Using Social Media Advertising Data to Map Poverty of Migrants and Refugees

Ingmar Weber

Regional Workshop on Poverty Measurement
in the Era of Big Data

December 22-23, 2020

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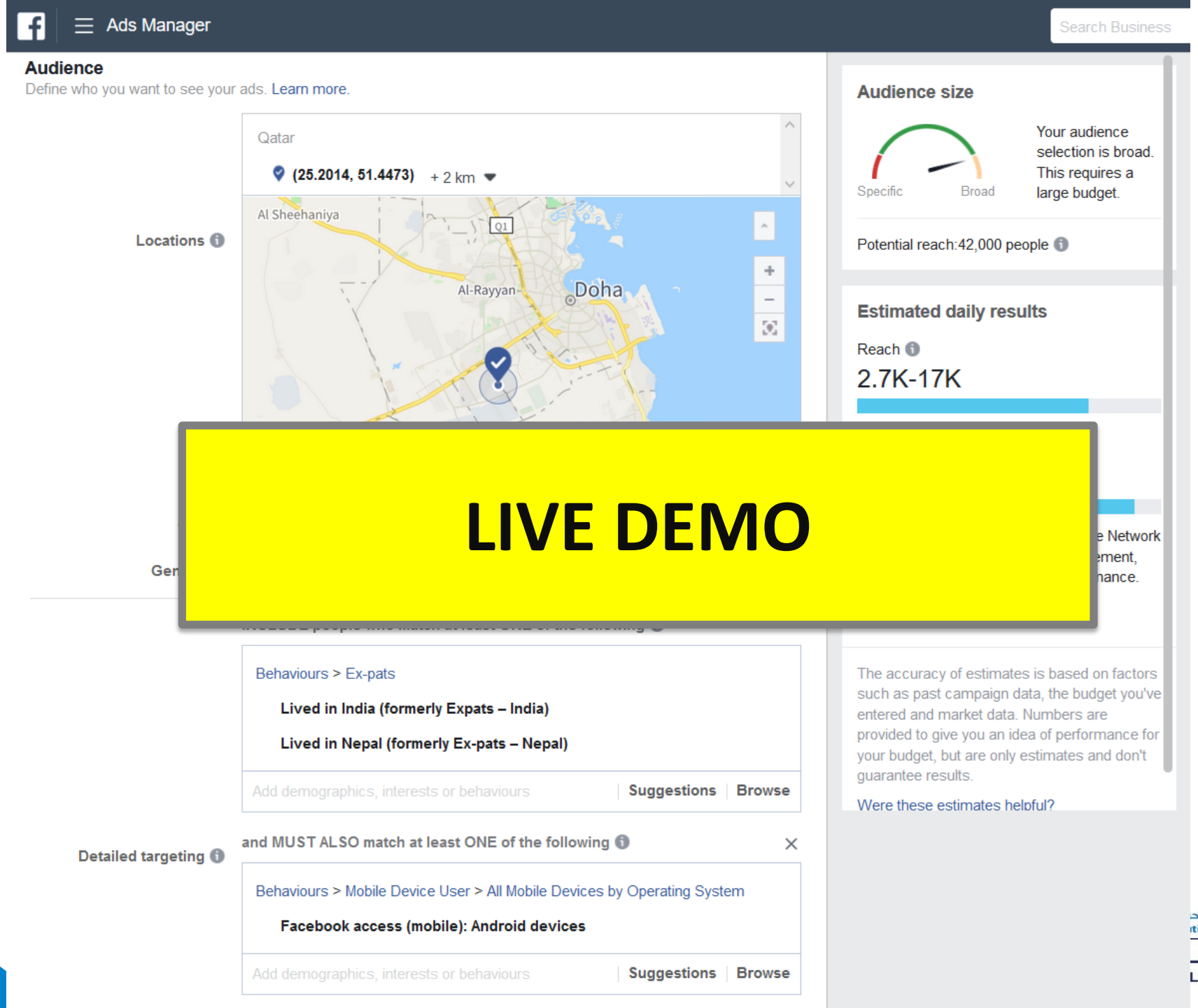

LIVE DEMO

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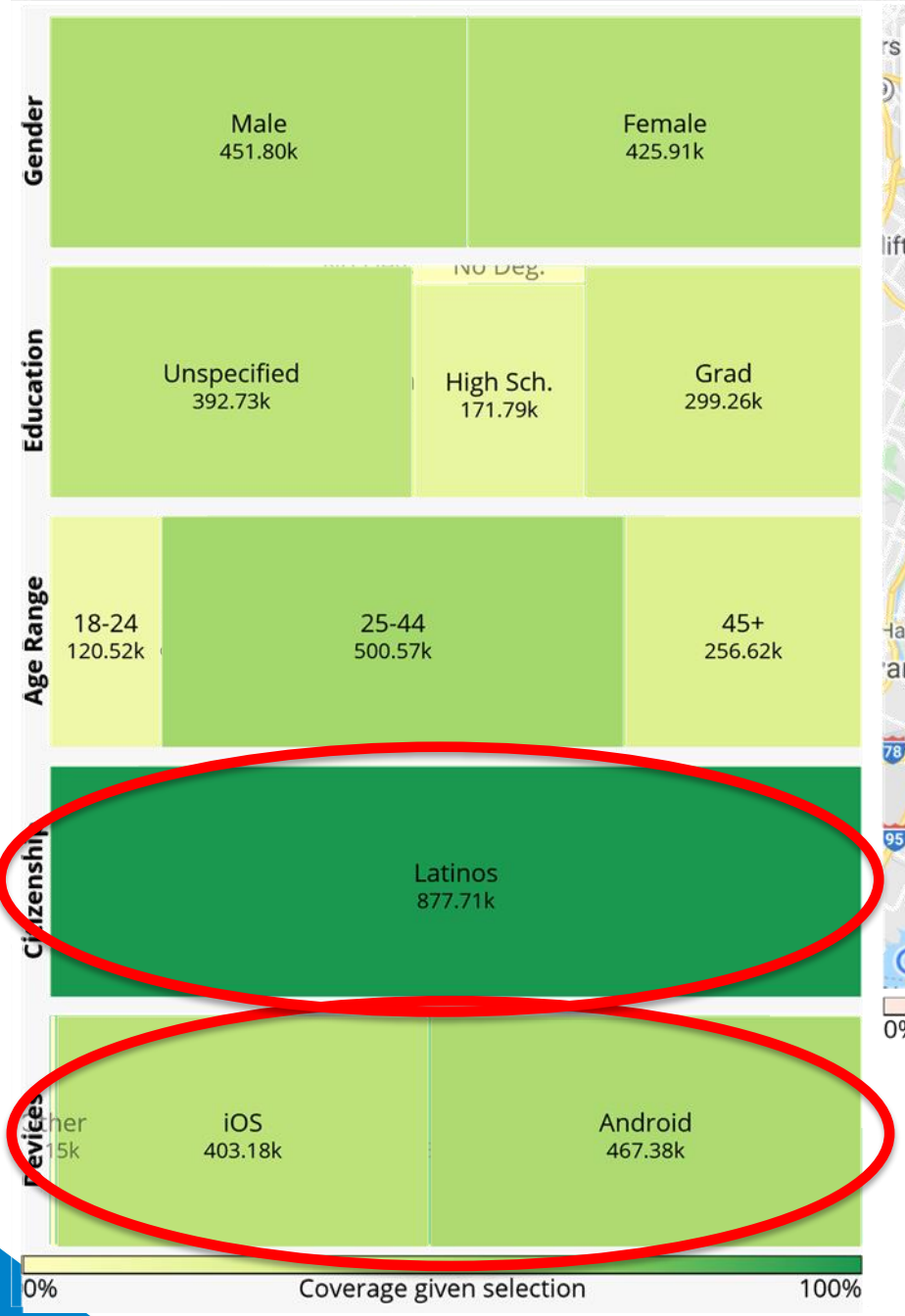

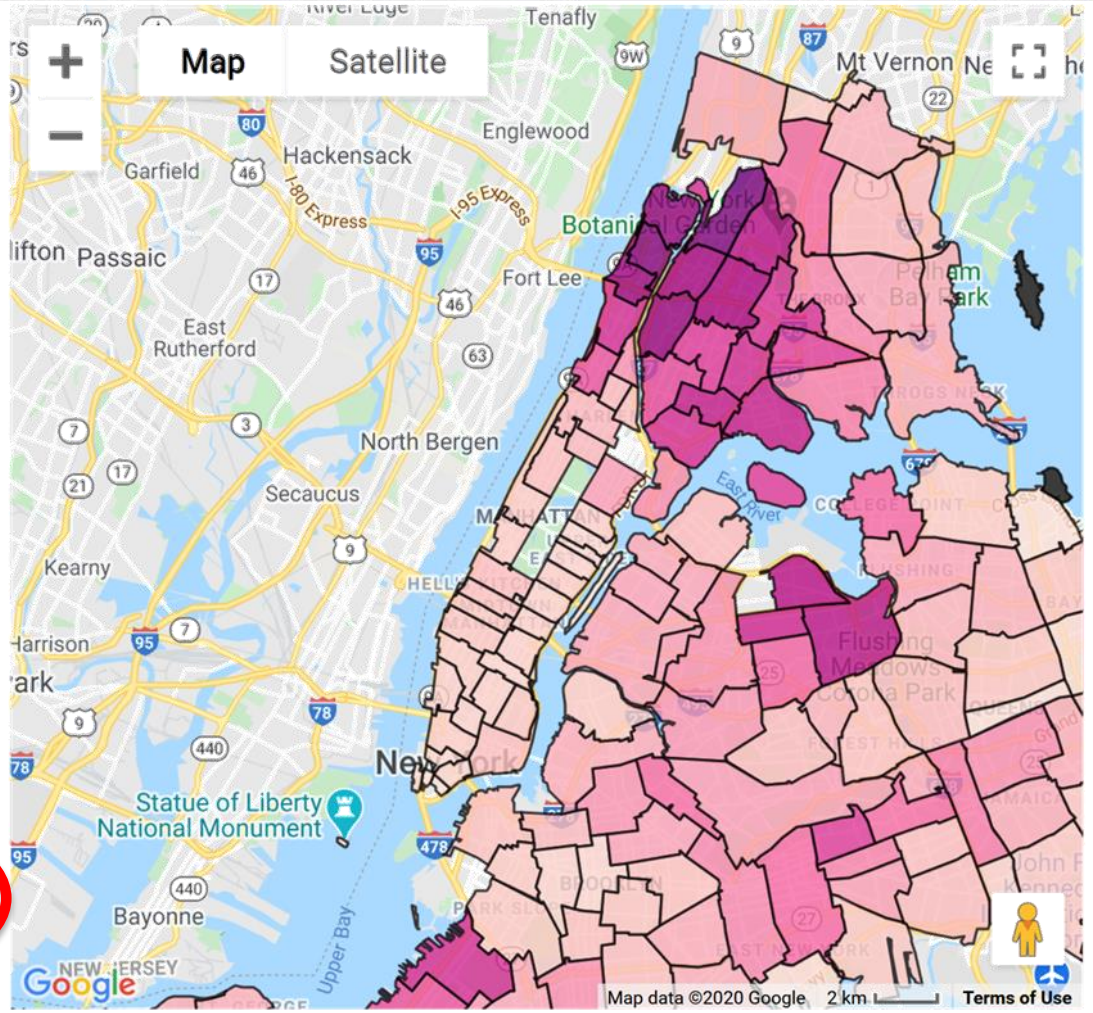

0% Matching given location 44.9%

All Locations | No Locations

Share what you see:

https://fb-nyc.qcri.org

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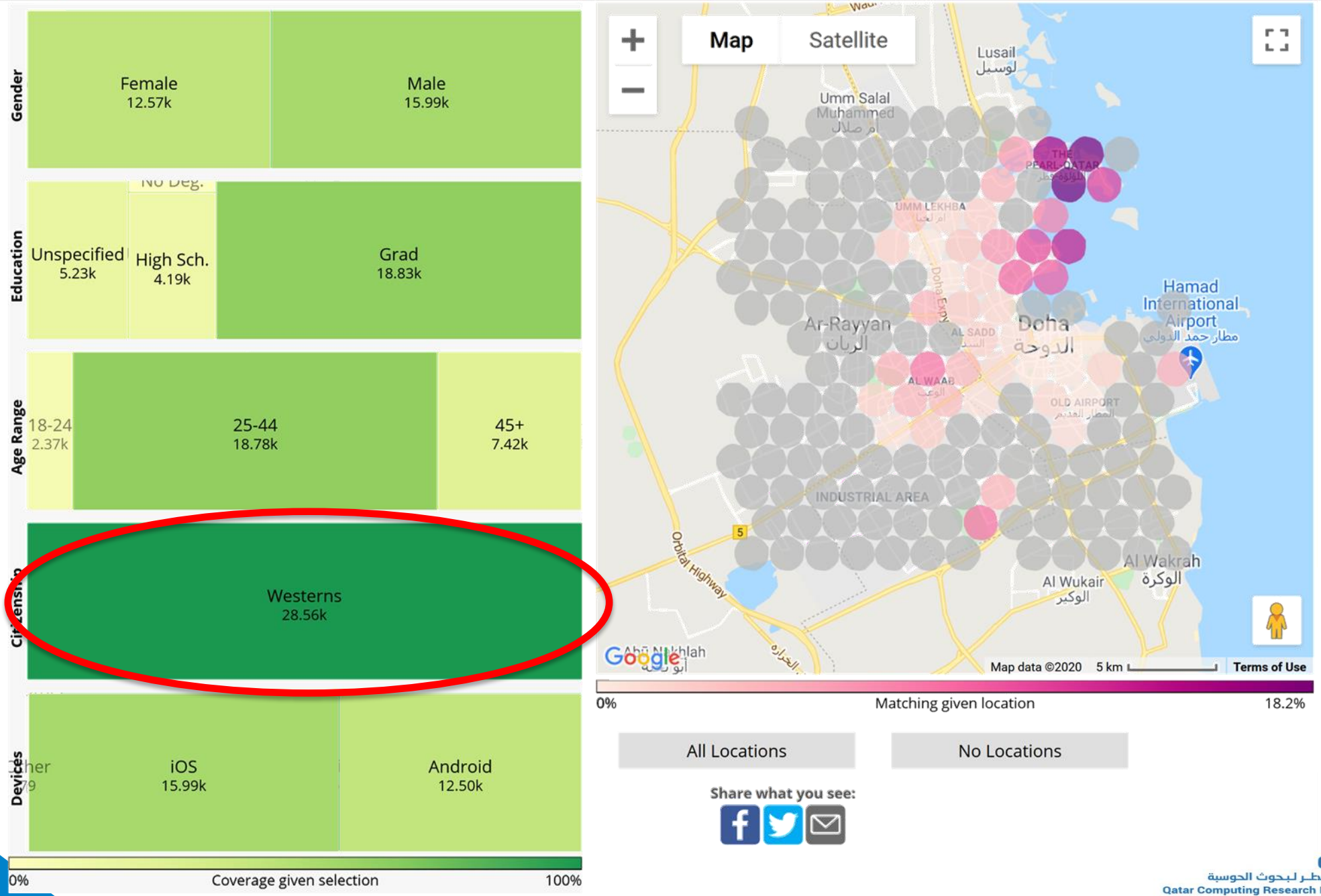

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VALIDATING IN A NON-REFUGEE SETTING

Ground Truth and Training Data

- Representative sample of ~40 households for each “cluster” (PH: n=1.2k, IN: n=28k)
- Target variable: asset ownership based “Wealth Index”
- Philippines: 2017 & India: 2015-2016 vs. FB features from 2019

Sampling noise
- Wealth index depends on particular households
- Expected R^2 = .955/.973 (PH/IN, bootstrap estimate)

Spatial perturbation
- True location is (x,y), but reported at (x’,y’)
- Protects privacy
- Expected R^2 = .885/.860 (PH/IN, simulations)

Combined
- **Expected R^2 = .845/.838 (PH/IN)**
- “Expected upper bound”, “explainable variance”

https://dhsprogram.com/data/dataset/India_Standard-DHS_2015.cfm
https://dhsprogram.com/data/dataset/Philippines_Standard-DHS_2017.cfm

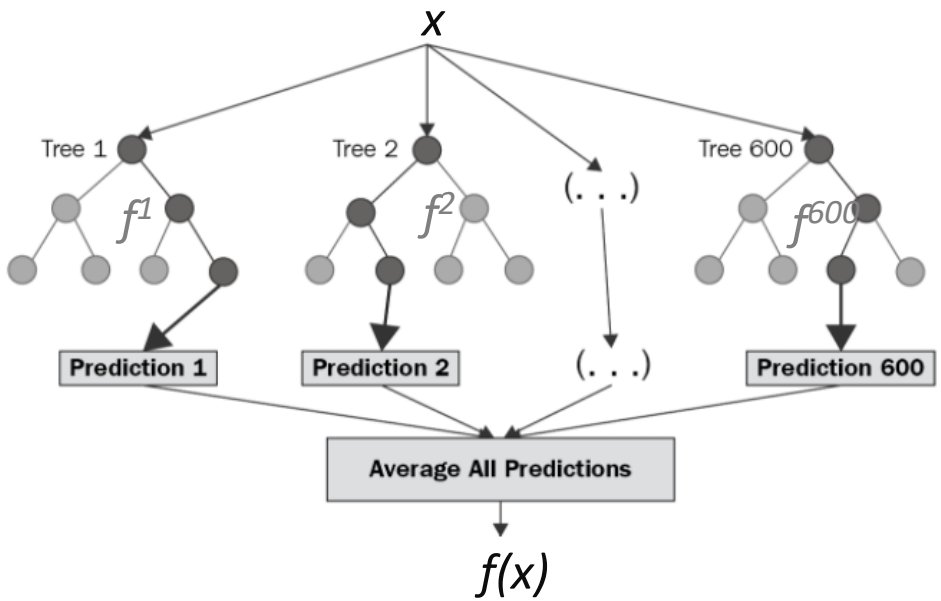
Regression Setup

The DHS Wealth Index is the target (y)
Use the FB data as features (x)
Try to find a function f such as $y \approx f(x)$

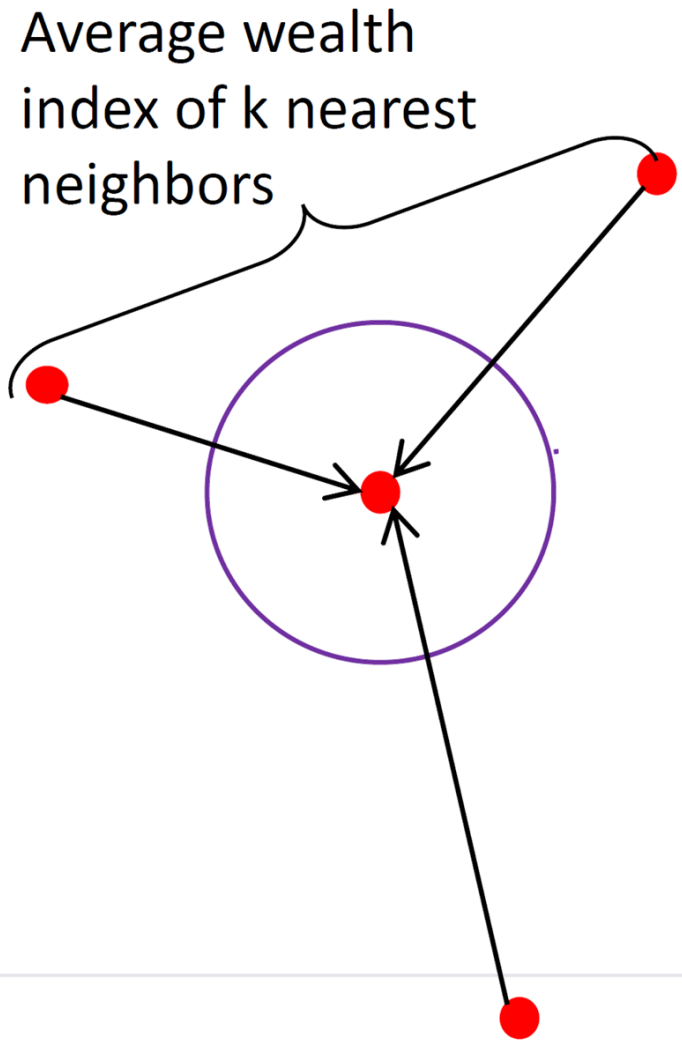
Use a gradient boosted regression forest as f
Worked better than linear methods

Fitted and evaluated using 10-fold cross validation.

Implemented using the “gbm” package in R
https://cran.r-project.org/web/packages/gbm/index.html



Baseline: Interpolation with Nearest Ground Truth



	$k=1$	$k=3$	$k=5$	$k=10$
Philippines	0.597	0.686	0.687	0.681
India	0.739	0.793	0.796	0.788

Pearson's *r* correlation

Results

This uses the Wealth Index of nearby locations as features.

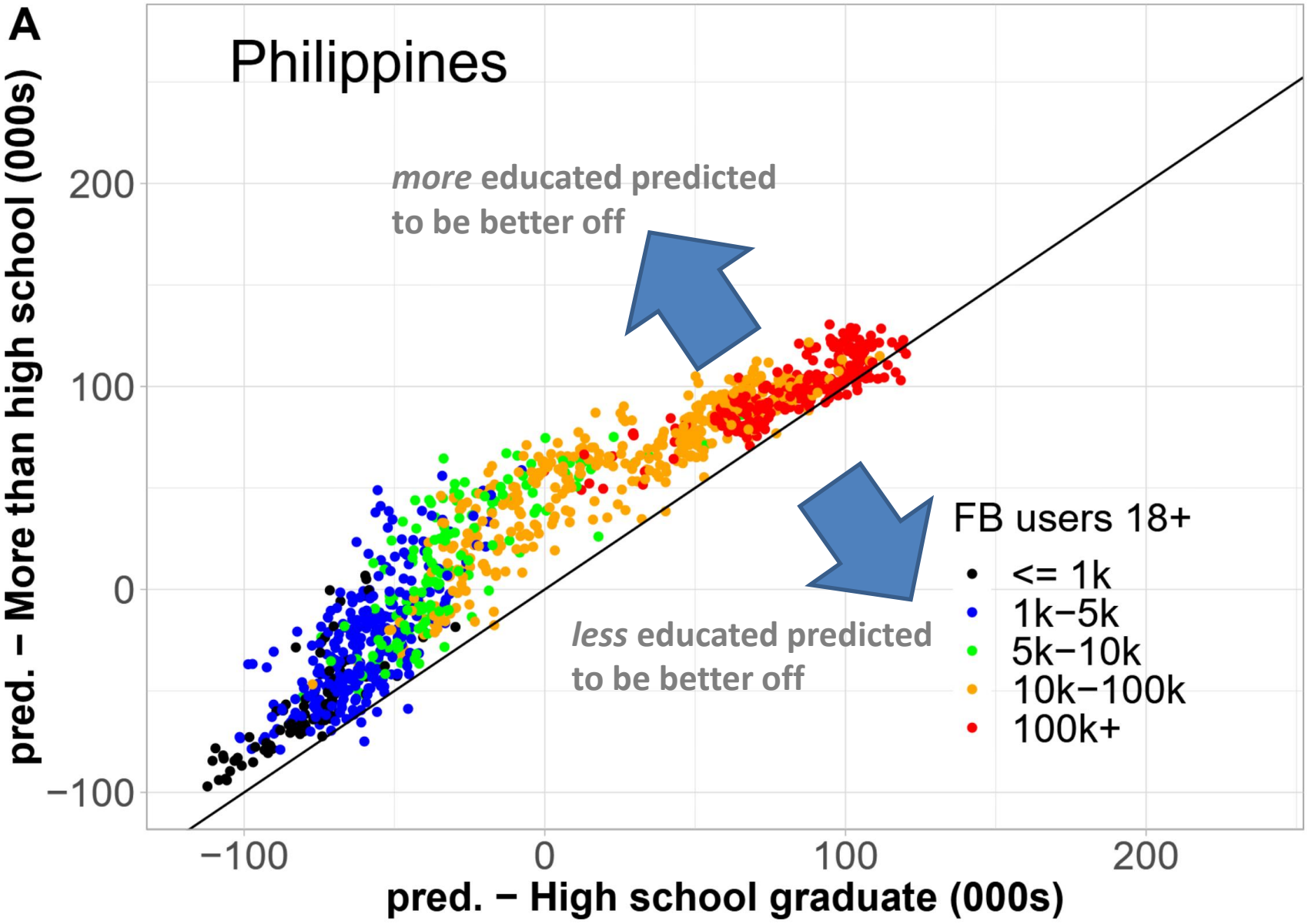
This includes the FB penetration, computed using high resolution settlement layer information.

This is a dummy variable “is the location part of [name of region]”.

Model features					
Interpolated DHS Wealth Index		X			X
Facebook features			X	X	X
Log population density				X	X
Regional indicators				X	X
Philippines (*N* = 1205)	R^2	0.480	0.608	0.627	0.630
	RMSE	50,983	44,218	43,099	42,965
India (*N* = 28,043)	R^2	0.652	0.563	0.691	0.728
	RMSE	46,810	52,502	44,149	41,394

Recall: upper bound R^2 = .845/.838 (PH/IN) (due to noise)

Education-Level-Disaggregated Predictions



MONITORING THE VENEZUELAN EXODUS

UNHCR
The UN
Refugee Agency

unicef

iMMAP

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https://www.facebook.com/adsmanager/creation/ 110%

Ads Manager | Search | Ingmar

Ingmar Weber (179...

Ad Set Name: Young, male Venezuelans living in Norte de Santander

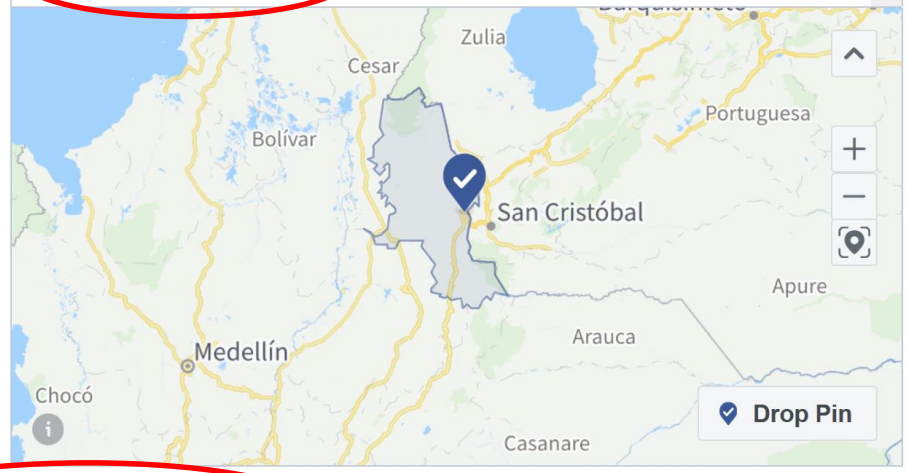
Switch to

- Campaign
  - Objective
- Ad Set
  - Audience
  - Placements
  - Budget & Schedule
- Ad
  - Identity
  - Format
  - Media
  - Text & Links
  - Languages
  - Tracking

Locations | People living in this location

Colombia

Norte de Santander



Age | 13 - 24

Gender | All | Men | Women

Detailed Targeting | Include people who match

Behaviors > Expats

Lived in Venezuela (Formerly Expats - Venezuela)

Size: 4,854,832

Behaviors > Expats > Lived in Venezuela (Formerly Expats - Venezuela)

Description: People who used to live in Venezuela who now live abroad

Audience Size

Specific — Broad

Your audience selection is fairly broad.

Potential Reach: 16,000 people

Estimated Daily Results

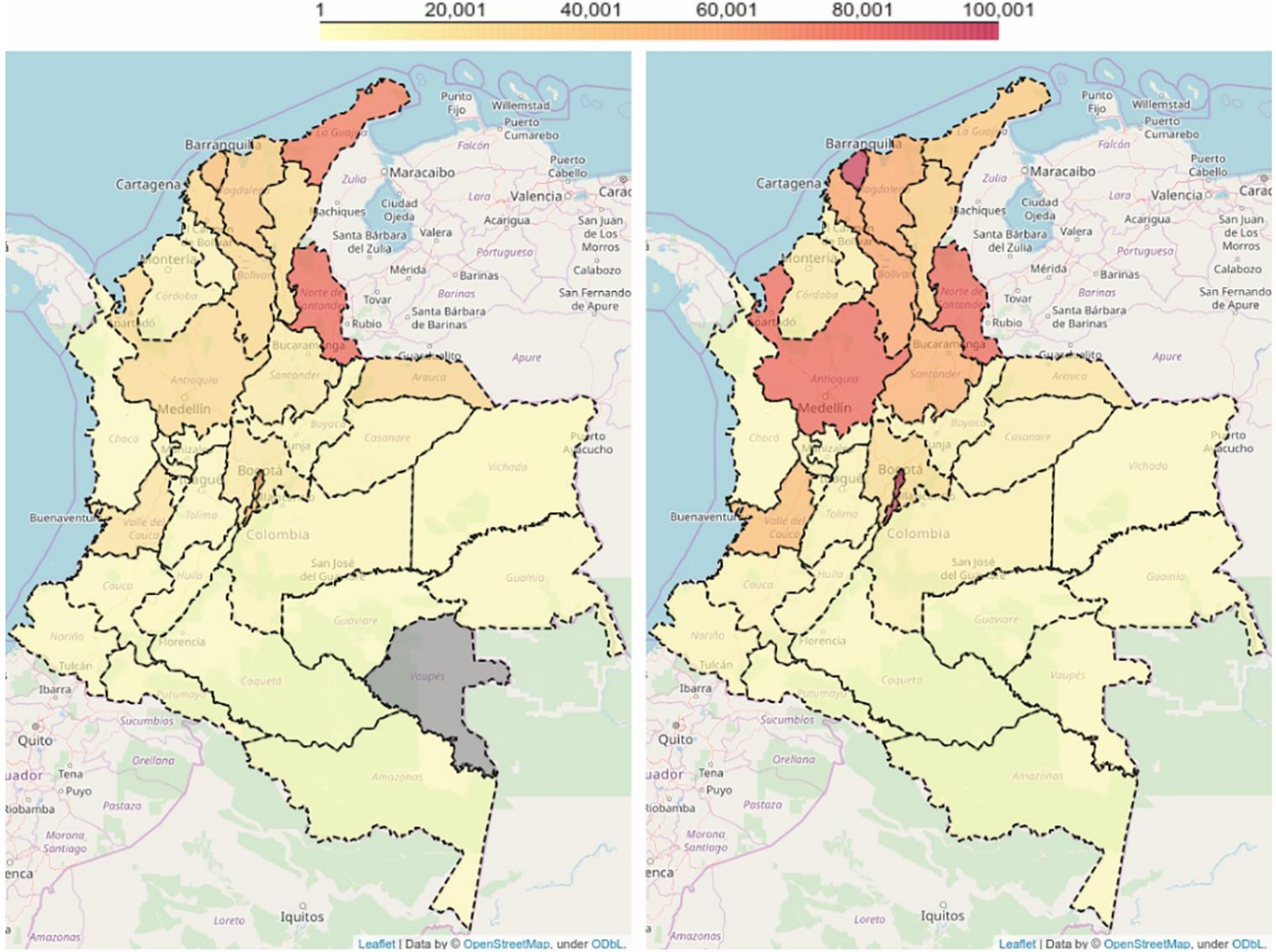
Reach

4.9K - 7.7K

The accuracy of estimates is based on factors like past campaign data, the budget you ...ta. Numbers are ...idea of performance ...e only estimates and ...

...elpful?

Validation w/ (Few) Available Data



(a) RAMV - April 6 to June 8, 2018

(b) Facebook - June 8, 2018

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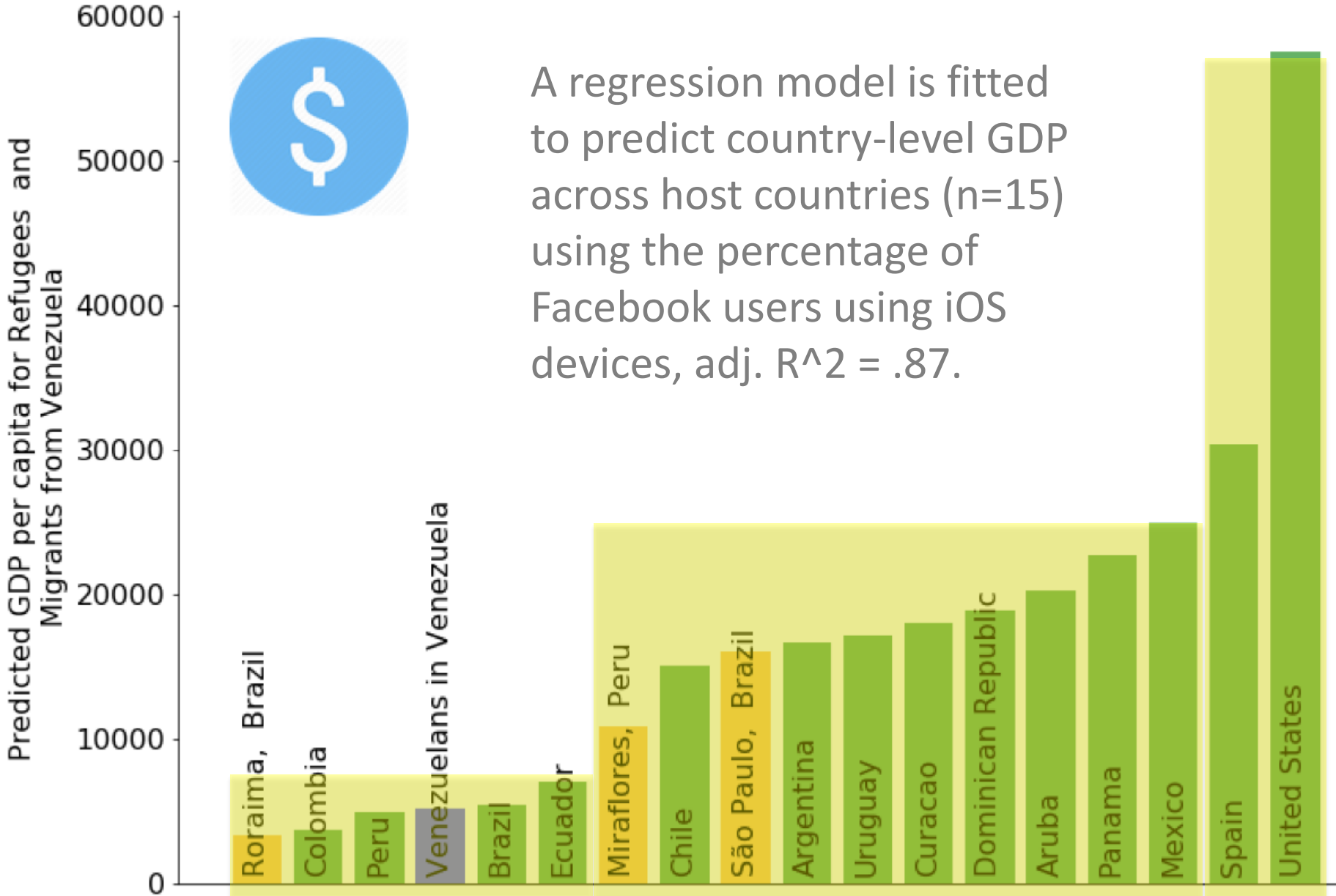
Predicted Income Based on OS



A regression model is fitted to predict country-level GDP across host countries (n=15) using the percentage of Facebook users using iOS devices, adj. R^2 = .87.

ASSESSMENT OF SYRIAN REFUGEES' SOCIO-ECONOMIC SITUATION IN LEBANON

UNITED NATIONS
الاسكوا
ESCWA

DATA POP ALLIANCE

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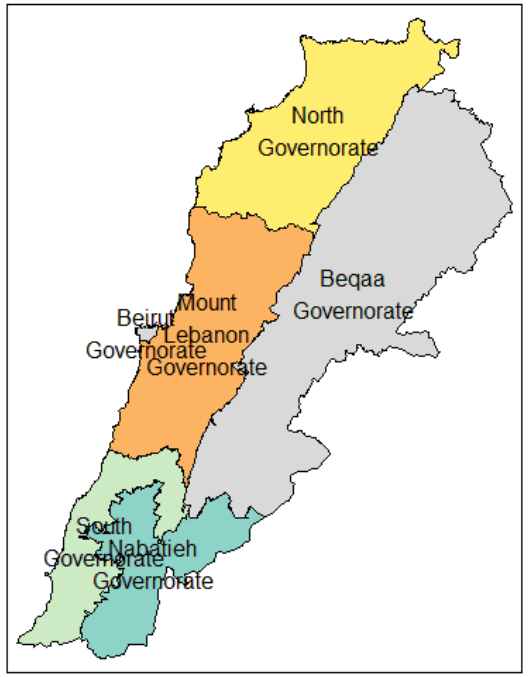
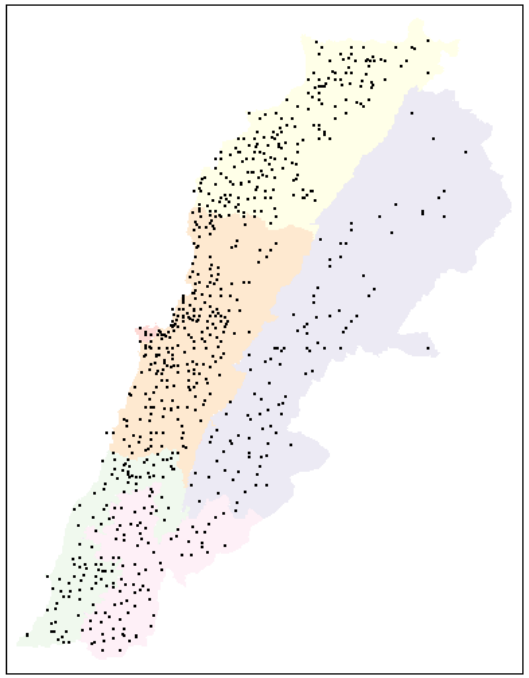
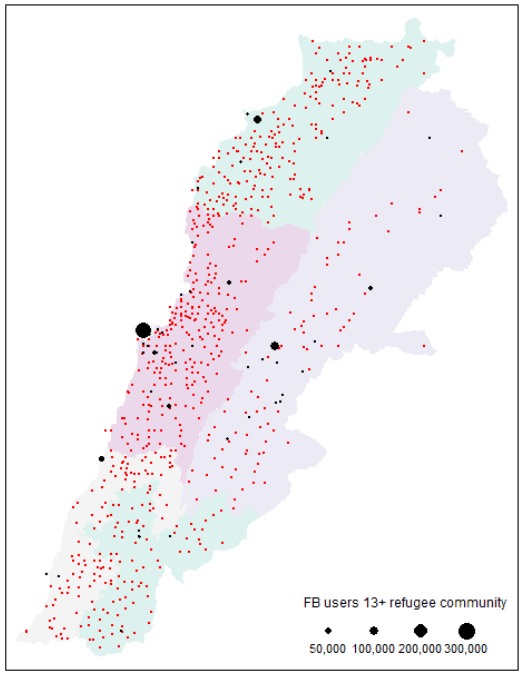
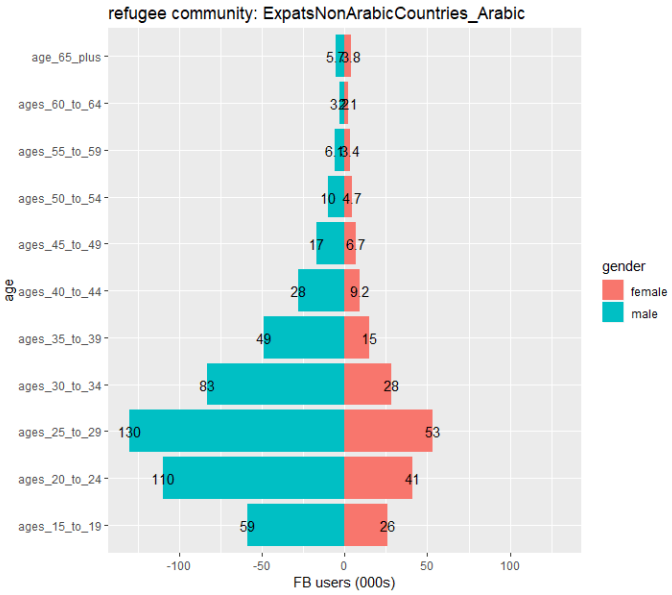
Collecting Facebook Audience Estimates









For 6 governorates and 770 cities

720k FB users “lives abroad” + AR

3.5M FB users overall

Only 157 cities with > 1000 FB users

Strong gender bias

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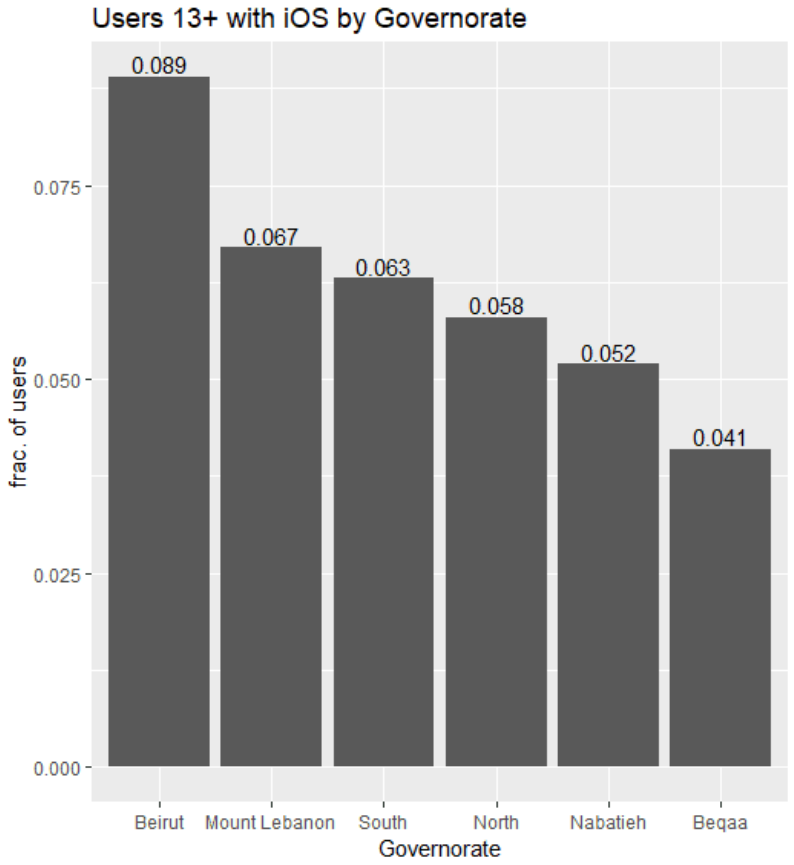
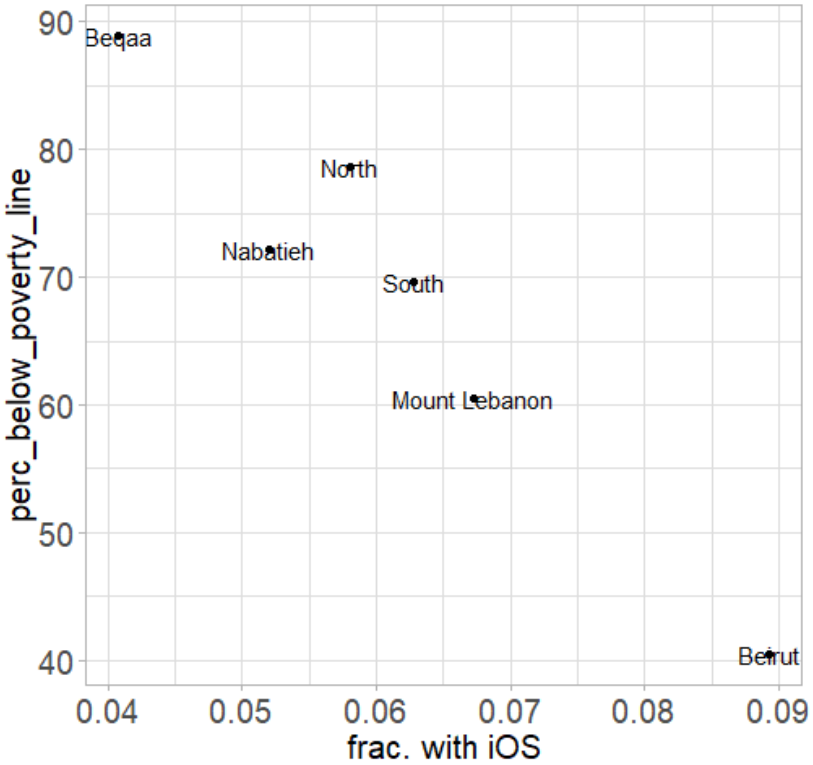
Is OS-Type Predictive of Poverty?





Predicting: % below poverty line	
Model variable	CV performance (LOOCV)
	R^2
% iOS device users	**0.895**
% high-end phones (iphones/galaxy) users	**0.678**

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CLOSING THOUGHTS

Strengths and Opportunities

+ (Almost) Real-time data
+ Can be collected at no cost
+ Anonymous and aggregate data
+ Directly measures one type of asset ownership
+ Could be used for connectivity mapping (4G)
+ Can be disaggregated by age, gender, …
+ Complementary strength to satellite imagery
+ Upwards development likely detectable

Limitations and Challenges

- Black box for how attributes are inferred
- Cross-context comparison risky due to bias
- Usage patterns change over time
- No historic data available
- Sparsity constraints (< 1000 FB users)
- Not all countries of origin are supported
- Downwards development likely not detectable
- Risk of misuse

Worth Exploring: Passive -> Active

- So far only “passive” use of advertising platform
  - Collect aggregate user data without users’ direct involvement
- Explore “active” use for targeted surveys
  - Show an advertisement message promoting a survey

Clearly not a representative sample, but quota sampling (age, gender, education level, …) is possible. Facebook-users-vs.-non-users bias remains though, and people without internet access are excluded.

Thanks!

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https://ingmarweber.de/publications/