Urban Economics: Introduction

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Objectives

This course is going to try to address three or four, main questions,

- How can we use economics to understand the internal structure of cities?
- What can we say about how much productivity depends on cities, and why?
- How can we use economics to understand economic geography at a larger scale? For example, what can we say about the size distributions of cities, their locations, and the distribution of activities across them?

Outline I

Today, I describe some important facts about cities. After this, we're going to study a series of particular topics and models that help to explain these some of these facts.

1. Spatial equilibrium. This is one of the two or three big ideas in the course. Everything builds from this (my notes).
2. The monocentric city model. This is basically, spatial equilibrium plus commute costs plus exogenous central workplace. It is probably the single most important model for the field. It comes in a several flavors.
    1. The linear city – the easiest version – a continuum of identical people and a continuum of locations.
    2. Add housing (Brueckner, 1987).
    3. Allow for a small number of household types (LeRoy and Sonstelie, 1983), also Fujita (1989).

Outline II

4. Endogenize firm location Fujita and Ogawa (1982).
5. Discrete space and a continuum of agent types (various, my notes). This is where almost all current research effort is directed.

3. The Hedonic model (Rosen-Roback). This is a cousin of the monocentric city model and is probably the second most widely used model in the field (Roback, 1982).

The monocentric city model is one of the best economic models I know. It rationalizes many features of the world in exchange for a small number of plausible assumptions about how people behave.

Outline III

- The monocentric city model explains how cities are organized, conditional on people wanting to be in them. An important question for the field is understanding why this occurs. The not very informative answer is ‘because of agglomeration economies’. We’ll spend some time talking about what is known about this.
- Another important topic involves studying a larger geography and the systems of cities that inhabit such geographies. Here we will ask questions like,
  - How many cities are there and how large are they?
  - Where do they locate?
  - What patterns of industrial specialization do we see?

  These questions have received a lot of attention recently, and there has been some interesting progress.

Outline IV

- If there are topics you are particularly interested in, let me know and we can try to work them in.

Why bother? I

The interest of these questions hinges in part on their immediate economic importance and their relevance to other important economic phenomena.

- Cities are important: Many people live in them.
- Urbanization is related to development and growth.
- ... and spatial equilibrium is useful for thinking about many other important problems,
  - Chetty et al. (2016) and Katz et al. (2001) investigate the effect of a randomly assigned subsidy (the MTO experiment) that encourages poor households to move to better neighborhoods. How do we think about the welfare implications of such a policy if we do not change the number of housing units?

Why bother? II

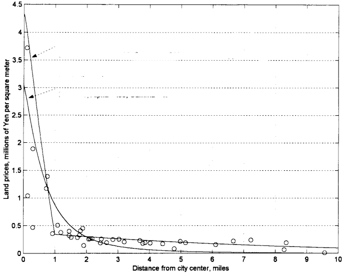
- Which children live in houses with lead paint? What are the implications of an expensive remediation mandate for rental housing for the level and distribution of exposure?
- ‘Opportunity zones’ provide tax cuts for capital investments in ‘poor’ census tracts. Do these zones create opportunity? Do they create opportunity for the intended population? Do they shift employment from one place to another?

Some facts about the internal structure of cities

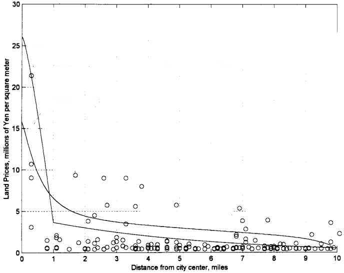
A rent gradient is:

$$\ln(\text{Rent}) = A + B\ln(\text{Distance to CBD}) + \varepsilon,$$

Fact #1: Rent gradients slope down approximately log linearly. This is true almost everywhere.

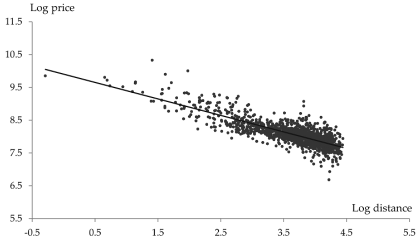


1991 land prices in Hiratsuka, Japan

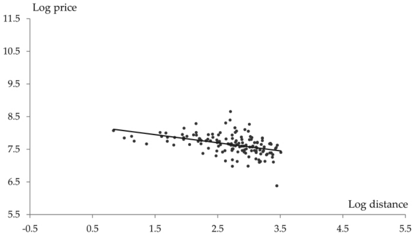


1991 land prices in Yokohama, Japan

Figures from Lucas et al. (2001) (in levels) showing the rapid decline of land rent with radial distance from the center of two



2012 land prices in Paris, France



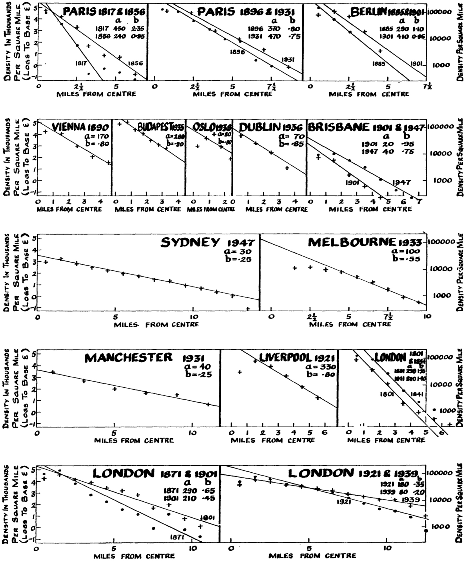
1991 land prices in Dijon, France

From Combes et al. (2019). They show the decline of the natural logarithm of rent with the logarithm of radial distance to the center of two French cities. Note the good fit of the log linear model.

Japan and France show the same exponential decline (one in levels and one in logs). Land rent behaves the same way in France as it does in Japan (and almost everywhere else I've seen it checked). This is pretty neat. It did not have to be true.

Fact #2-3: Population density gradients slope down about loglinearly. They have been getting flatter over time.

Clark (1951) looks at census data for many cities from early in the industrial revolution until the mid-20th century.


PARIS 1817 & 1856
PARIS 1896 & 1931
BERLIN 1885 & 1901
VIENNA 1890
BUDAPEST 1935
OSLO 1938
DUBLIN 1936
BRISBANE 1901 & 1947
SYDNEY 1947
MELBOURNE 1933
MANCHESTER 1931
LIVERPOOL 1921
LONDON 1801 & 1841
LONDON 1871 & 1901
LONDON 1921 & 1939
MILES FROM CENTRE
DENSITY IN THOUSANDS PER SQUARE MILE (LOGS TO BASE ε)
DENSITY PER SQUARE MILE

Notice:

- All have broadly downward sloping density gradients (except near zero where there is industry).
- All get flatter and lower over time – cities are spreading out.
- Population densities were MUCH higher than they are now. Several large cities recorded densities of 100,000/sq mile. Very few modern cities are anywhere near that dense.

Fact #4-6: Employment density gradients slope down about loglinearly, are steeper than population density, and vary by sector.

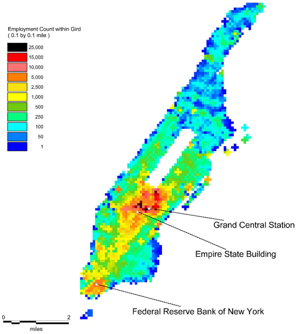


Fig. 2. Employment density in manhattan.

Employment density in Manhattan from Liu et al. (2020)

TABLE 3

Averages of Gradients by Sector and Year[a]

Sector	1948	1954	1958	1963	1970/1972[b]	1977/1980[b]
Population	0.58	0.47	0.42	0.38	0.29	0.24
Manufacturing	0.68	0.55	0.48	0.42	0.34	0.32
Retailing	0.88	0.75	0.59	0.44	0.35	0.30
Services	0.97	0.81	0.66	0.53	0.41	0.38
Wholesaling	1.00	0.86	0.70	0.56	0.43	0.37

[a] 1948–1963 data: [7, Table 12, p. 42].
[b] Noncommensurate years (see text).

Various gradients from Macauley (1985). Population gradient is flatter than employment. Averages over 18 US MSA's Employment density has been documented less carefully than population. It's harder to track.

Building density has not been studied very much. It's hard to observe. A recent paper (Henderson et al., 2021) uses satellite data to look for Nairobi. They measure is 'building volume per area' for formal and informal settlement areas.

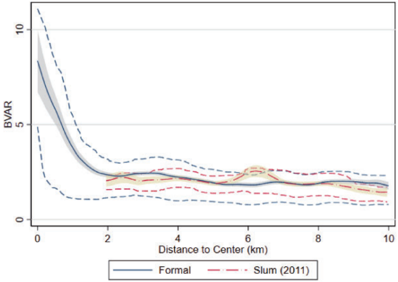


FIGURE 4

Built volume per unit area (BVAR)

Notes: Built volume to area ratio (BVAR) by distance from the centre for formal and slum sectors. Lines show the local average BVAR, shaded areas show local 95% confidence intervals, and dashed lines show local 25th and 75th percentiles. Local statistics calculated using an Epanechnikov kernel with bandwidth of 300 m.

Fact #7: Undeveloped land gradient slopes up

For Houston between 1950 and 1980, Mieszkowski and Smith (1991) look at developed land share as a function of distance from center by looking at building permits. Permits report lot size and house size, so we they can look at population density, population density of developed land, and undeveloped share as a function of distance.

Table 3

Gross vs. net density gradients; 1980 census tract estimates.

	Slope coefficient
Total land area vs. occupied land area	
Net density	−0.058
% occupied	−0.090
Gross density	−0.148
Total land area vs. occupied residential land area	
Net density	−0.050
% occupied	−0.098
Gross density	−0.148

Density gradient of all land is flatter than the density gradient of developed land. Density of developed land falls by only about 5%

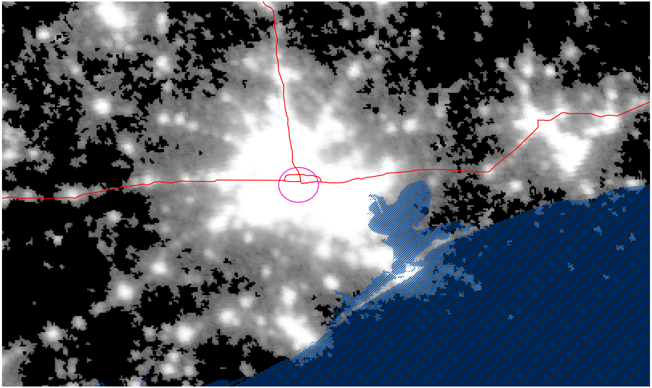
with each doubling of distance to center, while overall density falls by 14%.

50% developed share 8 miles from cbd, but much new development at 25-30 miles.

This is often called ‘leapfrog development’. It is not possible in standard models.

Fact #8: Cities are not really monocentric

Here is Houston in 1992, just after the end of the Mieszkowski and Smith (1991) study period(ring is 10k radius, red is interstate highways):



See also Harrison Jr and Kain (1974) for more on how density gradients vary over time. They argue that size of city and time are main determinants of NEW residential construction. This means that new development in Boston and LA is about the same density (which seems to be true).

Some facts about Urbanization and Development

	World population	Urban Population	Urb. Share
1960	3b	1b	0.34
2012	7b	3.5b	0.52

- There are more people in cities today than there were people in the world in 1960.
- 80% of world economic activity is in cities. With only half the people in cities, this means an average urban resident in about 4 times as productive as an average rural resident.

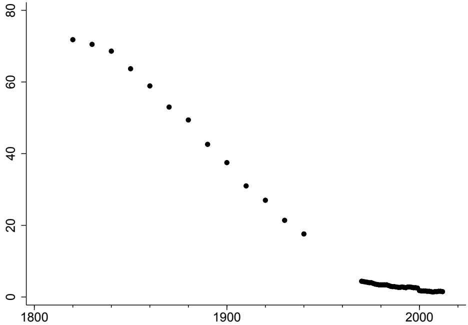
If you are interested in growth or development, you should probably be interested in cities.

Stylized facts about US/European economic development

The following series of slides presents evidence about the following features of US economic and urban development,

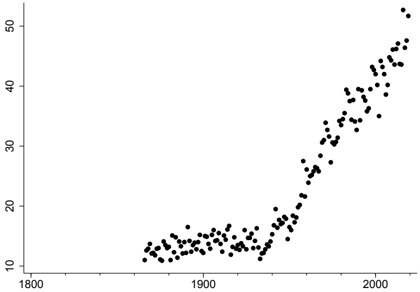
- Agricultural output has risen dramatically
- All output has risen dramatically.
- Urban share of population has risen dramatically. Mostly in the suburbs, since 1950.
- Urban productivity increases with city size.
- Urban mortality premium has fallen over time.
- Urban wage premium has been about constant (as a share) over time.

Agricultural Share of Population, US 1820-2012



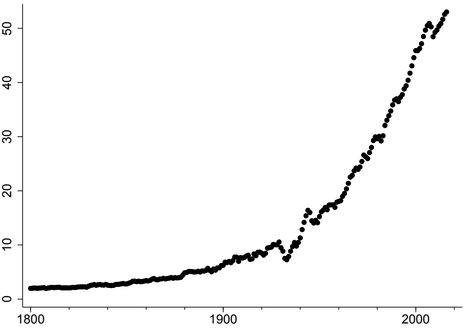
Note: Percent of Employment in Agriculture in the United States, Annual, FRED Graph Observations, Economic Research Division Federal Reserve Bank of St. Louis. The agricultural share of employment has declined from about 72% in 1820 to about 1.5% in 2012.

Wheat Yields, US 1866-2019



Note: From US Historical Census. Agricultural yields have increased more than fast enough to keep everyone fed.

US GDP from 1800 to 2016



Note: Real per capita GDP in constant 2011 dollars from Bolt and Van Zanden (2014). From 1800 to 2016, US incomes increased from 1980$ to 53015$, a factor of about 27.

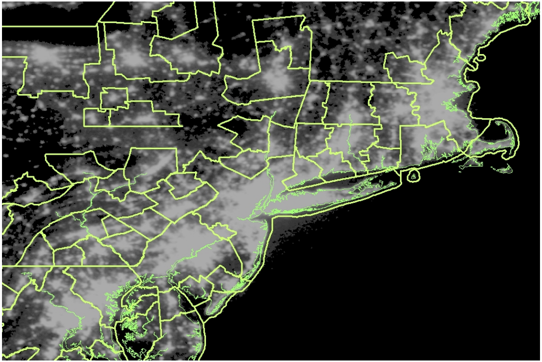
Aside – Defining ‘cities’ in real life I

- We need some real group of people to try to match to our theoretical cities.
- If you think carefully about this, it’s pretty hard.
- I think we want something like a ‘labor market’. That is, an area in which all residents work and live.
- This is fussy. In the US, the main unit is a metropolitan statistical area, or MSA. Think of these as metropolitan areas of at least 50k built from counties. They are purely reporting units. There are a few different flavors, ‘micropolitan statistical areas’, CBSA’s, CMSAs. Definitions are easy to find on the census website.
- Many of the empirical papers we discuss will use this definition of ‘city’.

Aside – Defining ‘cities’ in real life II

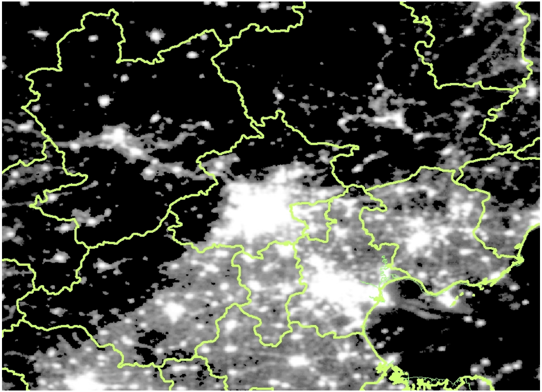
- Other candidates are,
  - municipal boundaries: These are administrative boundaries and need not contain their CBD; consider any suburban municipality.
  - ‘Urbanized areas’, these are more about land use than about function. They are more narrowly about where people live and they tend to match pretty closely to remote sensing data showing the presence of buildings.
- Other countries typically keep track of pretty similar units, either based on administrative or reporting boundaries.

Aside – Defining ‘cities’ in real life III



MSAs in New England, cs 2019 and lights at night ca 2013. The New York MSA is in the center of the picture.

Aside – Defining ‘cities’ in real life IV



Prefectural cities in China ca 2005. and lights at night ca 2013, Beijing is central. Prefectural cities are the nearest analog to US MSAs. But, prefectures are also administrative units in China, whereas, MSAs are purely reporting units in the US.

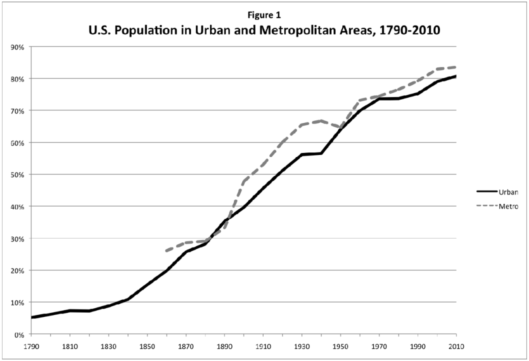


Figure 1: Before 1950, the urban share only includes residents living in incorporated places. From 1950 onward, the urban share includes residents living in both incorporated and unincorporated places. Data on urban population shares are from the U.S. Census Bureau. Metropolitan area population shares were calculated using data and the contemporaneous definitions provided by IPUMS in each year.

Boustan et al. (2013). The urban share of US population has grown monotonically from 5% in 1790 to about 90% in 2010.

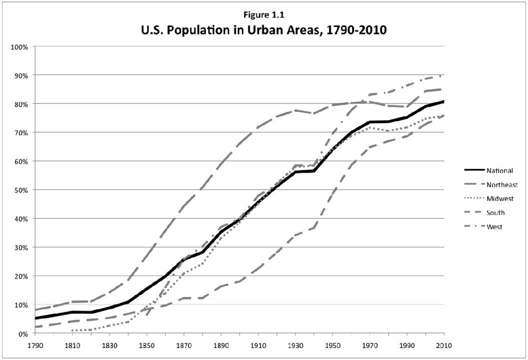


Figure 1.1: Before 1950, the urban share only includes residents living in incorporated places. From 1950 onward, the urban share includes residents living in both incorporated and unincorporated places. Data on urban population shares and region definitions are from the U.S. Census Bureau.

Boustan et al. (2013). The Northeast(South) was much more(less) urbanized than the rest of the country until pretty recently.

Figure 5: City and suburban population growth by decade, 1940–2000

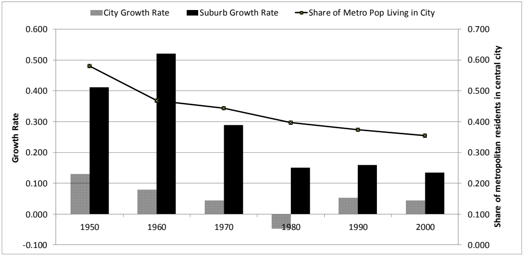


Figure 5: Source is Boustan and Shertzer (2013). Values refer to the decade ending in the census year on the *x*-axis. Sample includes 103 metropolitan areas anchored by a city that had at least 50,000 residents in 1970. City and county population are taken from the City and County Data Books. The 1970 county definitions of metropolitan areas are applied in all years. Suburban population is computed as the total metropolitan area population minus the city population.

Boustan et al. (2013). Most urban population growth since 1950 has been suburban.

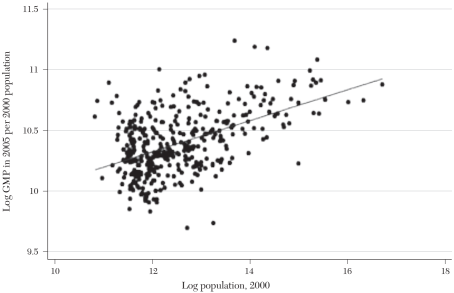


Figure 1. Productivity and City Size

Notes: Units of observation are Metropolitan Statistical Areas under the 2006 definitions. Population is from the Census, as described in the Data Appendix. Gross Metropolitan Product is from the Bureau of Economic Analysis.

The regression line is log *GMP per capita* = 0.13 [0.01] × log *population* + 8.8 [0.1]. $R^2 = 0.25$ and $N = 363$.

(Glaeser and Gottlieb, 2009) y is $\ln(\text{Gross Metropolitan Product})$, x is $\ln(\text{Metropolitan Population})$

US cities are more productive as they are larger, today. Doubling city population increases GMP by about 13%. Such effects are usually called ‘agglomeration economies’ (much more later).

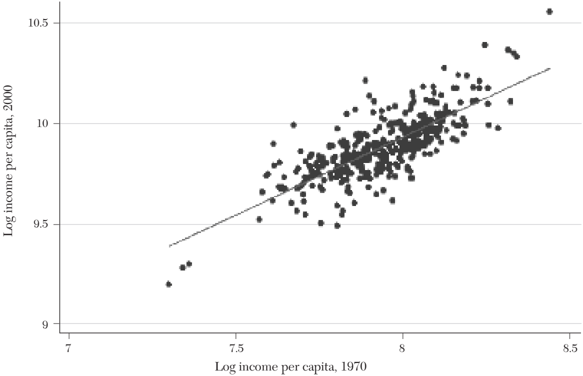
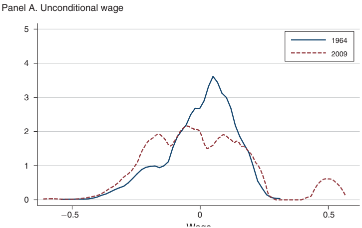


Figure 2. Income Over Time

Notes: Units of observation are Metropolitan Statistical Areas under the 2006 definitions, using Metropolitan Divisions where applicable. Data are from the Census, as described in the Data Appendix.

The regression line is *Income 2000* $= 0.77$ [0.03] $\times$ *Income 1970* $+ 3.75$ [0.26].
$R^2 = 0.60$ and $N = 363$.

(Glaeser and Gottlieb, 2009) City GMP is persistent and so is city size. The relationship between size and productivity is persistent. It’s not just a statistical oddity.



(Hsieh and Moretti, 2019) Distributions of de-meaned log wages across MSAs weighted by MSA employment in two years.

Conditional wage controls for three levels of educational attainment (high school dropout, high school, college), race, gender, age, and union status in each MSA. 220 MSAs observed in 1964 and 2009.

Wage dispersion across cities is increasing over time.

Table 1
Some simple correlations

	Mean local wage in 1998 ($\log w_{a,98}$) as a function of:			
	(1) $\log Density_{a,98}$	(2) $\log Emp_{a,98}$	(3) $\log Diversity_{a,98}$	(4) $Skill_{a,98}$
Intercept	5.720[a]	5.147[a]	5.329[a]	5.352[a]
	(0.014)	(0.025)	(0.037)	(0.006)
Coefficient	0.049[a]	0.049[a]	0.047[a]	1.763[a]
	(0.003)	(0.004)	(0.012)	(0.085)
R^2	0.51	0.34	0.04	0.56

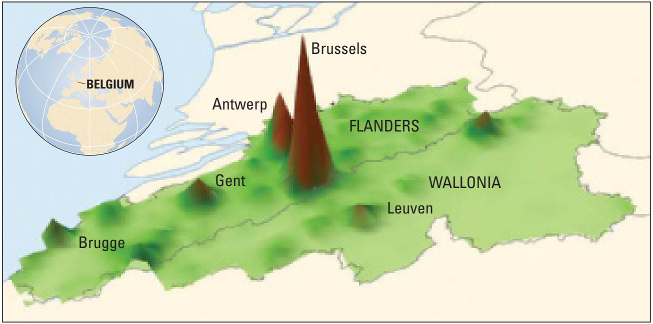
Notes. 341 observations. Standard error between brackets. $Density_{a,t}$ is the density of employment in employment area a and year t; $Emp_{a,t}$ is total employment; $Diversity_{a,t}$ is the diversity of employment as measured by an inverse-Herfindahl index, $Diversity_{a,t} = Emp^2_{a,t} / \sum_k Emp^2_{a,k,t}$ where subscript k denotes the industries; and $Skill_{a,t}$ is the employment share of professionals.

[a] Significant at the 1% level.
[b] Idem, 5%.
[c] Idem, 10%.

- French cities are more productive as they are larger or denser.
- It's true everywhere that people have checked in the modern world.

...most countries look like this I

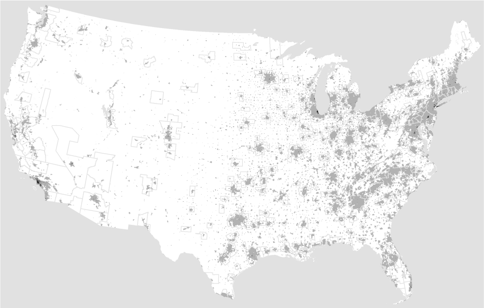
Map 1.1 The landscape of economic mass is bumpy, even in a small country like Belgium



Source: WDR 2009 team and World Bank Development Research Group, based on subnational GDP estimates for 2005. See also Nordhaus 2006.

Scott (2009). Economic activity tends to be very concentrated in small areas.

...most countries look like this II



(a) Density deciles of population

So does population. 10% of US population lives in the black areas in 2010 (Duranton and Turner, 2018) (Actually, poor country population is more concentrated, see Henderson and Turner (2020) below.).

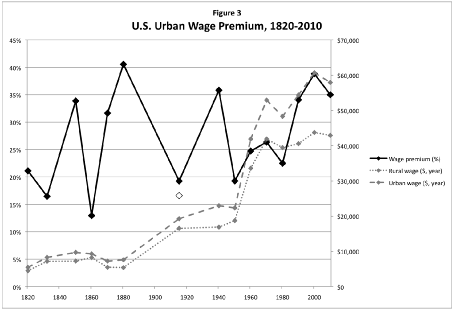
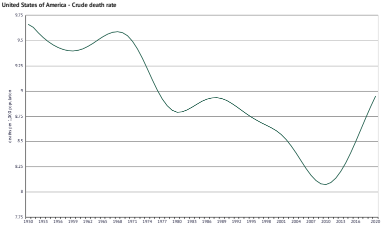


Figure 3: All dollar figures for the period 1913 to 2010 are inflation-adjusted to 2010 values using the urban consumer price index from the BLS; David and Solar's (1977) historical cost of living estimates are used for years prior to 1913. The values for 1820 and 1832 are from Sokoloff and Villaflor (1992), and represent the urban wage premium in New England and the Mid-Atlantic for male manufacturing workers in a county with at least one city of 10,000 residents or more, or in a county adjacent to such a county. The premium for 1850 to 1880 was calculated using data from the Census of Manufacturing, and represents the premium nationally for men (and women for 1870 and 1880) employed in non-farm industries earning non-negative wages in incorporated cities of at least 2,500 residents (Atack and Batemen, 2004; Atack, Weiss and Bateman, 2004). The urban wage premium for 1915 was calculated using data from the Iowa State Census and represent the premium in Iowa for working age men employed in non-farm industries earning non-negative wage income annually in Des Moines, Davenport and Dubuque (Goldin and Katz, 2010). The open white diamond in 1915 represents the actual urban wage premium in Iowa in 1915, whereas the closed black diamond represents the Iowa premium adjusted upward using the Iowa premium relative to the national premium in 1940. The urban wage premium for 1940 to 2010 was calculated using data provided by IPUMS, and represents the premium nationally for working age men employed in non-farm industries earning non-negative wage income annually living in metropolitan areas. Results are similar if we instead use men living in urban areas, defined as towns with at least 2,500 residents.

Boustan et al. (2013)

- We don't have estimates (that I know of) for agglomeration effects, until the late 20th century, but
  - The simultaneous increases in urban share and aggregate income is suggestive.
  - The persistent urban wage premium is also suggestive.
  - The nature of industrial production after the beginning of the industrial revolution suggests that packing people together for work is important.

Modern Crude Death Rate, US



Downloaded from the internet 2021.

Each year, about 9 people per 1000 die in the modern US.

Development and urbanization in the US and Europe

Fig. 2 *Crude Death Rate*
Boston, MA, 1811-1920

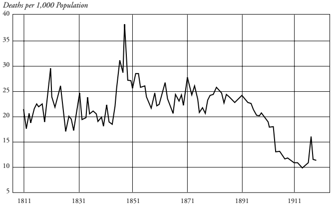


Fig. 3 *Crude Death Rate*
Philadelphia, 1802-1920

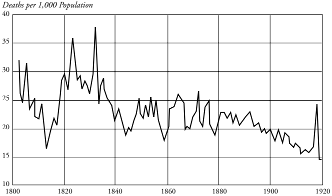


Fig. 1 *Crude Death Rate*
New York City, 1804-1900

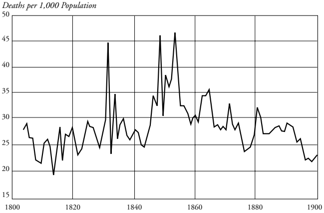
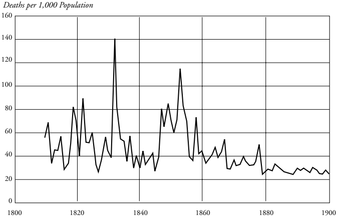


Fig. 5 *Crude Death Rate*
New Orleans, 1810-1900



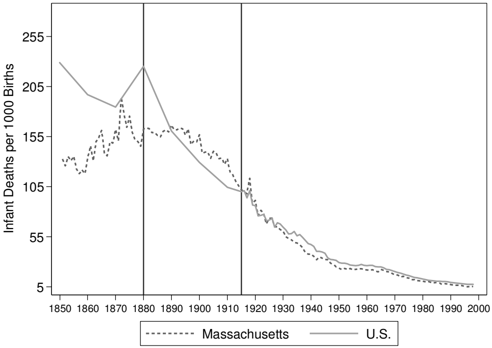
Haines (2001). Crude death rates were 20-80 in 19th century US cities, and fell in the 20th century.

Urban vs Rural Crude Death Rates

Decade	Ratio
1870-1880	1.38
1880-1890	1.50
1890-1900	1.35
1900-1910	1.33
1910-1920	1.21

Table from Haines (2001) showing the ratio of urban to rural crude death rates in the US, by decade. The urban mortality premium was about 40% in 1780 and declined to 20% by 1920.

Figure 1: Infant Mortality in the United States and Massachusetts: 1850 to 1998

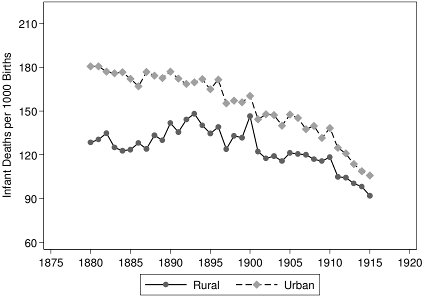


Alsan and Goldin (2019). Infant mortality in the US and Massachusetts in the 19th century was terrifyingly high.

Current US rates are about 5 per 1000

www.cdc.gov/nchs/pressroom/sosmap/infant_mortality_rates/infant_mortality.htm.

Figure 2: Urban and Rural Infant Mortality Rates: Massachusetts, 1880 to 1915



Sources and Notes: See Data Appendix. Urban is defined as the 32 largest municipalities in Massachusetts in the Registration Report of 1898. Rural is defined as all other populations in each of the counties. The minimum urban population in 1880 is 4,159 and is 15,250 in 1915. The data are from the Annual Registration Reports and mortality rates are aggregates within the urban and rural designations.

Alsan and Goldin (2019). Urban infant mortality in MA was about 50% higher than rural in 1870, falling to about 10% higher by 1915.

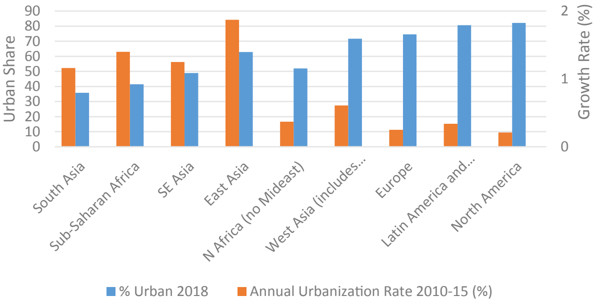
Story

All together, this suggests the following story,

- With the industrial revolution, agricultural yields and urban productivity began to rise.
- This lead to surplus food to sustain an urban population
- Surplus agricultural labor to work in progressively more productive urban factories.
- The whole process was slowed down by the urban mortality premium. Cities were really dangerous until well into the industrial revolution.

Note this is a ‘spatial equilibrium’. People choose locations by trading mortality risk against wages.

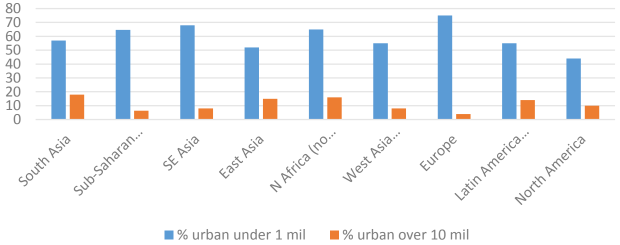
Urbanization in the developing world, basic facts



Regions are UN regions. The Middle East is part of West Asia (not North Africa) and Latin America includes the Caribbean. Oceania is excluded. Based on Henderson and Turner (2020).

We are building cities in Asia and Africa. Everywhere else, urbanization seems about done.

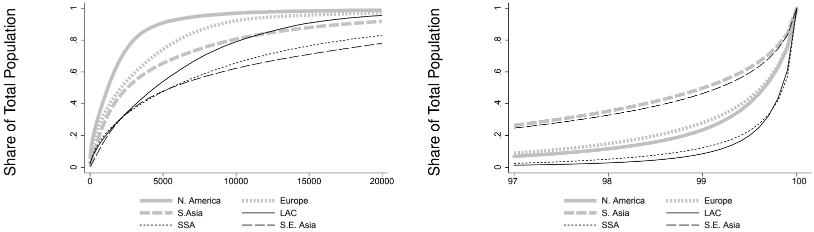
Urbanization in the developing world



Regions are UN regions. The Middle East is part of West Asia (not North Africa) and Latin America includes the Caribbean. Oceania is excluded. Based on Henderson and Turner (2020).

The size distribution of cities is different across regions. Why are really big cities more important in Asia and North Africa?

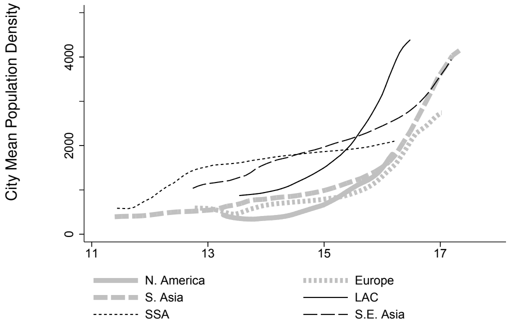
Population Density and Land Use by Region



(left) Cumulative share of population by density. (right) Cumulative share of population by land area in the region. Based on population data from GHS. Based on Henderson and Turner (2020)

Population densities are much higher in poorer countries. Small shares of land are occupied everywhere. Caveat: GHS data is suspicious.

City mean population density



Vertical axis is mean population density from GHS in a 50km radius disk centered on the centroid of each of the 657 UN world cities. Horizontal axis is total population in the same disk, also from GHS. Based on Henderson and Turner (2020)

The density of African cities does not increase with size. Everywhere else it does. Same caveat, this is from GHS.

Share of manufacturing in GDP by region and year.

Region	1990	2000	2010	2017
E. Asia	24.6	25.2	27.6	27.4
S.E. Asia	22	24.8	22.6	20.9
L. America and Caribbean	20.7	17.9	15.7	15.2
N. Africa	17.6	17.9	16	16
Europe	17.5	15.3	11.9	11.8
S. Asia	15.9	15.6	16.1	14.4
W. Asia	14.4	13.2	12.1	13.8
S.S.A.	13.8	11.6	8	9

From Henderson and Turner (2020). Data from the World Development Indicators 2018 are organized by UN regions. The table reports regional weighted averages using weights based on country share of regional GDP in 2017. Data cover 126 countries in a consistent sample over time. The Middle East is part of West

Farmers in African cities by city size.

African countries	All urban	All rural	Primate city	Secondary cities (top 25%)	Tertiary cities (50-75%)	All others
% reporting agriculture as main industry	20.5	88	8.5	23.8	38.6	41.3
% reporting manufacturing as main industry	10.6	<2	12.4	10	8.3	7.3

From Henderson and Turner (2020). The data are from IPUMS for the most recent census for Ethiopia, Tanzania, Uganda, Mozambique, Ghana, Cameroon, Mali, Malawi, Zambia, Sierra Leone, Liberia, and Botswana. Small cities are in the bottom 50% of cities by size and tertiary cities are in the 50-75th percentiles. Cities are defined by night-light boundaries to which population is assigned. Details are reported in Henderson and Kriticos (2018).

Urban Share and national income

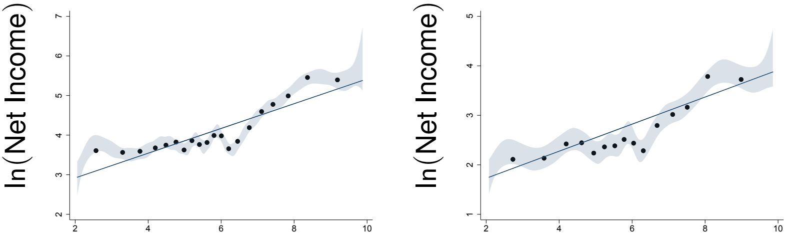
- SSA: 40% urban share $\sim$ 2010, GDPpp$\sim$ 1481 USD1990.
- Latin America: 40% urban share $\sim$ 2010, GDPpp$\sim$ 2500 USD1990.
- East Asia: 60% urban share $\sim$ 2000, GDPpp$\sim$ 5451 USD1990.
- United States: 40% urban share $\sim$ 1900, GDPpp$\sim$ 5000 USD2010.

Latin America and SSA are building cities when they are much poorer than were the US and Europe when they were at similar shares of urban population Henderson and Turner (2020).

Are cities urbanizing too early?

- Story: on the basis of developed world experience, we think farmers move to cities to take high paying manufacturing jobs but are subject to high rates of disease.
- This seems not to apply in SSA. Manufacturing is scarce, farmers live in cities, but cities are probably too poor to manage 'demons of density'(Glaeser, 2011).
- But cities are growing fastest in SSA!
- Cities in SSA and Asia are different from those in the US and Europe. Are different economic forces at work? Are SSA cities growing 'too fast' to rationalize with spatial equilibrium?
- ... or maybe, we don't have our facts straight.

Log net income versus log population density/km^2 within a 5k radius.

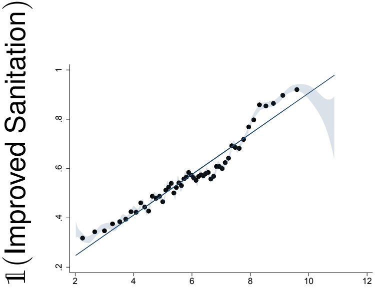


(a) No Controls (b) Demographic controls

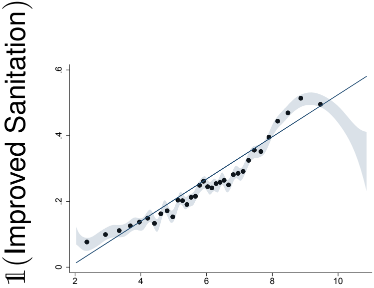
Binscatter plots of LSMS net income of respondent household against the log of GHS population density in a 5km disk around the survey respondent. Log population density is censored below 2. Left panel has no controls. Right panel includes demographic controls and country fixed effects. Shading indicates 95% confidence band. Income includes wage income, net farm income and net business income. For a small number of observations expenses exceed (monthly) incomes. We drop these observations to permit logarithmic scaling.

Income increases dramatically with density.

Access to improved sanitation versus log population density/km^2 within a 5k radius.



(a) No Controls



(b) Demographic controls

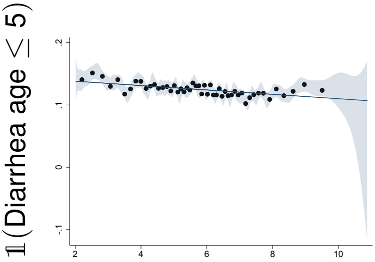
Binscatter plots of a DHS indicator variable that is one if a respondent household has access to improved sanitation. Log population density is censored below 2. Left panel is unconditional. Right panel includes demographic controls and country fixed effects. Shading indicates 95% confidence band.

Access to improved sanitation increases rapidly with city size. NB: ‘improved sanitation’ $\neq$ ‘flush toilets’.

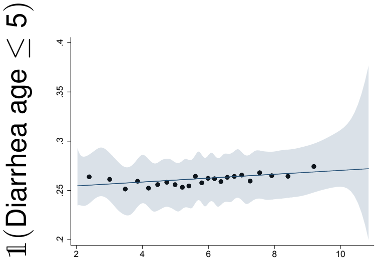
Are cities urbanizing too late?

- Wages are much higher in SSA cities. Moving from 550 people per km (ln $\sim$ 6.3) to 8100 (ln $\sim$ 9) increases net income by about a factor of 4. Whatever people are doing in cities, they are much more productive than they are in the countryside.
- Access to improved sanitation increases very rapidly with density. In spite of their poverty, SSA cities are providing basic public services to most of their residents.
- Wages are better, public services are better, why don't more people move?
- Can we rationalize this 'too slow' urbanization (Gollin, Kirchberger, Lagakos (2017)) with spatial equilibrium? Maybe people are really attached to their homes or migration is really expensive?
- ... or maybe, we don't have our facts straight.

Diarrhea last two weeks for children ≤ 5 vs log pop. density/km^2 within a 5k radius.



(a) No Controls



(b) Demographic controls

Binscatter plots of a DHS indicator that is one if a child five or under had diarrhea in the past two weeks against the log of GHS population density in a 5km disk around the survey respondent. Log population density is censored below 2. Left panel is unconditional. Right panel includes demographic controls and country fixed effects. Shading indicates 95% confidence band.

Rate of illness in children increases with density, ceteris paribus.

Density gradients for Afrobarometer, LSMS and DHS outcomes.

	No controls		Controls						
Outcome	β *s.e.*	R^2	β *s.e.*	R^2	$\overline{y}$ *s.e.*	$\overline{x}$ *s.e.*	N	Clusters	Countries
Data: *LSMS*									
ln(Income)	.3126[a]	0.067	.3170[a]	0.856	4.097	5.77	35,231	2,118	5
	(.0161)		(.0141)		(2.014)	(1.67)			
ln(Wage)	.1177[a]	0.019	.0488[a]	0.553	1.191	6.38	18,806	1,704	5
	(.0152)		(.0094)		(1.435)	(1.69)			
Controls: $\mathbb{1}$(*Kindergarten*), $\mathbb{1}$(*Some prim. sch.*), $\mathbb{1}$(*Some high sch.*), *age O(2)*, $\mathbb{1}$(*fem.*).									
Data: *DHS household*									
Electricity	.0797[a]	0.084	.0444[a]	0.827	.691	5.96	987,081	28,088	38
	(.0012)		(.0010)		(.462)	(1.68)			
Safe Water	.0853[a]	0.083	.0576[a]	0.655	.510	5.95	1,005,468	28,604	39
	(.0013)		(.001)		(.500)	(1.69)			
Imp. Sanitation	.0825[a]	0.079	.0630[a]	0.662	.572	5.95	1,005,283	28,604	39
	(.0010)		(.0010)		(.495)	(1.69)			
Controls: *H.H. size O(2)*, $\mathbb{1}$(*fem. HoH*),*age HoH O(2)*, $\mathbb{1}$(*Some prim. sch. HoH*), $\mathbb{1}$(*Some sec. sch. HoH*), $\mathbb{1}$($>$ *sec. sch. HoH*).									
Data: *DHS school*									
School$\geq$8yr	.0497[a]	0.029	.0158[a]	0.719	.611	5.94	95,687	25,529	39
	(.0014)		(.0011)		(.488)	(1.67)			
Controls: $\mathbb{1}$(*fem.*), $\mathbb{1}$(*fem. HoH*), *age HoH O(2)*, $\mathbb{1}$(*Some prim. sch. HoH*), $\mathbb{1}$(*Some sec. sch. HoH*), $\mathbb{1}$($>$ *sec. sch. HoH*).									
Data: *DHS female*									
Contraception	.0297[a]	0.011	.0122[a]	0.595	.496	5.9	183,273	19,294	36
	(.0016)		(.0009)		(.500)	(1.76)			
Justified Beating	-.0361[a]	0.017	-.0120[a]	0.499	.384	5.87	575,495	20,129	39
	(.0016)		(.0009)		(.486)	(1.76)			
Victim	.0001	0.000	.0074[a]	0.320	.277	5.8	194,157	17,951	31
	(.0010)		(.0009)		(.448)	(1.77)			
Tot. # births	-.0278[a]	0.008	-.0109[a]	0.370	.298	6.01	1,110,331	28,604	39
	(.0007)		(.0004)		(.531)	(1.68)			
Controls: *age O(2)*, $\mathbb{1}$(*Some prim. sch.*), $\mathbb{1}$(*Some sec. sch.*), $\mathbb{1}$($>$ *sec. sch.*), $\mathbb{1}$(*fem. HoH*),*age HoH O(2)*, $\mathbb{1}$(*Some prim. sch. HoH*), $\mathbb{1}$(*Some sec. sch. HoH*), $\mathbb{1}$($>$ *sec. sch. HoH*).									
Data: *DHS birth*									
Infant Death	-.0006[a]	0.000	.0008[a]	0.038	.035	5.75	294,385	28,205	39
	(.0002)		(.0002)		(.184)	(1.71)			
Controls: $\mathbb{1}$(*fem.*), *age (mother) O(2)*, $\mathbb{1}$(*Some prim. sch.(mother)*), $\mathbb{1}$(*Some sec. sch.(mother)*), $\mathbb{1}$($>$ *sec. sch.(mother)*), $\mathbb{1}$(*fem. HoH*), *age HoH O(2)*, $\mathbb{1}$(*Some prim. sch. HoH*), $\mathbb{1}$(*Some sec. sch. HoH*), $\mathbb{1}$($>$ *sec. sch. HoH*).									

Note: *Regressions of respondent level 'outcome' on log population density in a 5km disk. Standard errors are clustered by 'survey cluster'. Each row reports results from two regressions, one without demographic controls and one with;* $^a = 1\%$, $^b = 5\%$, $^c = 10\%$, *all two-tailed tests. Relevant demographic controls are listed at the bottom of each panel.* $\overline{y}$ *and* $\overline{x}$ *are mean of outcome and* ln(*pop. density*) *in the 'no-controls' sample. Except for the LSMS panel, we lose only a tiny number of observations when we add controls.(Henderson and Turner, 2020)*

Density gradients for Afrobarometer, LSMS and DHS outcomes.

	No controls		Controls						
Outcome	β *s.e.*	R^2	β *s.e.*	R^2	$\overline{y}$ *s.e.*	$\overline{x}$ *s.e.*	N	Clusters	Countries
Data: *DHS children*									
Diarrhea	-.0035[a]	0.000	.0030[a]	0.160	.125	5.76	512,855	28,507	39
	(.0005)		(.0004)		(.331)	(1.71)			
DPT3	.0209[a]	0.007	.0123[a]	0.798	.763	5.76	95,334	24,914	39
	(.0013)		(.0011)		(.425)	(1.71)			
Cough	-.0001	0.000	.0038[a]	0.255	.188	5.76	513,082	28,507	39
	(.0008)		(.0006)		(.391)	(1.71)			
Controls: *age O(2),* $\mathbb{1}$(*Some prim. sch.(mother)*), $\mathbb{1}$(*Some sec. sch.(mother)*), $\mathbb{1}$($>$ *sec. sch.(mother)*), $\mathbb{1}$(*fem. HoH*),*age HoH O(2),* $\mathbb{1}$(*Some prim. sch. HoH*), $\mathbb{1}$(*Some sec. sch. HoH*), $\mathbb{1}$($>$ *sec. sch. HoH*).									
Data: *DHS lifestyle*									
High B.P.	.0076[a]	0.001	.0108[a]	0.260	.244	6.17	475,157	15,838	1
	(.0008)		(.0008)		(.430)	(1.57)			
Asthma	0.00002	0.000	.00012	0.019	.015	6.18	712,978	15,546	1
	(.00012)		(.00012)		(.122)	(1.57)			
Diabetes	.0019[a]	0.001	.0015[a]	0.028	.014	6.19	677,232	15,545	1
	(.0001)		(.0001)		(.117)	(1.57)			
Obese	.0128[a]	0.006	.0100[a]	0.154	.077	6.07	851,767	28,330	38
	(.0005)		(.0003)		(.267)	(1.67)			
Controls: *age O(2),* $\mathbb{1}$(*Some prim. sch.*), $\mathbb{1}$(*Some sec. sch.*), $\mathbb{1}$($>$ *sec. sch.*), $\mathbb{1}$(*fem. HoH*),*age HoH O(2),* $\mathbb{1}$(*Some prim. sch. HoH*), $\mathbb{1}$(*Some sec. sch. HoH*), $\mathbb{1}$($>$ *sec. sch. HoH*).									
Data: *Afrobarometer*									
Fear Walking	.0157[a]	0.003	.0155[a]	0.430	.381	5.65	26,437	2,210	23
	(.0037)		(.0034)		(.486)	(1.76)			
Fear at Home	.0094[a]	0.001	.0102[a]	0.386	.334	5.65	26,437	2,210	23
	(.0037)		(.0036)		(.472)	(1.76)			
Theft at Home	.0042	0.000	.0059[b]	0.320	.288	5.65	26,476	2,210	23
	(.0028)		(.0026)		(.453)	(1.76)			
Attacked	.0026	0.000	.0024	0.147	.103	5.65	26,468	2,210	23
	(.0019)		(.0019)		(.303)	(1.76)			
Controls: $\mathbb{1}$($<$ *Primary sch.*), $\mathbb{1}$(*Some sec. sch.*), $\mathbb{1}$($>$ *high sch.*), *age O(2),* $\mathbb{1}$(*fem.*), *H.H. size*									

Note: *Regressions of respondent level 'outcome' on log population density in a 5km disk. Standard errors are clustered by 'survey cluster'. Each row reports results from two regressions, one without demographic controls and one with;* $^a = 1\%$, $^b = 5\%$, $^c = 10\%$, *all two-tailed tests. Relevant demographic controls are listed at the bottom of each panel.* $\overline{y}$ *and* $\overline{x}$ *are mean of outcome and* $\ln(\textit{pop. density})$ *in the 'no-controls' sample. Except for the LSMS panel, we lose only a tiny number of observations when we add controls.*

Summary

With more complete data, moving to the city looks like a complicated trade-off.

- Better: Income, public utilities, status of women(mostly), innoculations.
- Worse: Domestic Abuse, Infant mortality, Childhood illness, lifestyle diseases, crime.

This suggests a story quite similar to the one we started with for the developing world. People move to cities for better wages, but face a worse disease environment. The difference is that new urbanites seem not to be working in manufacturing.

This suggests that ‘spatial equilibrium’ is relevant to this process, but it would be nice to understand migration costs better.

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