The spatial distribution of amenities in Africa

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Large Rural-Urban Income Gaps in Developing World

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- Wages (Herrendorf and Schoellman, 2015)
- Value added per worker (Gollin, Lagakos and Waugh, 2014)

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- Important role in accounting for income differences across countries

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2. Sorting of heterogeneous workers.
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3. Unlikely that whole gap is due to sorting.
   $\rightarrow$ Bryan, Chowdhury, and Mobarak (2014), Akram, Chowdhury, and Mobarak (2017).

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- Are higher real consumption levels of urban areas offset by lower non-monetary amenities (Rosen, 1979; Roback, 1982)?
- Few attempts to measure amenities directly in developing countries.
- New detailed spatial evidence on three prime categories of amenities: public goods, crime and air pollution.

What We Find

- Almost all metrics, in almost all countries, constant or increasing in population density.
- Happiness and life satisfaction higher on average in urban areas.
- Migration towards cities.
- Suggest that little of the urban-rural consumption gaps are due to fixed negative amenities of urban life relative to rural life.

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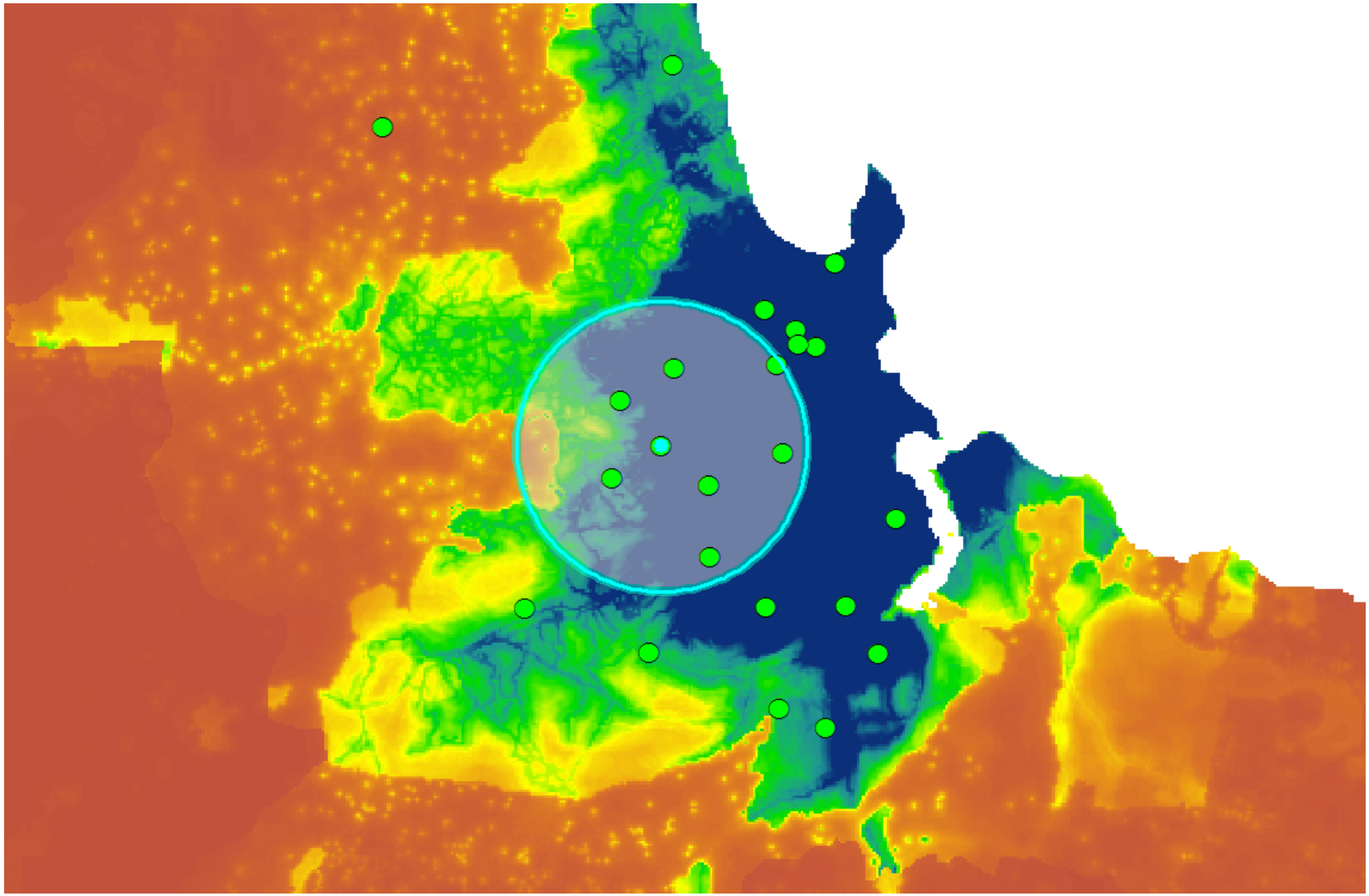
- Suggest that little of the urban-rural consumption gaps are due to fixed negative amenities of urban life relative to rural life.
- Obvious disamenity of cities: people.

Data

Data

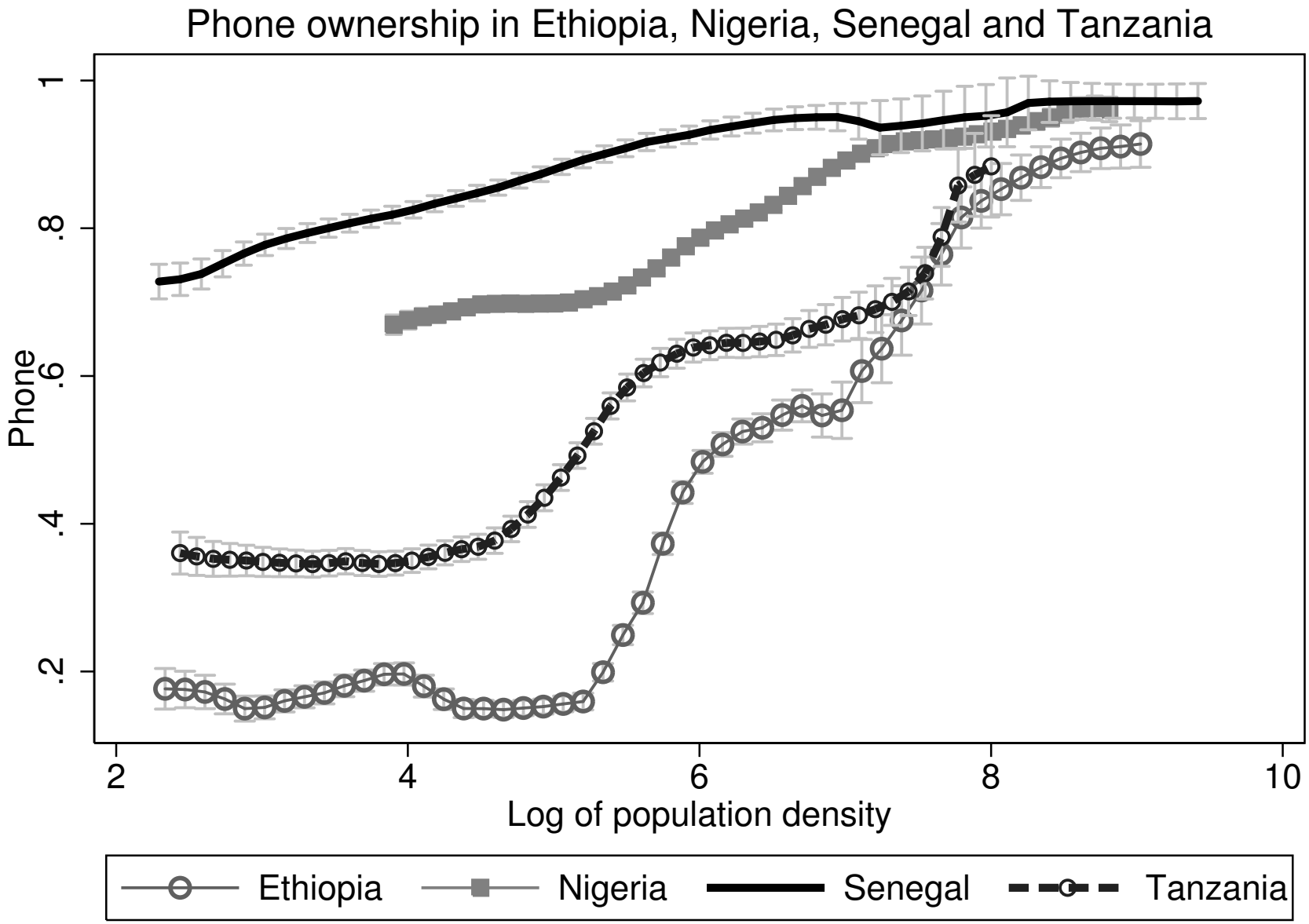
- Household-level data from Demographic and Health Surveys (DHS) ▸ more
  - Nationally representative surveys, consistent methodology
  - Use all DHS surveys from 2005 onwards with available GPS coordinates for survey clusters
  - 276,000 households from 20 countries
- Satellite-derived measures of air pollution data
- Crime data from Afrobarometer surveys and Living Standards Measurement Surveys (LSMS)
- Data on population density measures from Gridded Population of the World (GPW)
  - Resolution of $\sim 1km$ at equator
  - Based on census data; minimal amount of modeling
  - Restrict attention to countries with sufficiently high spatial detail

Example: DHS Clusters in Dar Es Salaam, Tanzania



▸ Displacement ▸ Sampling Weights ▸ Distribution of Densities ▸ Comparison with Census Data

Phone ownership



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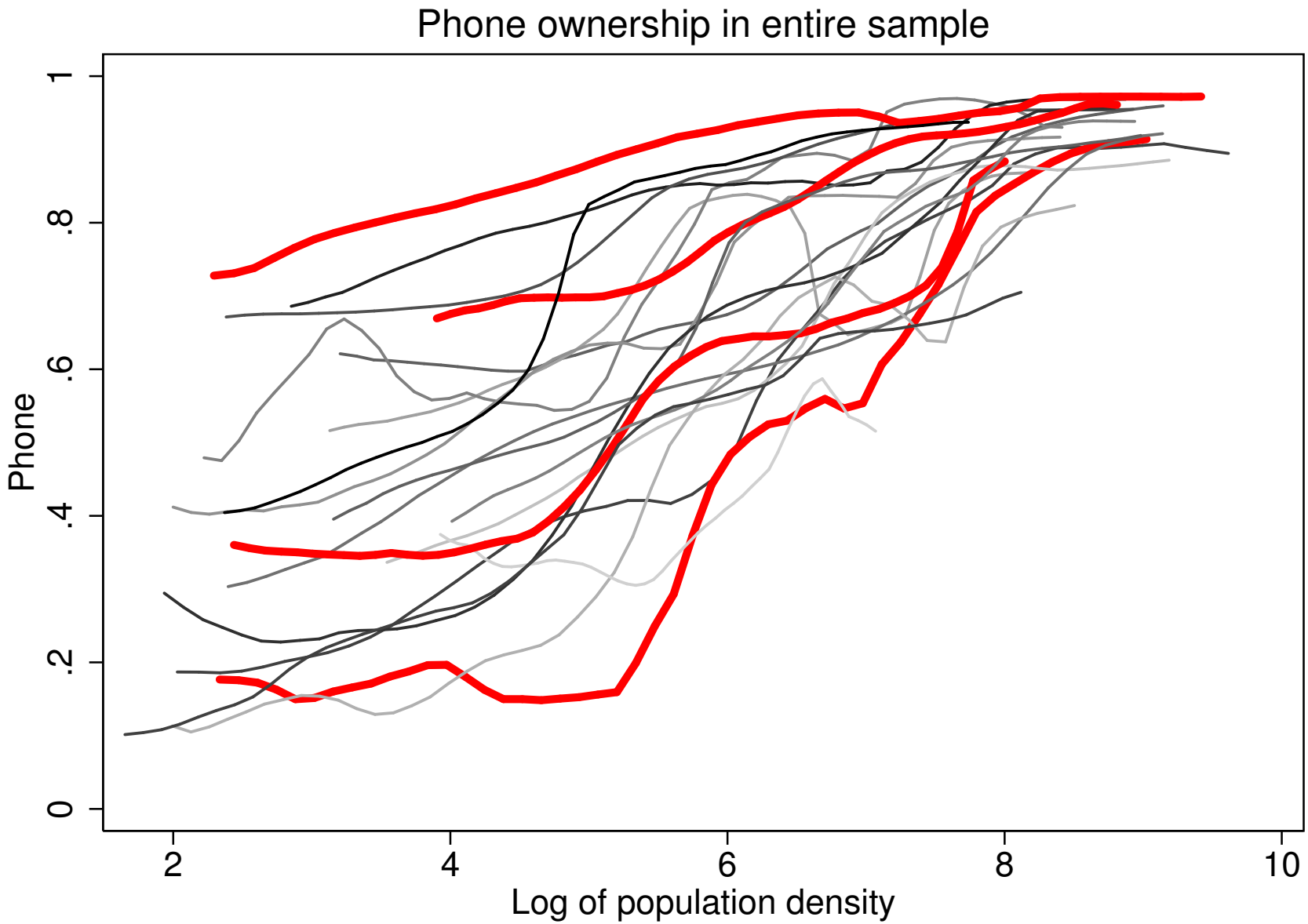


Linking Afrobarometer and Pollution with Population Density

Afrobarometer: develop algorithm that performs a series of exact and fuzzy matches of location names using online gazeteers.

Pollution: draw 10km fishnet and spatially link datasets.

Presentation

- Divide locations within each country into quartiles of populations density.
- Compute averages by quartiles.
- Compare averages across quartiles.

Public Goods

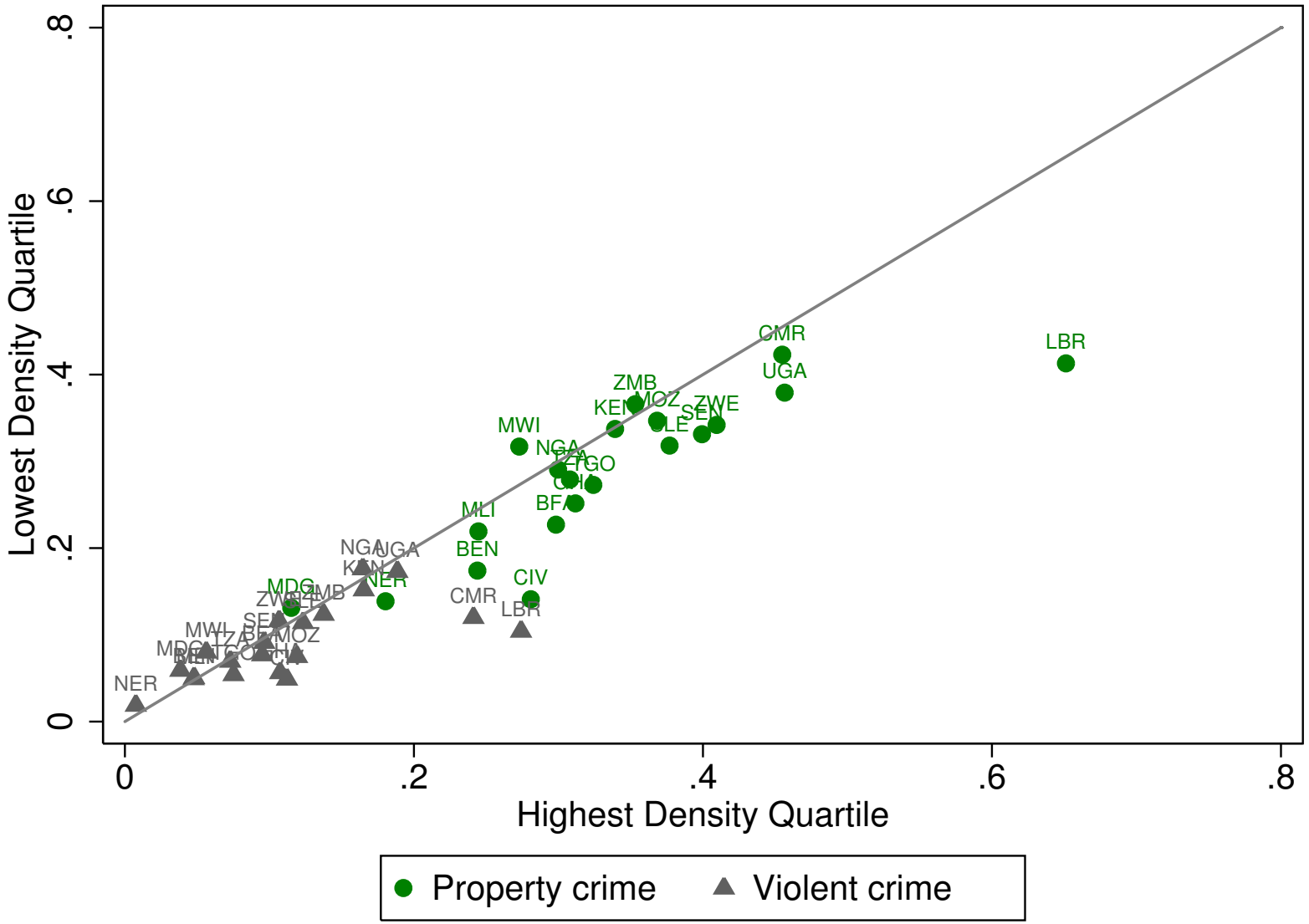
Public Goods

	Population Density Quartile			
	Q1	Q2	Q3	Q4
Electricity Grid	0.39	0.42	0.48	0.72
		1-0	0-4	0-10
Piped Water	0.36	0.35	0.42	0.67
		0-0	0-2	0-11
Sewage System	0.14	0.13	0.18	0.37
		0-0	0-0	0-7
Public School	0.91	0.90	0.90	0.90
		0-0	0-0	0-0
Health Clinic	0.59	0.58	0.62	0.73
		1-0	0-0	2-4
Police Station	0.29	0.30	0.33	0.47
		0-0	0-0	1-4
Paved Road	0.27	0.30	0.35	0.54
		1-0	1-2	0-6

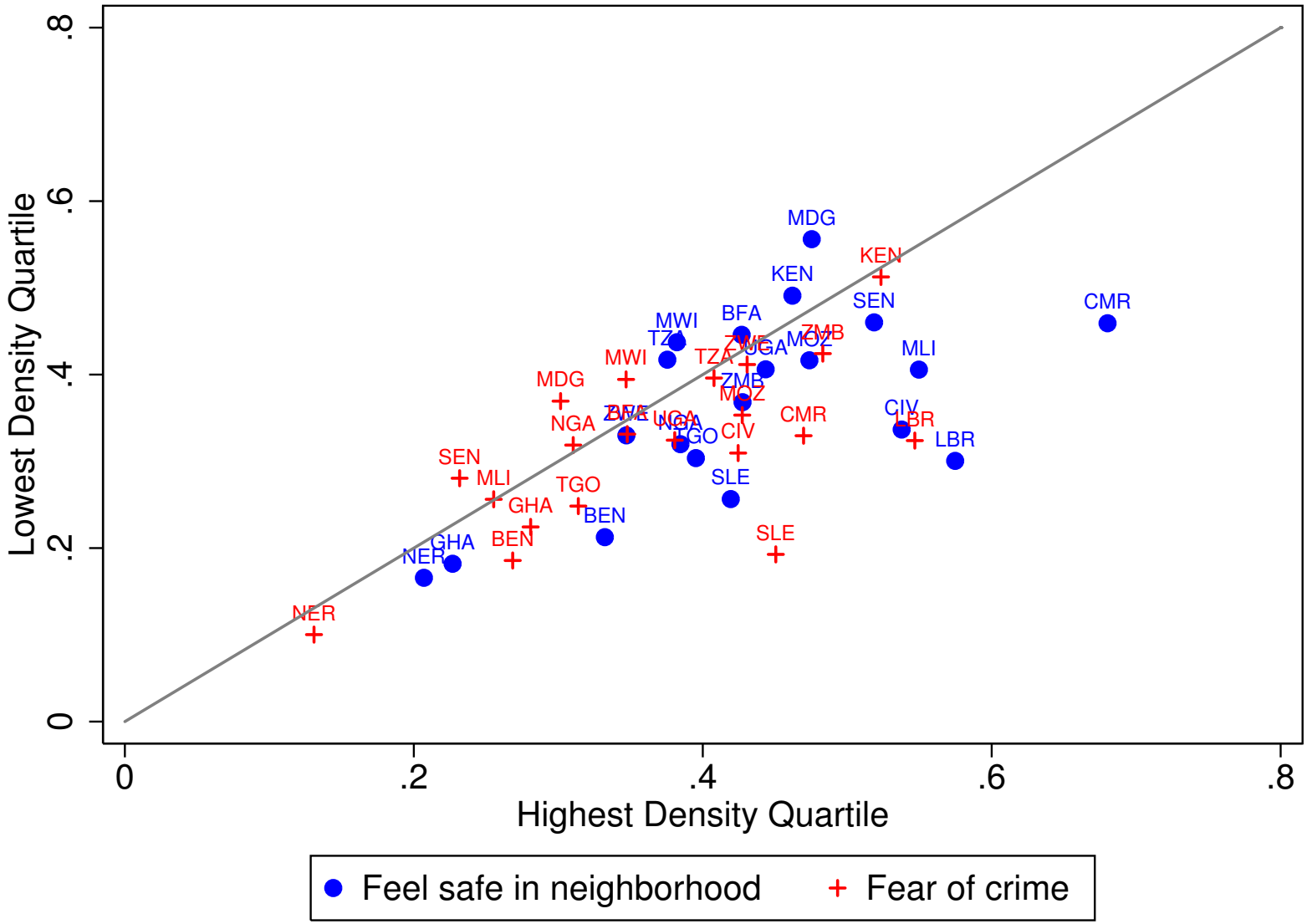
Crime

Property Crime and Violent Crime

Detail on variables | Evidence from LSMS



Fear of Crime



Crime by Density Quartile

	Population Density Quartile			
	Q1	Q2	Q3	Q4
Property crime	0.29	0.31	0.31	0.33
		0-3	0-1	0-4
Violent crime	0.1	0.09	0.1	0.12
		0-1	0-0	0-4
Fear of crime	0.32	0.33	0.34	0.36
		0-1	0-2	0-4
Feel unsafe	0.37	0.39	0.38	0.45
		0-2	0-1	0-3

Crime Variables – Summary

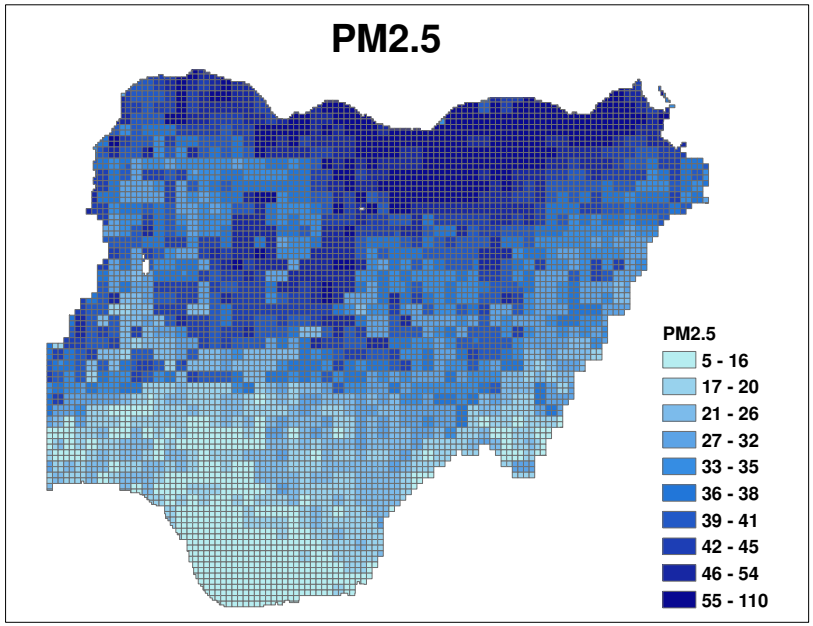
- Best evidence so far of negative amenities of cities
- Still, magnitudes small relative to size of urban-rural gap
- Bishop, Murphy (2011): San Francisco residents willing to pay $472 to avoid 10% increase in violent crime; $472 / $57,276 = **0.8% of income**
- Cohen et al (2001): US residents in 2000: willing to pay $120 to reduce chance of armed robbery by 10%; $120 / $34,432 = **0.4% of income**
- Ludwig and Cook (1998): US households in 1998 willing to pay $240 per year to reduce chance of gunshot injury by 30%; $240 / $51,939 = **0.5% of income**

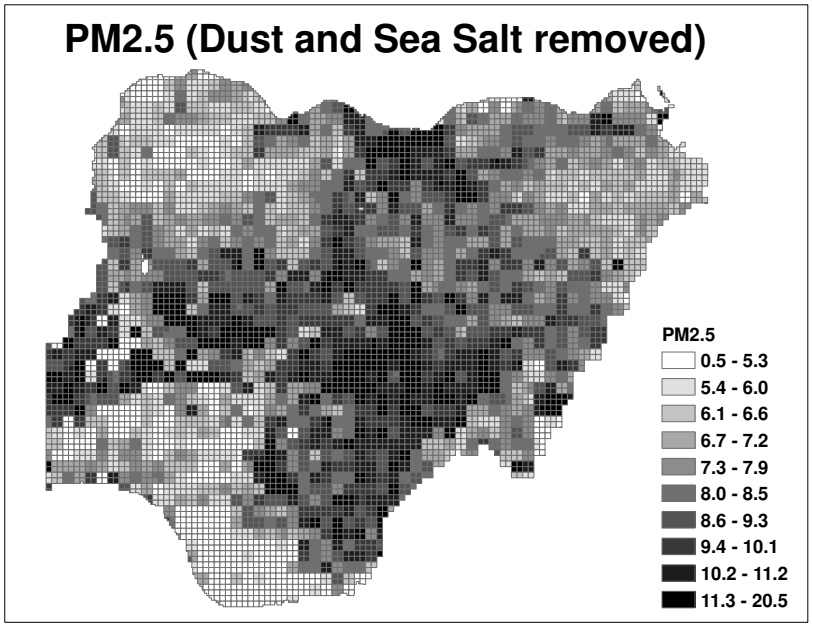
Pollution

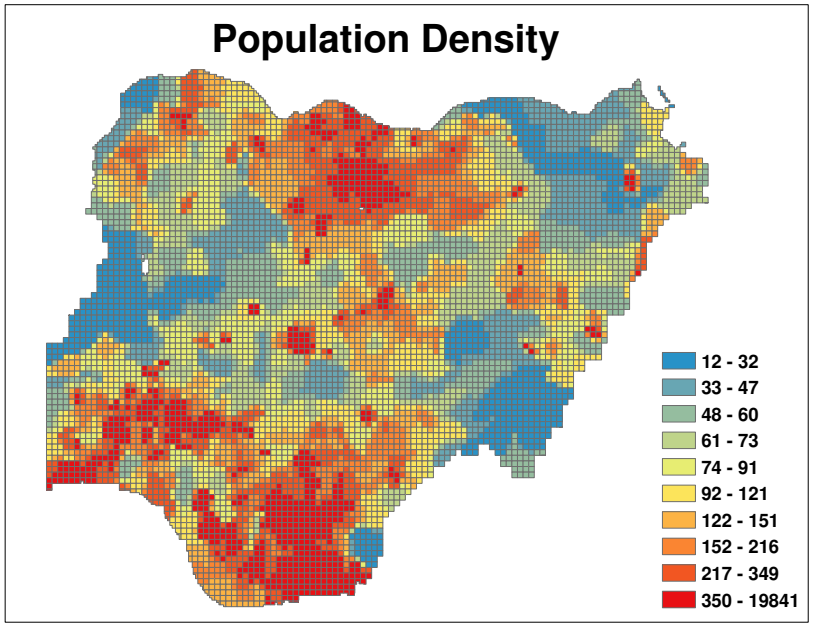
Pollution Variables

- Satellite data on outdoor air pollution at ground level
  - Van Donkelaar et al (2015, 2016): Fine particulate matter (PM2.5)
  - Geddes et al (2015): Nitrogen Dioxide (NO2)
- DHS evidence on indoor air pollution
  - Uses solid fuel source (wood, coal), and
  - Primarily cooks indoors
- Clear negative links of long-term exposure to health – literature enormous (Pope & Dockery, 2006: meta analysis of meta analyses)

PM2.5 Concentrations in Nigeria ($\mu g/m^3$)

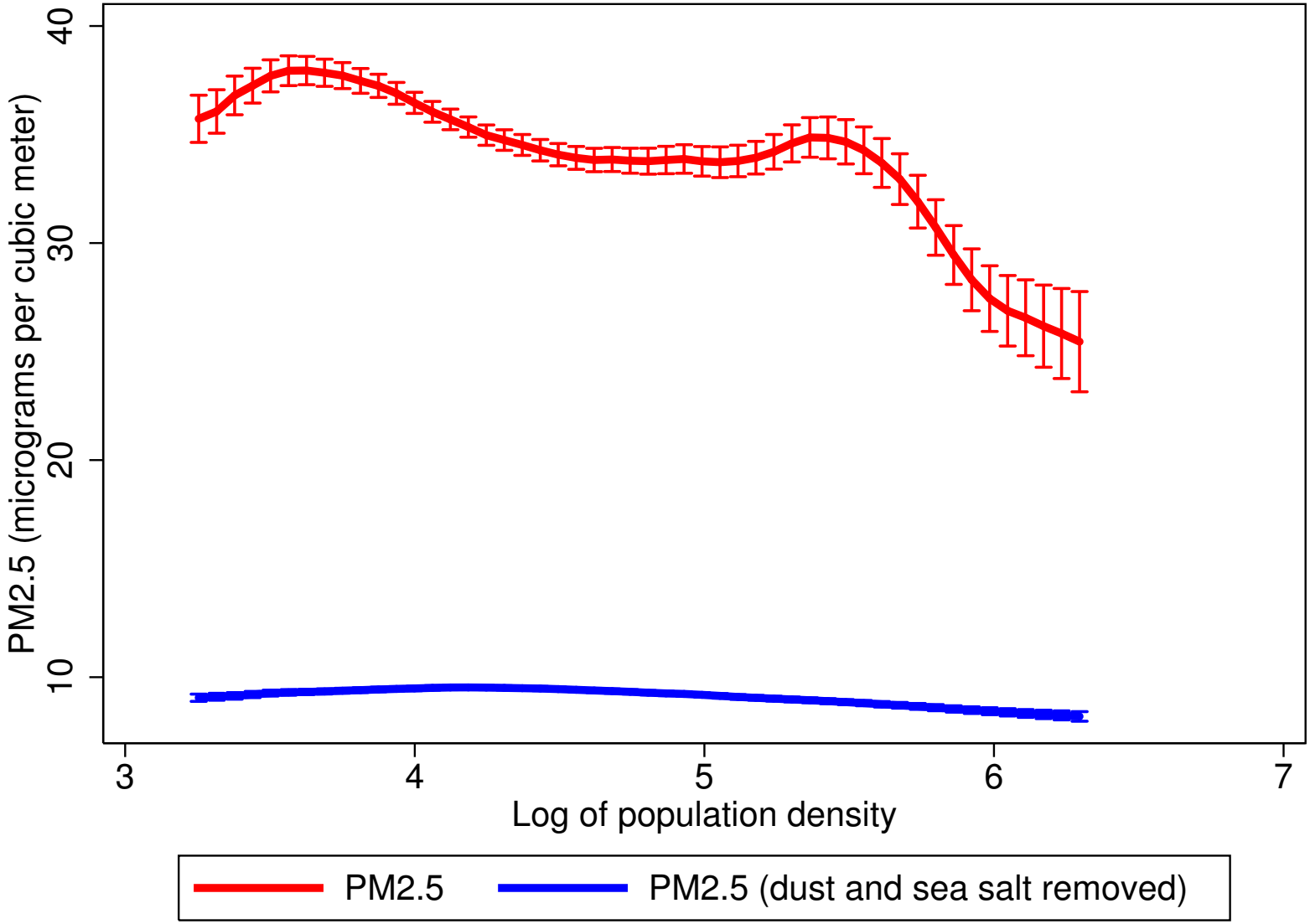




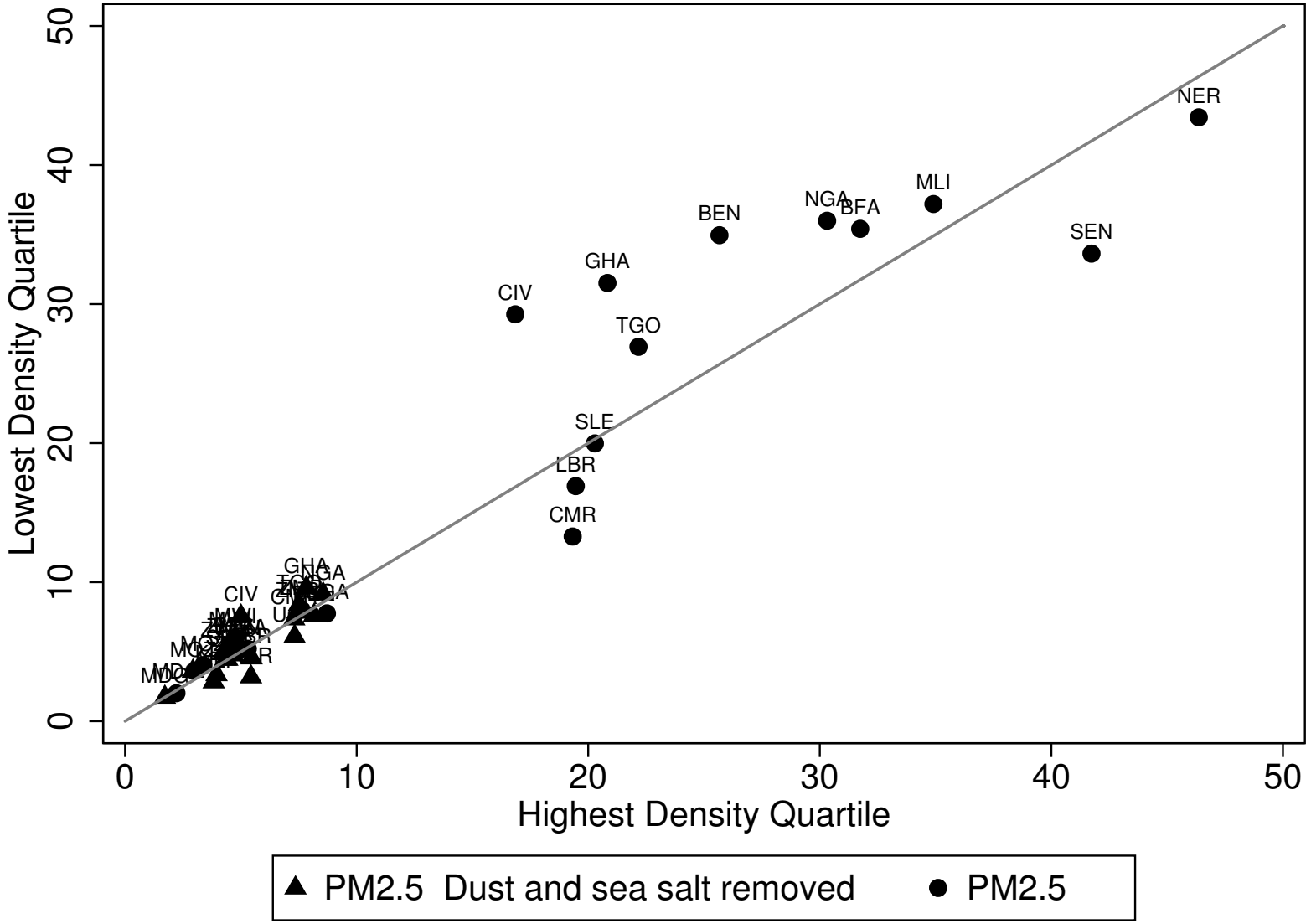


PM2.5-Density Gradient in Nigeria

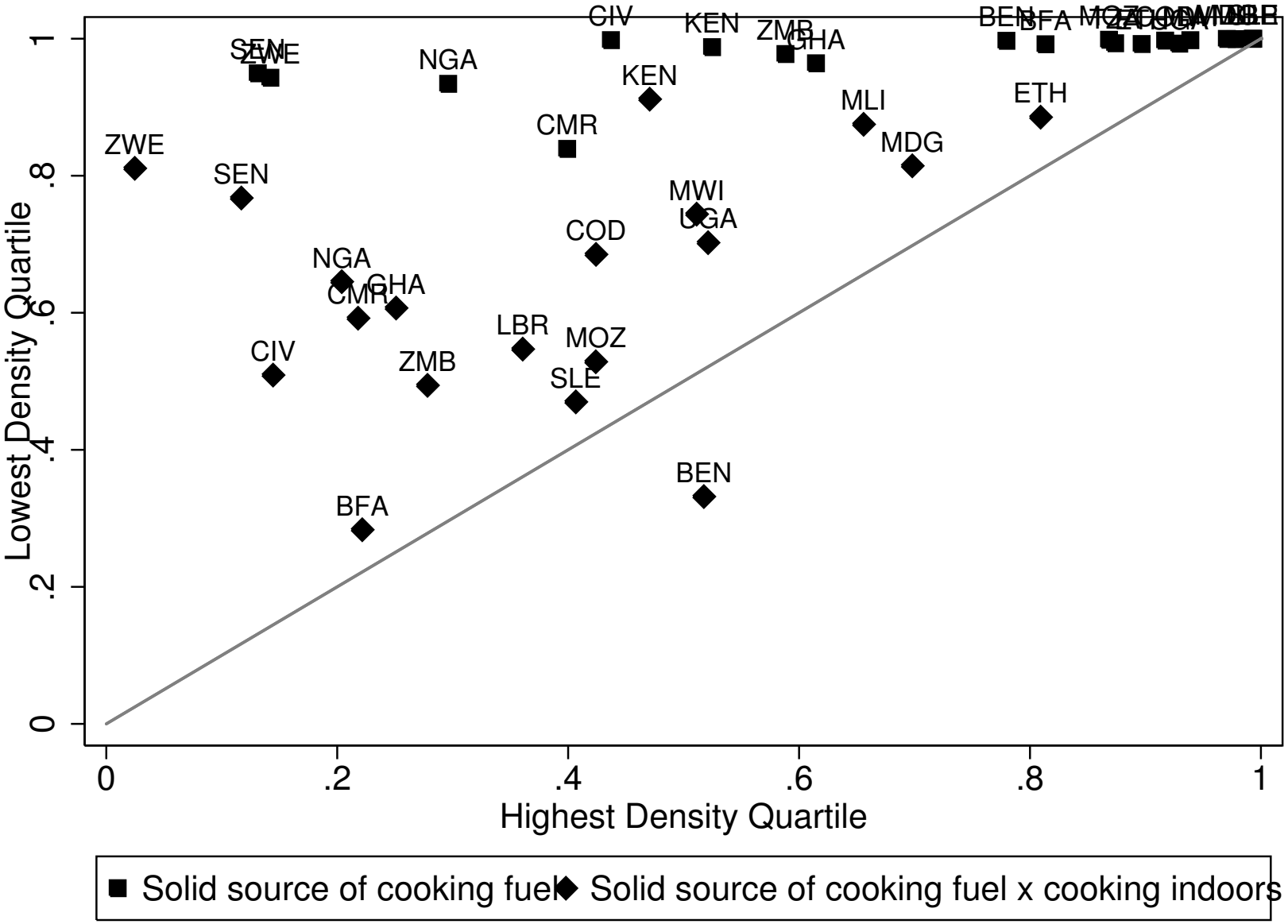
▸ Pollution in China and the US



Outdoor air pollution



Indoor air pollution



Pollution Variables – Summary

- Outdoor air pollution largely related to proximity to Sahara
- ...not population density
- Commentary on Africa's under-developed manufacturing sector
- Indoor air pollution improves on average with density
- Caveat: Africa clearly different from India and China
- Still, biggest rural-urban income gaps in Africa, so simple theory of pollution offsetting higher income in developing world hard to tell

Additional Evidence: well-being, migration, housing and health

Life satisfaction

Life satistfaction

	Average Life Satisfaction			Percent "Happy"		
	Urban	Rural	Difference	Urban	Rural	Difference
Burkina Faso (2007)	5.7	5.5	0.3**	81.0	78.4	2.6
Ethiopia (2007)	5.0	4.4	0.6*	63.6	58.3	5.2
Ghana (2007)	6.5	5.8	0.7***	82.1	75.5	6.5***
Nigeria (2011)	6.3	6.1	0.2**	89.2	74.7	14.4***
Rwanda (2012)	6.5	6.4	0.1	90.2	91.2	-1.0
Uganda (2001)	5.7	5.6	0.1	80.1	78.2	1.8*
Zimbabwe (2011)	6.3	5.6	0.6***	43.4	37.9	2.8*

Life satisfaction: reported on a scale of 1 (least satisfied) to 10 (most satisfied).

Happiness: fraction of individuals reporting that they are "quite happy" or "very happy." ("Taking all things together...")

Internal Migration

Rural-Urban and Urban-Rural Migrants as Percent of Adults

	Rural-to-Urban	Urban-to-Rural	Difference
	Percent of Adults		
Dem. Republic of the Congo (2007)	2.39	0.47	1.92***
Ethiopia (2005)	3.08	0.15	2.93***
Ghana (2008)	4.82	1.18	3.64***
Kenya (2008-2009)	7.60	0.58	7.02***
Liberia (2007)	2.46	2.24	0.23
Madagascar (2008-2009)	4.16	0.19	3.97***
Malawi (2010)	7.23	0.45	6.77***
Mali (2006)	4.46	0.66	3.80***
Nigeria (2008)	4.83	0.37	4.46***
Senegal (2005)	2.75	0.92	1.83***
Sierra Leone (2008)	4.44	0.36	4.08***
Zambia (2007)	4.00	0.56	3.44***

Health and housing

- Child Health (stunting, wasting, anemia, minimum acceptable diet): poor on average, but at least as good if not better on average in cities ▸ Child Health
- Housing quality (constructed floor/roof/walls, flush toilet, tap water, electricity) is strongly increasing with density ▸ Quartile averages
- Gradients robust to controlling for education ▸ Education Snakeplot ▸ Education Dotplot ▸ Control for education

Conclusion

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- Examined amenities across space in 20 African countries.
- Focused on three prime candidate amenities – public goods, crime and pollution.
- Every public good is at least as prevalent in areas with higher population density.
- Property and violent crime are high throughout density space in most countries, marginally higher in denser areas, but statistically insignificant for most countries.
- Using willingness to pay measures, differences in crime levels are dwarfed by differences in income.

Conclusion

- Outdoor pollution (PM2.5 and NO2) is largely unrelated to population density in Sub-Saharan Africa.
- Indoor air pollution: cooking indoors with solid fuels falls sharply with population density.
- People in rural areas face worse air quality on average than their urban counterparts.
- Reported happiness and life satisfaction are higher on average in urban areas.
- Net rural-urban migration rates are towards cities.

Conclusion

- At least for three prime-candidate amenities, unlikely that rural-urban income gaps are compensating for disamenities of urban life.
- Easier explanation: households vote with feet, move to cities, which offer higher consumption and at least as good amenities if not better.
- To better understand persistence of urban-rural gaps, focus on identifying and understanding frictions.