



Moving targets: When does a poverty prediction model need to be updated?

Emily L. Aiken*
U.C. Berkeley
USA
emilyaiken@berkeley.edu

Tim Ohlenburg*
University College London
England
email@timohlenburg.com

Joshua E. Blumenstock
U.C. Berkeley
USA
jblumenstock@berkeley.edu

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A key challenge in the design of effective anti-poverty programs is determining who should be eligible for program benefits. In developing countries, one of the most common criteria is a Proxy Means Test — a simple decision rule that determines eligibility based on basic information about each household (for example, the number of rooms in the household, the number of children, whether there is indoor plumbing, and other observable characteristics) [1, 3, 4, 7]. At the core of each Proxy Means Test (PMT) is a machine learning algorithm that uses the short list of household characteristics to *predict* whether the household should be deemed poor, and therefore eligible, or non-poor, and therefore ineligible [5, 6].

This paper documents an important weakness in the use of machine learning for PMTs: the accuracy of the PMT prediction algorithm decreases steadily over time. First, using nationwide survey data from four African countries over ten years, we show that PMT inclusion and exclusion error rates increase by an average of 1.7 percentage points each year that a PMT is not updated (relative to a baseline average of 42.4% inclusion and exclusion errors for a PMT with up-to-date data). In a typical real-world anti-poverty program where the PMT data is updated only every 5–8 years [2], the expected decline in accuracy due to an out-of-date PMT is 19–32%.

Second, we show that the aggregate effect of PMT decline can be decomposed into two forces: “model decay” caused by model drift in the joint distribution of poverty and the household characteristics used as covariates in the PMT, and “data decay” caused by changing household characteristics. We find that data decay contributes approximately three times as much to the overall effect as model decay.

Our final set of results use information on survey costs from several countries to assess the financial implications of different policies available to anti-poverty program administrators for updating registry data and retraining PMT models. We find that, under

reasonable assumptions about the trade-off between survey costs and the cost of mis-targeted program benefits, most social protection programs should aim to update registry data and recalibrate the PMT model every 1–3 years.

REFERENCES

- [1] Vivi Alatas, Abhijit Banerjee, Rema Hanna, Benjamin A Olken, and Julia Tobias. 2012. Targeting the poor: evidence from a field experiment in Indonesia. *American Economic Review* 102, 4 (2012), 1206–1240.
- [2] V Barca and M Hebbat. 2020. On-demand and up to date? Dynamic inclusion and data updating for social assistance. *GIZ* (https://socialprotection.org/sites/default/files/publications_files/GIZ_DataUpdatingForSocialAssistance_3.pdf) (2020).
- [3] Margaret Grosh and Judy L Baker. 1995. Proxy means tests for targeting social programs. *Living standards measurement study working paper* 118 (1995), 1–49.
- [4] Rema Hanna and Benjamin A Olken. 2018. Universal basic incomes versus targeted transfers: Anti-poverty programs in developing countries. *Journal of Economic Perspectives* 32, 4 (2018), 201–26.
- [5] Linden McBride and Austin Nichols. 2018. Retooling poverty targeting using out-of-sample validation and machine learning. *The World Bank Economic Review* 32, 3 (2018), 531–550.
- [6] Alejandro Noriega-Campero, Bernardo Garcia-Bulle, Luis Fernando Cantu, Michiel A Bakker, Luis Tejerina, and Alex Pentland. 2020. Algorithmic targeting of social policies: fairness, accuracy, and distributed governance. In *Proceedings of the 2020 Conference on Fairness, Accountability, and Transparency*. 241–251.
- [7] Patrick Premand and Pascale Schnitzer. 2021. Efficiency, legitimacy, and impacts of targeting methods: Evidence from an experiment in Niger. *The World Bank Economic Review* 35, 4 (2021), 892–920.

*Both authors contributed equally to this research.



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