interventions and policies to encourage desired behaviors. They describe the role of reference groups in changing interdependent behaviors, which is relevant to this intervention – people are more likely to adopt interdependent beliefs and behaviors that others in their reference group adopt. Moreover, reference networks are one of the strongest influencers on behavior: what people in one's ethnic group, gender, religious or political community do and think exert a much greater influence than people who are perceived as dissimilar (Hogg and Turner, 1987). Finally, when normative and empirical information are not congruent, we frequently see that the empirical information exerts a stronger pull than the normative one (Bicchieri and Xiao, 2009).

All of these insights were considered when crafting the SMS norm-nudge messages. As discussed in the previous section, SMS-based strategies have had tremendous success in the implementation of other behavioral nudges within healthcare, development, etc., but none have applied this medium to reduce the widening gap between subjective and objective poverty. This intervention will attempt to fill that gap.

The choice to pursue a field experiment instead of a lab experiment was done to ensure higher external validity and easy scalability of this intervention to more developing regions, if successful.

Design

This experiment will be a longitudinal study that will last three years. This much time is needed in order to observe changes in micro- and macro-economic factors that would change objective poverty metrics. Simultaneously monitoring subjective poverty would provide enough data to find meaningful correlations between the two measures of poverty for each of the treatment groups.

Participants will be recruited in villages of Madhya Pradesh and Karnataka, as discussed in the Motivation section. They will be incentivized to remain active in the study through a scaled monthly payment scheme. For their initial participation, they will be paid a small amount (approximately INR 0.5, i.e., 10 percent of their monthly expenditure), but this amount will increase in a scaled manner to about INR 36 by the end of the third year. The formula to calculate compensation is as follows: $Y(n) = 1 + (n - 1) * 0.5$, where Y is the month-end payment and n is the total months elapsed in the study.

During the recruitment phase, their demographic information will be collected, including caste, age, gender, status in the family (breadwinner, dependent, etc.), income, fluent languages, and so on. This information will be used to customize the SMS content and also as control variables in the analysis. The participants will be randomly assigned to three treatment groups summarized in *Table 1* to ensure heterogeneity in samples. The differences between the three treatments would be the content of the SMS text. Each treatment group will be informed that they will receive monthly SMS messages on subjective financial well-being. They will also receive their compensation at the end of each month. Lastly, they will be informed that experimenters will visit their village in the middle of each month to measure participants' subjective poverty estimates. Due to well-known linguistic barriers in Indian

villages, the SMS text will be translated in their respective local languages (Hindi and Kannada). The content of the SMS messages will similar to the following:

1. **Treatment 1**: *After the recent developments in your village, 80% people of Vaishyas caste in your area improved their reported their financial status to 'Sufficient' in the following scale: Very good; Good; Sufficient; Bad; Very bad.*

2. **Treatment 2**: *After the recent developments in your village, 80% people of Vaishyas caste in your area think that others should improve their financial status to 'Sufficient' in the following scale: Very good; Good; Sufficient; Bad; Very bad.*

3. **Control**: *No SMS.*

The first treatment applies the principle of empirical expectations to nudge participants to align their subjective well-being with that of their reference group. Likewise, the second treatment applies the principle of normative expectations to nudge participants. The goal of these norm-nudges is to see if they change reported subjective poverty estimates. Finally, the third group will be the control group.

Experimental Group	Description
Treatment 1	Receives an empirical expectation SMS (monthly)
Treatment 2	Receives a normative expectation SMS (monthly)
Control	No SMS

Table 1: Experimental Treatments

Previous studies have shown that the correlation between objective and subjective poverty measures tends to be about 0.19 (Alem, 2014). Assuming that our intervention improves this

correlation to about 0.5 on average across the treatment groups (to be considered a success), we obtain an effect size of 0.31. A power analysis detailed in *Table 2* gives us our desired sample size for each treatment.

Input Parameters	Values
Effect size (d)	0.31
Error probability (α)	0.05
Power (1 - β)	0.90
Sample size (per group)	179

Table 2: Power Analysis (Per Group)

Therefore, we will recruit a total of 537 participants for the three treatments in Madhya Pradesh. Similarly, we will recruit the same number of participants in Karnataka. Hence, total cost as participation compensation for all participants is INR 357,642 (equivalent to USD 4,742).

The timeline for this experiment will be three years. At the end of each month, an SMS will be sent with either an empirical or normative statistic to nudge people's subjective poverty beliefs. They will also be asked to answer a questionnaire about their subjective poverty beliefs. This will be measured either physically (with experimenters visiting their location wherever possible), or through phone calls using an interactive voice response. This survey will have several questions to measure their subjective poverty perceptions, their financial ranking among others in their reference network, their sense of agency, capability, optimism, and so on. These questions on subjective poverty perception will be the primary variable of interest. They will also be asked to report their monetary income and consumption patterns for that month, which will be the second variable of interest. This process will go on for three years, giving a total of 36 snapshots of subjective and objective monthly

income measures. Finally, the Pearson correlation will be calculated between these two measures. The main hypotheses for this experiment are as follows:

H_0: There is no difference in correlation between the treatment and control groups.

H_A: The correlation of Treatment 1 (empirical expectations) will be the highest, followed by Treatment 2 (normative expectations), and finally the control group.

By varying the SMS messages according to macroeconomic factors, the messages will attempt to guide the participants' subjective perception of poverty in alignment with objective income metrics. Therefore, every month, experts will decide, based on objective micro-economic and macro-economic factors, whether to adjust the categorical financial situation mentioned in the SMS upwards, downwards, or keep the same (details in the Analysis section). The reference group mentioned in the SMS, i.e., the caste of the individual, will remain constant throughout the study, since abundant studies (discussed in the Background section) claim that people in rural India consider castes as their reference group.

The approximate total cost is merely INR 367,014 (*Table 3)*, which is a small amount for the Indian Government, making it a cheap and feasible field experiment.

Item	Cost
Incentives to participants	INR 357,642 (USD 4,742)
Sending SMS	INR 6,372 (USD 84.5)
Conducting the survey	INR 3,000 (USD 40)
Total	**INR 367,014 (USD 4,867)**

Table 3: Total Cost

Analysis

The purpose of this study is to see how subjective poverty measurements correlate with objective poverty measures. Therefore, this study monitors how these objective measures change with micro- and macro-economic changes, and then conducts timely measurements of subjective poverty to calculate the Pearson correlation of these two measurements eventually.

A Pearson correlation closer to 1 would indicate that changes in subjective poverty perceptions are commensurate to changes in objective poverty measurements. This would show that policies that have attempted to improve people's objective financial status have also successfully changed people's subjective perception of their financial status. Note, the goal of this study is to measure merely the changes in and correlation between objective and subjective poverty estimations, not their absolute values.

To be able to observe visible changes in objective poverty measures due to micro- and macro-economic factors, the study has selected villages in Madhya Pradesh and Karnataka, India, because they are among the fastest-growing states in India recent years (discussed in the Motivation section). The sampling will be done randomly for each treatment to ensure a robust randomized controlled trial experimental design using simple random sampling techniques. During recruitment, people will be asked about their income, consumption patterns, age, caste, gender, family status, and so on. These assessments will be used for finalizing the caste-based reference group in the SMS messages, to check for heterogeneity in the samples, and as control variables in the final analyses.

The purpose of the intervention, i.e., sending the monthly SMS updates, is to see if it is possible to change people's subjective perception of poverty in a predictable direction. If yes, this would be the

first step in understanding how government organizations can use behaviorally-inspired messages to change people's subjective poverty assessments.

To ensure the nudge-direction is approximately parallel to objective economic trends, every month these objective trends will be monitored, their changes from the previous month will be calculated, and accordingly, a decision will be made to shift the subjective nudge-direction upwards, downwards, or keep the same. The following formula will be used, where y is the change in objective poverty measures.

$$f(x) = \begin{cases} 1, & if \Delta y > 2\% \\ 0, & if -2\% \leq \Delta y \leq 2\% \\ -1, & if \Delta y < -2\% \end{cases}$$

If the function yields *1*, the SMS text will be changed to shift one level left in the five-point subjective poverty scale, that has the ordinal values *Very good*, *Good*, *Sufficient*, *Bad*, and *Very bad*. So, if it was *Good* last month, this month would suggest marking *Very good*. Likewise, if the function yields the value *-1*, the SMS text will be changed to shift one level right, and no change if the value is *0*. This will be done for each village that recruited participants.

After the experiment, the Pearson correlations will be calculated between objective and subjective poverty measurements for each treatment. And the values will be compared between each treatment using the parametric Student's t-test. Since there are three treatment groups, there will be three pairwise combinations, hence three Student's t-tests.

For robustness, a linear regression will be performed, with the correlation as the dependent variable and the type of message treatment as the categorical independent variable. Also, control

variables like age, gender, family status, income, employment type, and so on, will be added to the regression equation to check for any confounding effects.

Assuming that the experimental design principles of robust randomized controlled trials have been applied (appropriate randomization, etc.), we can infer causality that indeed sending behaviorally-inspired messages to norm-nudge people's subjective poverty perceptions has an effect on reported subjective poverty.

A limitation of this intervention is that once the SMS updates are stopped, there is a likelihood that people would no longer have guidance on how to understand their subjective poverty states. Hence, the success of this intervention is that an overarching government body will have to send regular SMS updates about the economy's situation and accordingly tweak the norm-nudge SMS messages.

An advantage of this intervention is its cost. Sending SMS updates is extremely cost-effective for governments, and may even be free in some countries. Also, this system can easily be automated by designing a program that monitors objective economic changes online and accordingly customizes the SMS that is sent to citizens. Recommended tools are Python to design the program that monitors micro- and macro-economic online data. Applications like Textlocal can be used to send cheap SMS updates automatically. In the future, other mediums like interactive voice response software and emails can also be explored to send people norm-nudge messages.

Since governments around the world already spend millions of dollars on improving objective poverty situations of people, it would be advantageous to supplement those initiatives with this extremely cost-effective method of improving subjective poverty measures. Aligning the two forms of

poverty measurements will be advantageous to policymakers since they can gauge the sentiment of their citizens and accordingly launch policies. Also, having these two forms of poverties aligned with each other will maximize the potential of successful initiatives that improve objective poverty in countries. Also, an accurate perception of one's subjective poverty situation will ensure that people use their financial recourses wisely. The way Goldilocks desired soup that was 'just right' – not too hot, not too cold – likewise, policymakers would want their citizens to use their financial resources in the most optimal manner – not too wasteful, not too frugal.

Discussion

Aligning subjective and objective poverty measures can have multiple benefits for policymakers and citizens. Policymakers can use accurate assessments of subjective poverty as a litmus test for incumbent governments' initiatives, a proxy for the financial well-being of people, and as feedback on the ability of current poverty-related initiatives to make people feel less poor. On the other hand, when people experience subjective poverty that's aligned with their objective poverty status, they are more likely to apply their financial resources optimally.

However, empirical evidence from many sources suggests that usually, these two forms of poverty are misaligned. This intervention is a novel way of applying norm-nudging to shift people's subjective perception of their poverty status and align them to their objective counterparts. Since behavioral and psychological factors shape subjective poverty, norm-nudging people with behaviorally-inspired messages has the potential to be effective.

One of the cheapest and most trustworthy ways to send information to people is the short-message service (SMS), and governments have used this service successfully in many behavioral initiatives for alleviating socio-economic issues. Moreover, SMS-based technologies are extremely cost-effective and reliable. Hence, this intervention chooses SMS-based messaging to leverage these benefits.

Participants in Madhya Pradesh and Karnataka, India, will be divided into three groups, two of which will receive SMS messages inspired by norm-nudging techniques, and one as a control group that will not receive messages. The messages will describe how their reference groups actually (Treatment 1: Empirical) and ought to (Treatment 2: Normative) think about their subjective poverty status. These

messages will be designed to nudge people in the same direction as the changes in objective poverty measures like income and consumption. Participants will also be surveyed every month on their subjective poverty perceptions as well as their objective poverty-related metrics. Based on previous literature on similar nudges, the empirical expectations-based messages are expected to have maximum impact, with the highest correlation between subjective and objective poverty measures. This will be followed by the correlation for normative expectations treatment, and finally, the control group's correlation. Having a higher correlation implies a better alignment of subjective and objective poverty assessments, which is beneficial to policymakers and citizens alike.

If successful, insights from this paper can be used to understand how people can be nudged in specific, predictable directions to align subjective and objective poverty assessments. Also, the cost-effectiveness of this strategy makes it easy to scale and implement in other regions around the world.

However, some challenges must be kept in mind. While cultures like India are collectivist and hence may be receptive to norm-nudging, other more individualistic cultures may need a different kind of behavioral messaging strategy. Also, SMS-based technologies may not always be available in local languages, and alternative technologies may need to be considered, like emails and interactive voice response technologies. Finally, there is a likelihood that once the SMS updates stop, people may revert to their old ways of thinking, leading to a misalignment of subjective and objective poverty measures. Fortunately, there are technologies like Python and Textlocal that can automate this process of customizing and sending SMS updates to people, making it a feasible, long-term solution.

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