

Mapping subnational gaps in internet and mobile adoption using social media data

Digital Demography

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July 5, 2024

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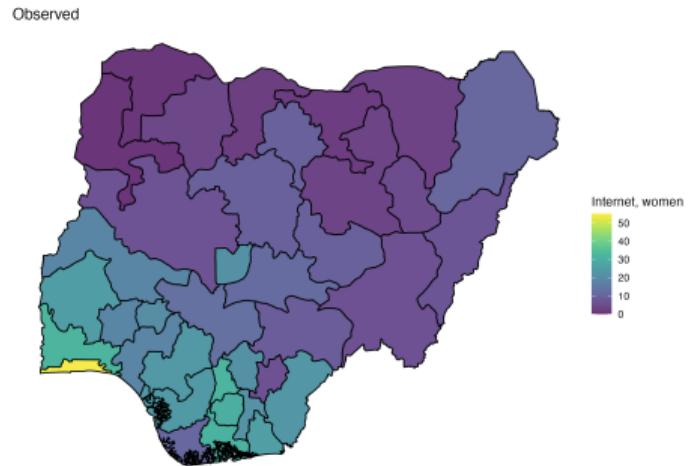
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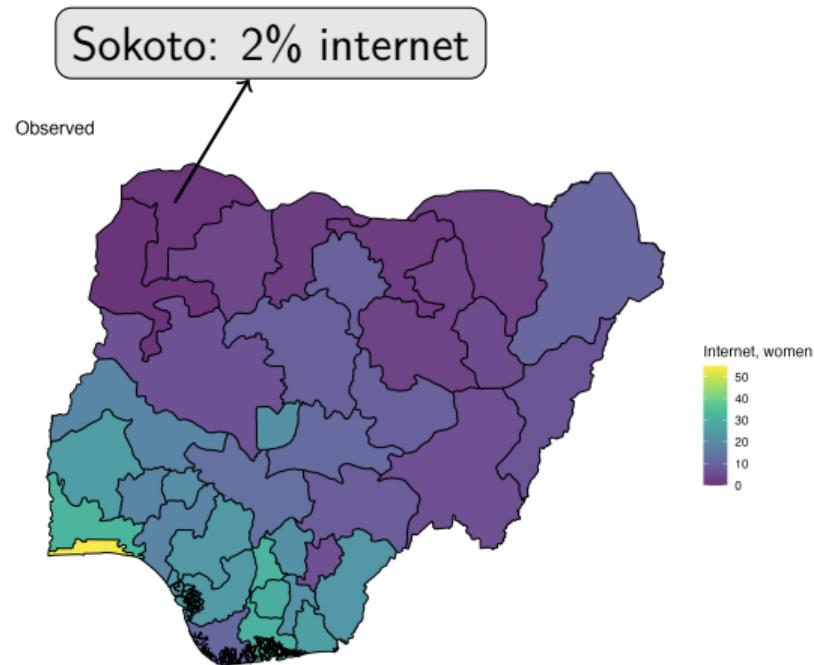
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 - ▶ Increases levels of education, economic benefits ([Hjort and Poulsen, 2019](#); [Kho, Lakdawala and Nakasone, 2018](#); [Kharisma, 2022](#))
- ▶ Yet large **inequality** in who has access to digital technology...

Adoption of digital technology varies geographically

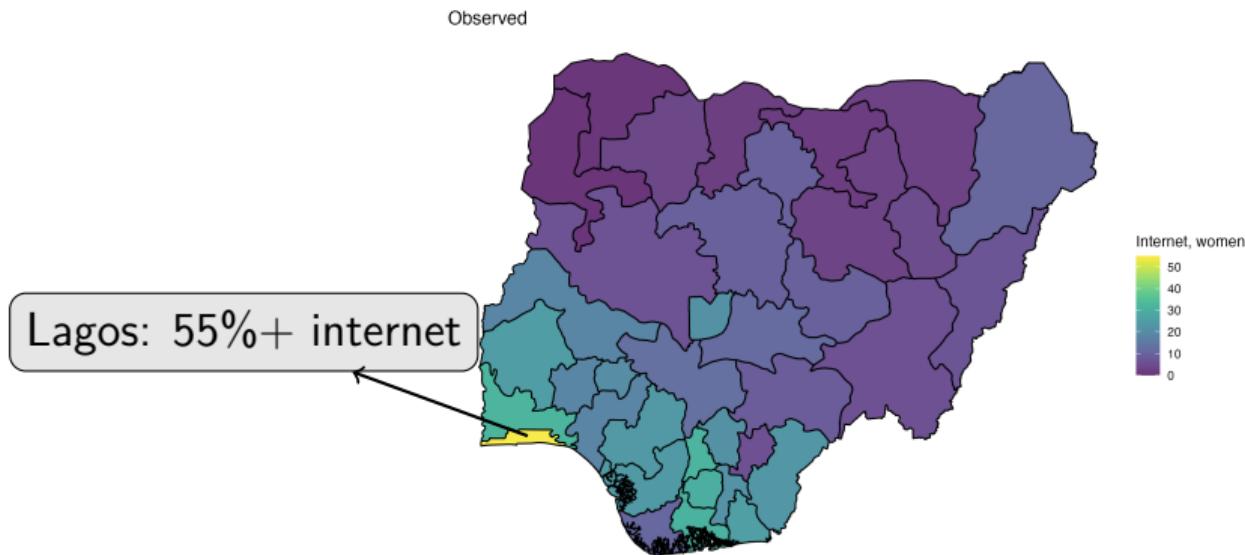


Source: Nigeria, Demographic and Health Survey

Women using internet, past 12 months



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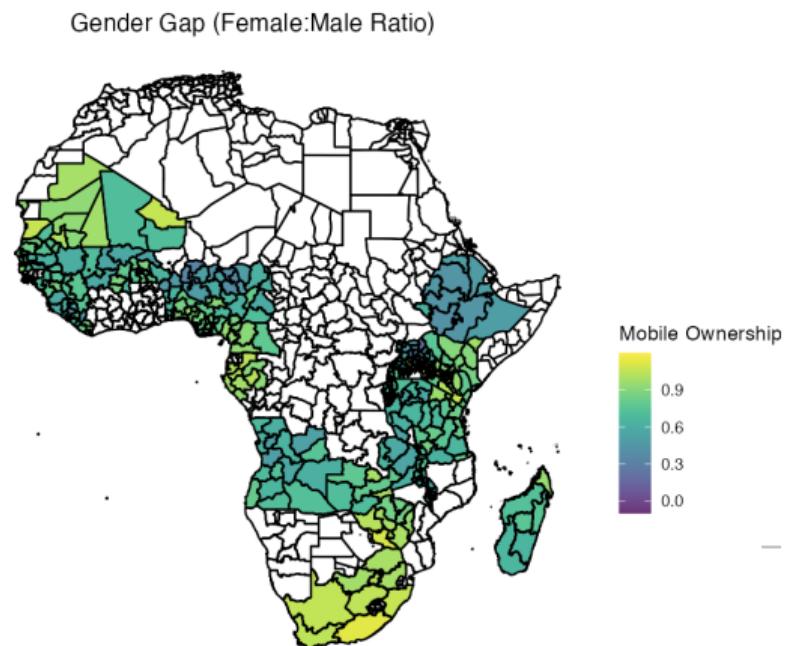


Develop subnational estimates of adoption

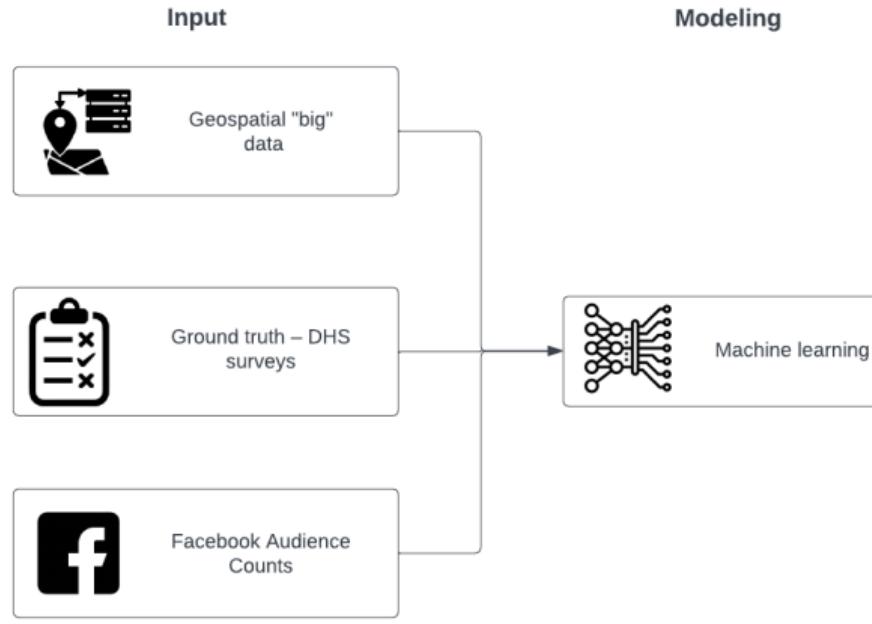
- ▶ **Goal:** Develop estimates of internet and mobile adoption by gender and digital gender gaps

Develop subnational estimates of adoption

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- ▶ First subnational level
 - ▶ 52 countries, 874 subnational units



Overview of approach



24 countries, with
ground truth

Introduction
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Background
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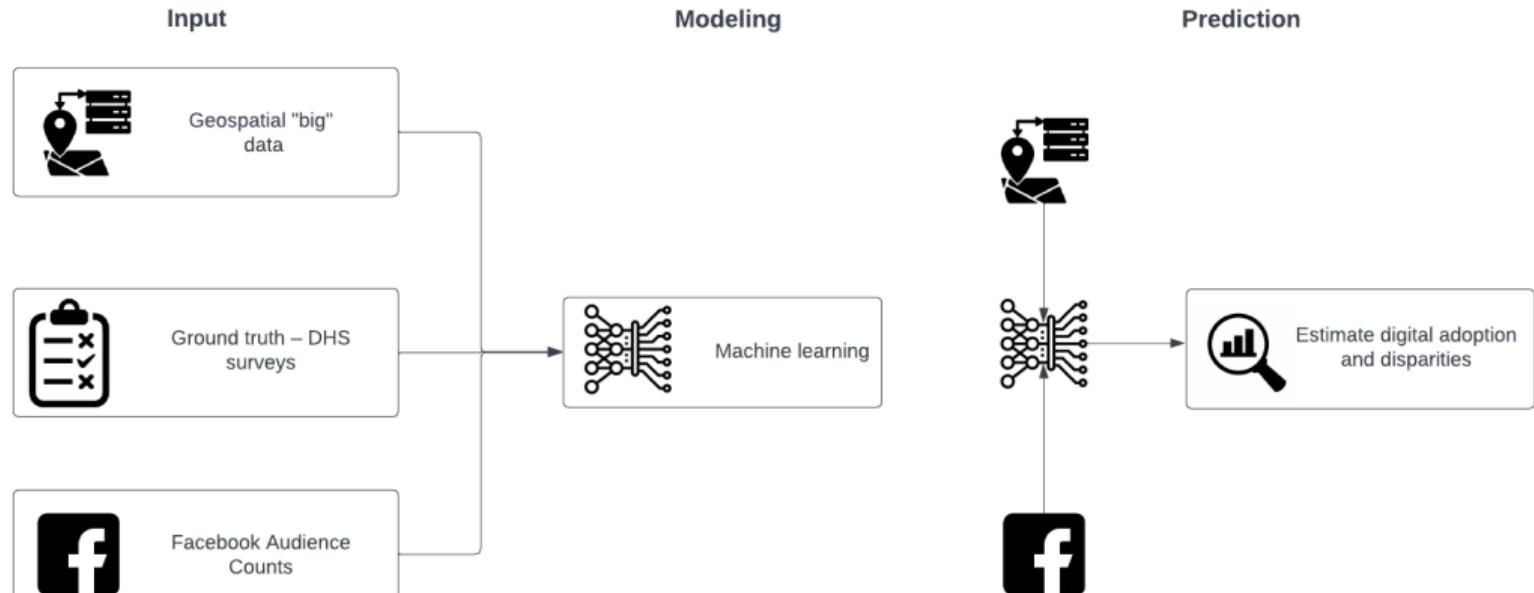
Data + methods
●○○○○○○

Results
○○○○○○

Conclusion
000

References

Overview of approach



19 countries, with
ground truth

Introduction
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Background
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Results
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52 countries, with and
without ground truth

Conclusion
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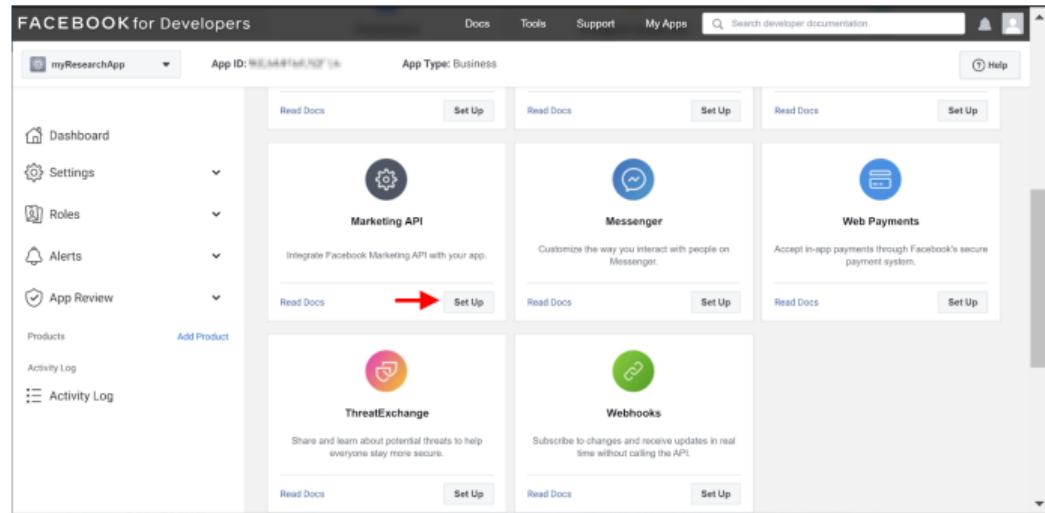
References

Ground truth – Demographic and Health Surveys (DHS)

- ▶ Household surveys representative at the first subnational level
 - ▶ Standardized sample design, questionnaire, implementation, etc.
 - ▶ Questions on individual-level internet use and mobile phone use (wave 7 onwards)
- ▶ Focus on 24 different DHS surveys, 2016-2020

Facebook audience counts

- ▶ Collected through public marketing API
- ▶ Specify geographic region (FB template or custom region)
- ▶ Disaggregated counts by gender, age, device type, etc.



Big geospatial and population data

- ▶ Include 'offline' predictors that are uniformly available and consistent across subnational units
 - ▶ Satellite-derived nightlights data
 - ▶ Population density
 - ▶ Relative wealth index (Meta)
 - ▶ Subnational education index, income index, human development index (HDI), gender development index (GDI)

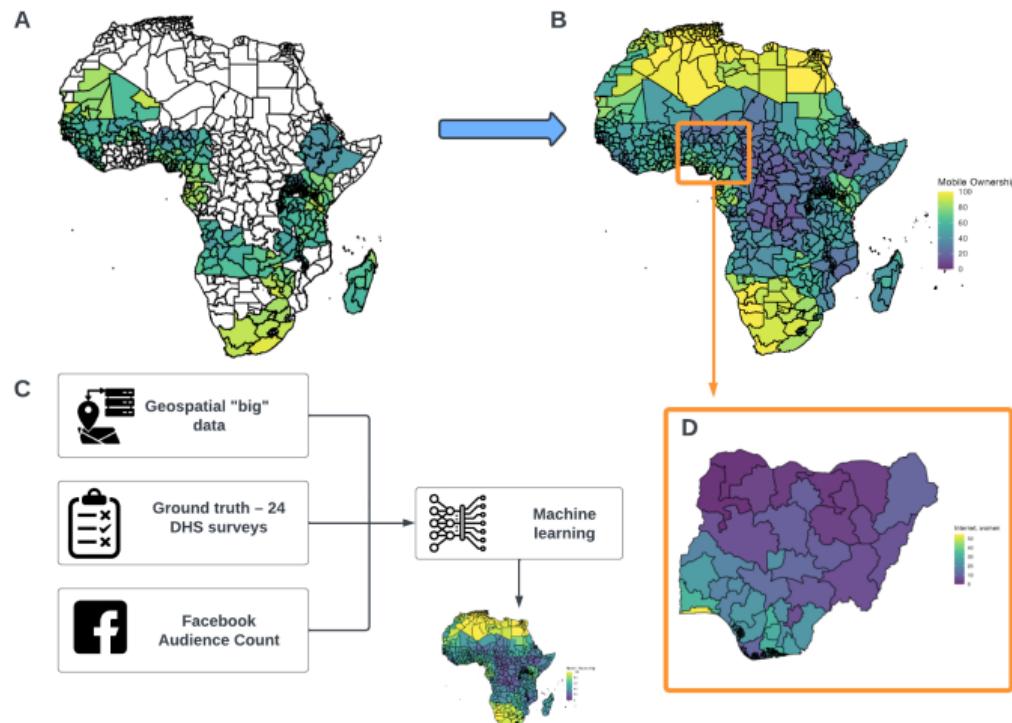
Outcomes of interest (from DHS)

Indicators	Women	Men	Gender Gap
Mobile Phone Ownership	✓	✓	✓
Internet Use, Past 12 Mo	✓	✓	✓

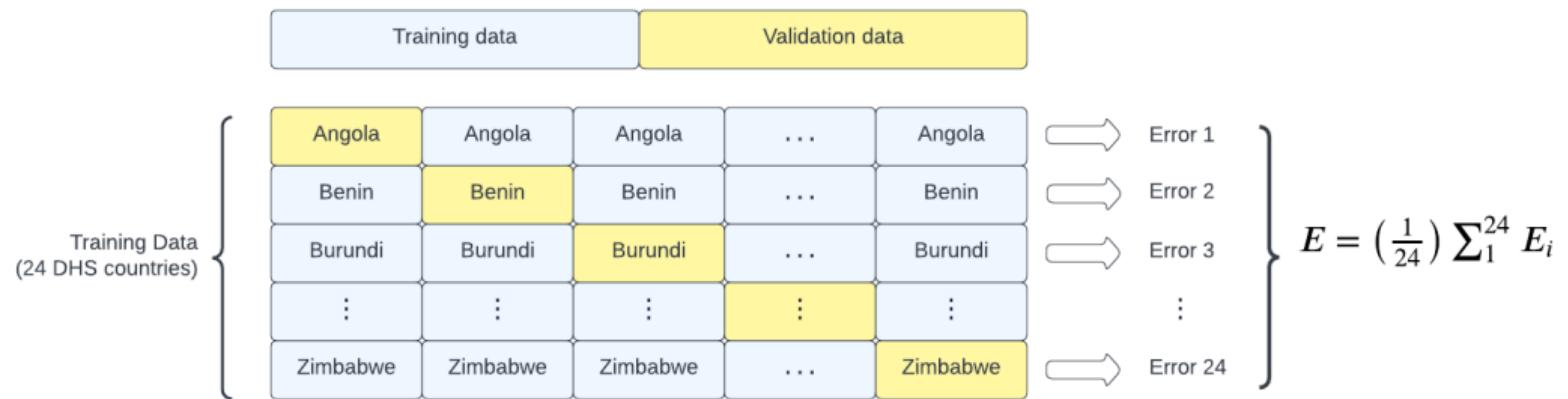
Modeling approach - machine learning

Algorithm	Description
glmnet (Lasso)	Lasso Regression
glmnet (Ridge)	Ridge Regression
glmnet (Elastic Net)	Elastic Net with 50% L1 Ratio
polyspline	Polynomial Spline
ranger	Random Forest with 100 Trees
gbm	Gradient Boosted Machine
glm	Generalized Linear Model
xgboost	Extreme Gradient Boosting
SuperLearner	Ensemble method combining multiple learning algorithms

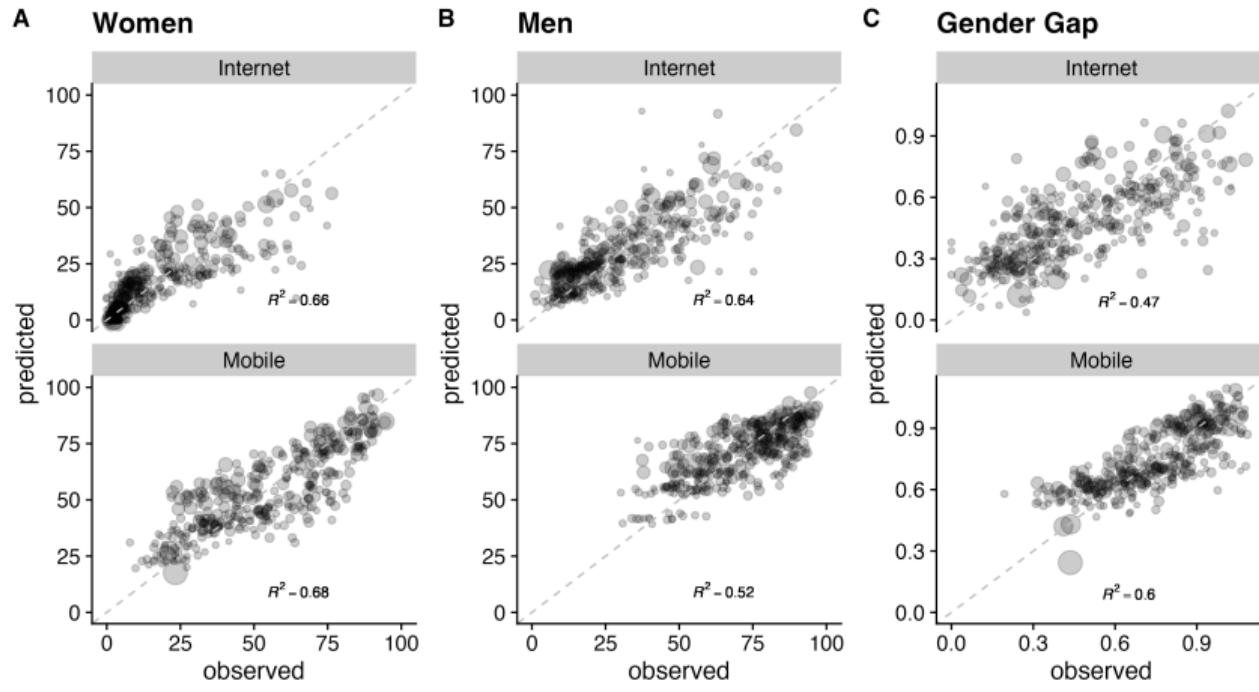
Greatly expanded coverage



Leave-one-country-out cross validation



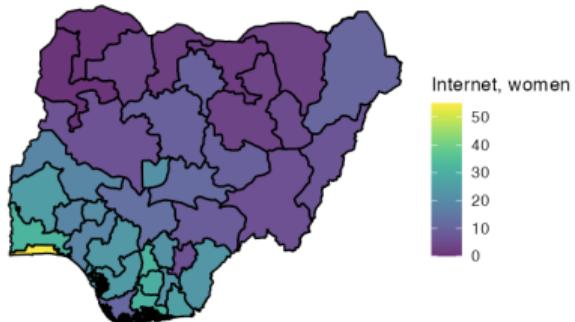
Overall predictive accuracy



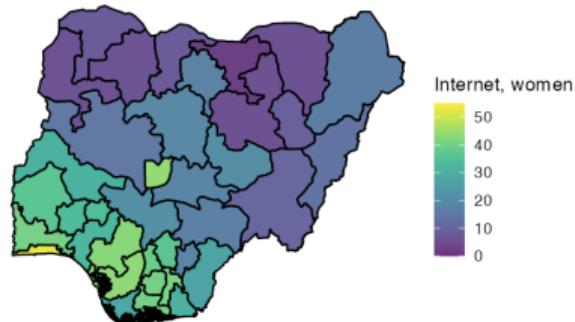
Population Size • 300k • 1m • 3m • 10m

Results for Nigeria (Leave-one-country-out)

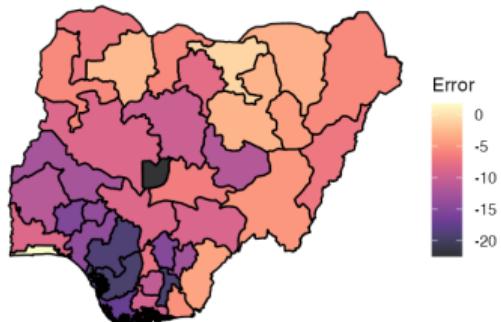
A Observed



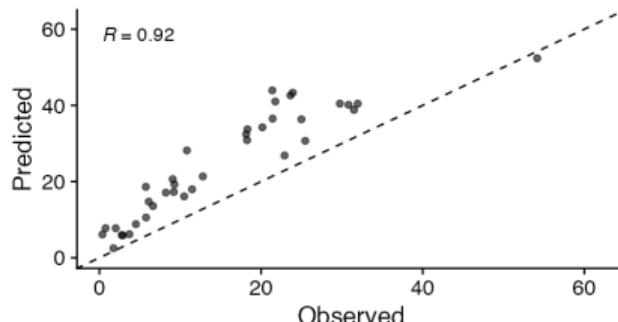
B Predicted



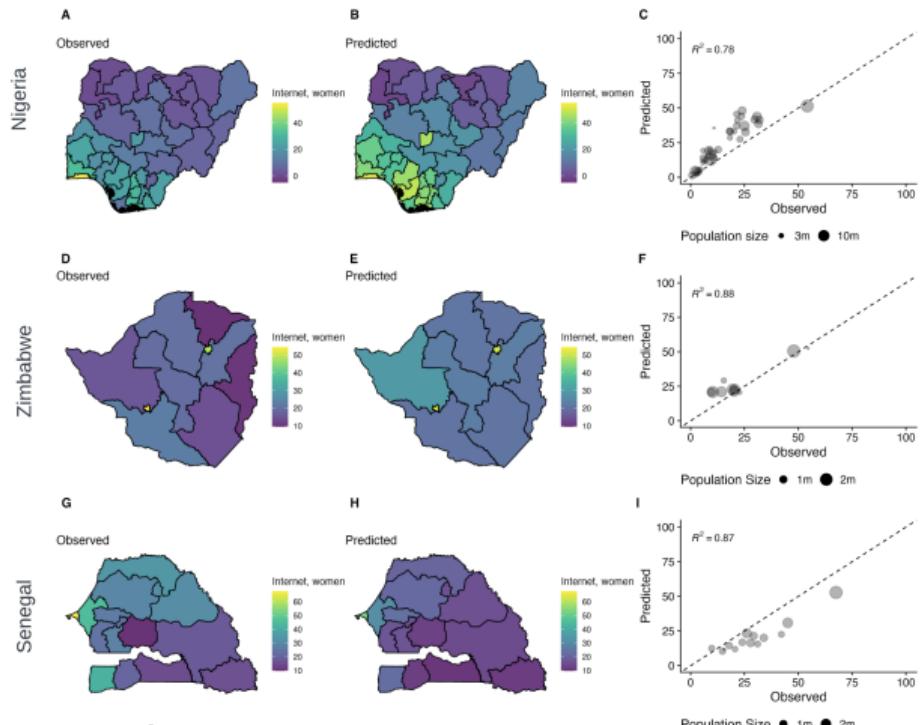
C Error



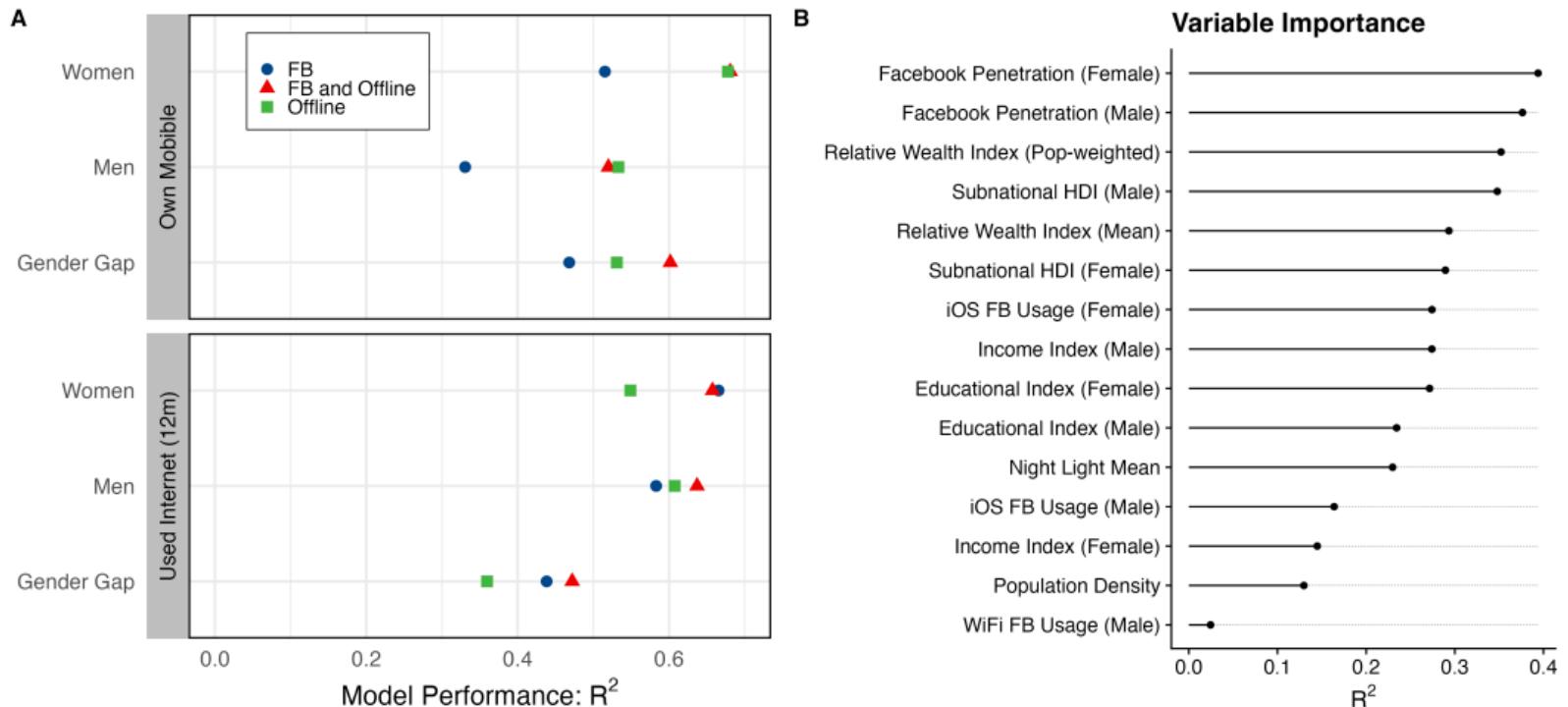
D Internet, women (error)



Error by country



Most important predictors



Next steps and future opportunities

- ▶ Expanding to all 135 LMIC countries (ongoing...)
- ▶ Quantifying uncertainty

Summary

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Summary

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- ▶ Huge **disparities** in access to mobile and internet technologies between and within countries
- ▶ New opportunities to study **population-level impacts** of digital technology using these subnational estimates

Thank You

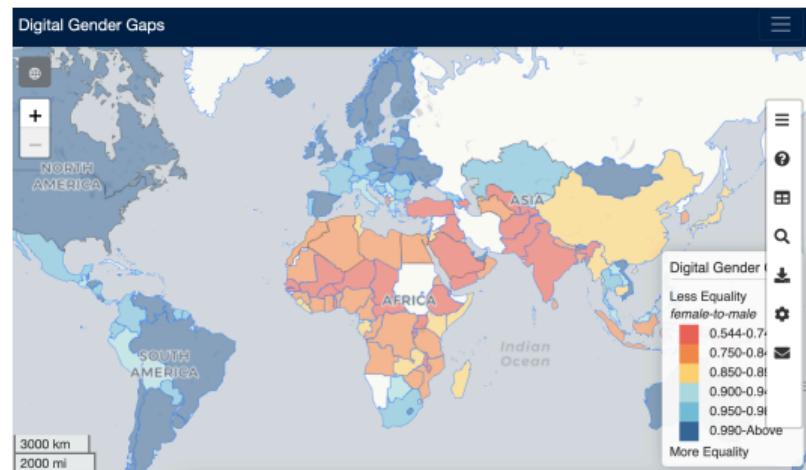
Funders:

- ▶ Bill and Melinda Gates Foundation (INV-045370)
- ▶ Leverhulme Trust (Grant RC-2018-003) for the Leverhulme Centre for Demographic Science

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