EC1410 Topic #4

Urbanization and the Developed and Developing World

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Spring 2022

(Updated October 1, 2021)

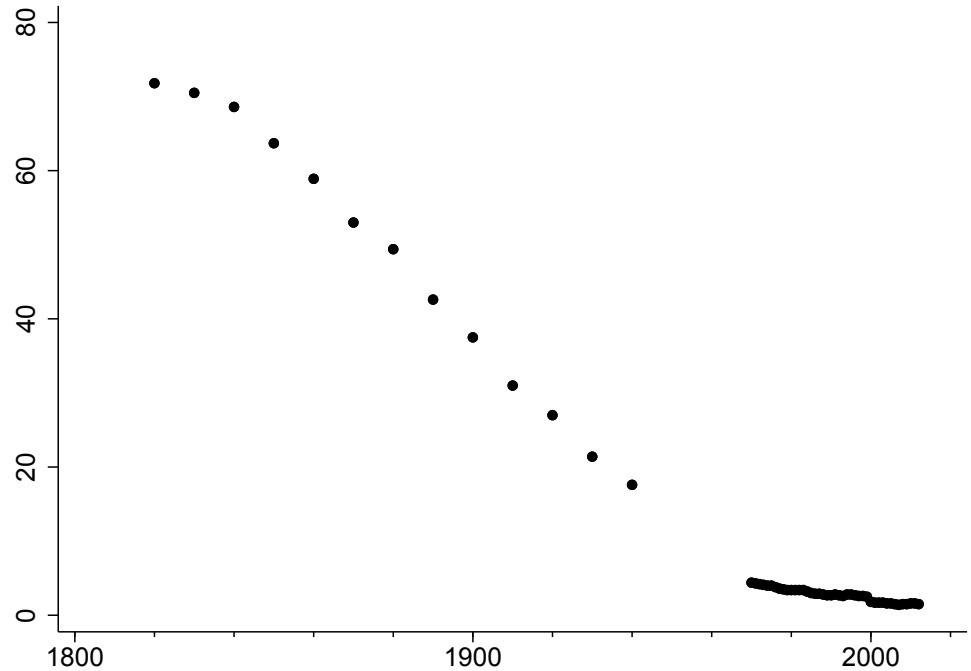
Outline

Urbanization in the US

- Use the monocentric city model to understand urbanization in the US and Europe.
- Basic idea: Urbanization reflects a trade off between:
  - Rising urban productivity.
  - Improving public health in cities.
  - falling commute costs.
- The monocentric city model and the idea of spatial equilibrium seems to fit the facts pretty nicely.

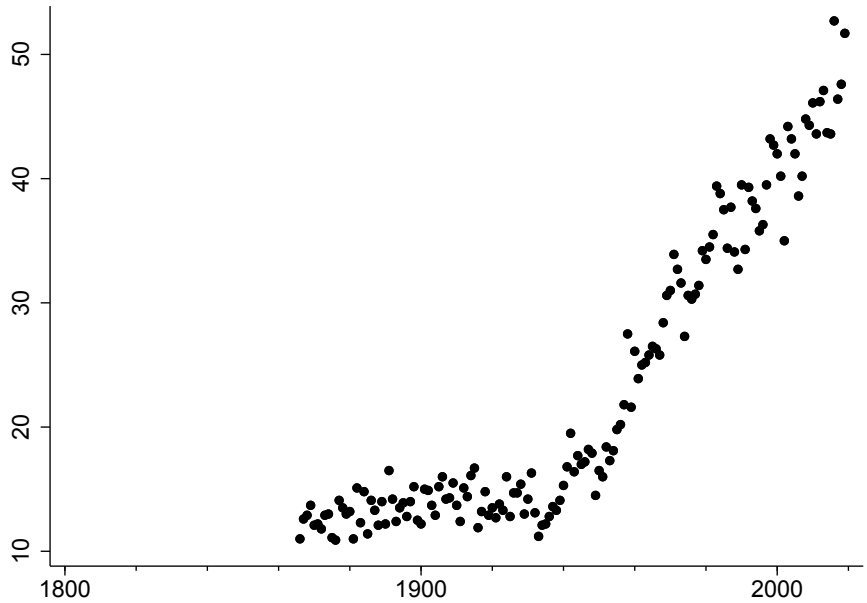
In this lecture, we present some stylized facts about development in both regions and try to relate them using the moncentric city model.

Agricultural Share of Population, US 1820-2012



Note: From US Historical Census. The agricultural share of employment has declined from about 72% in 1820 to about 1.5% in 2012.

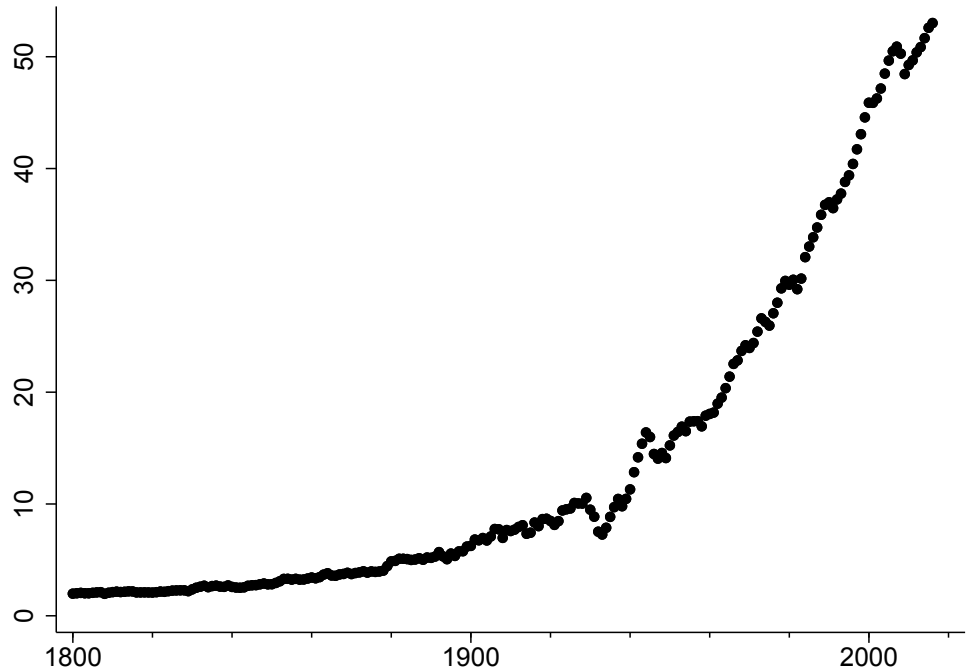
Wheat Yields, US 1866-2019



Note: Percent of Employment in Agriculture in the United States, Annual, Not Seasonally Adjusted FRED Graph Observations, Federal Reserve Economic Data, `Link:https://fred.stlouisfed.org`,Economic Research Division Federal Reserve Bank of St. Louis.

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.

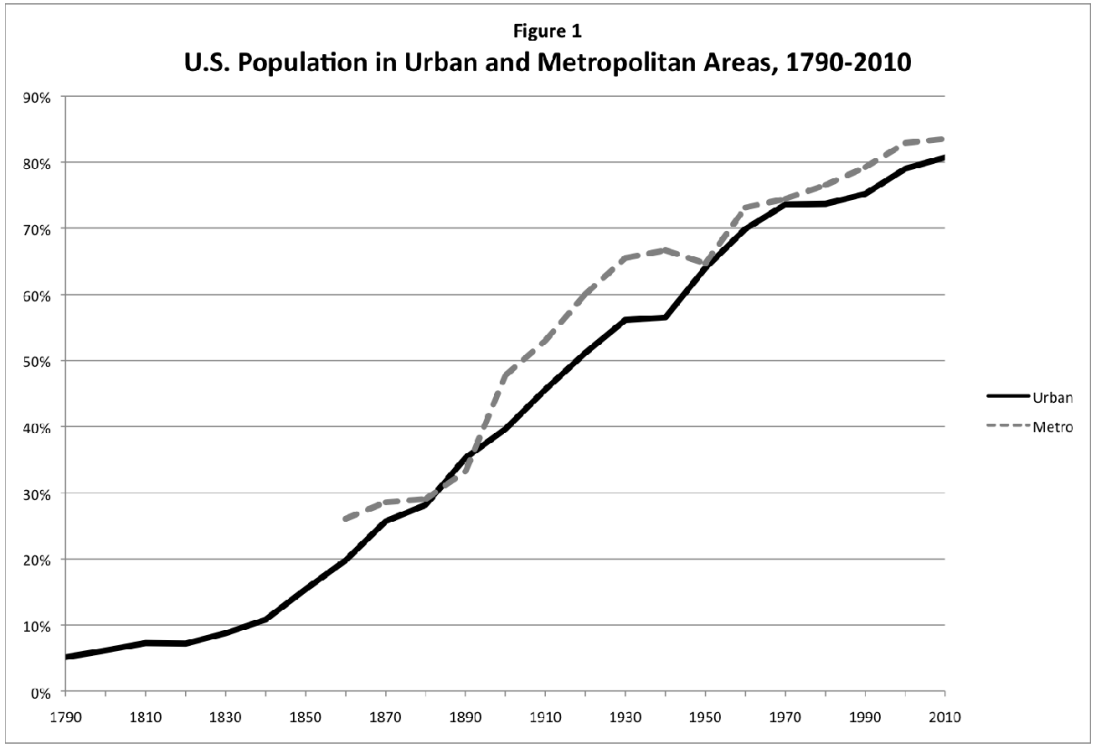


Figure 1: Before 1950, the urban share only includes residents living in incorporated places. From 1950 onward, the urban share includes residents living in both incorporated and unincorporated places. Data on urban population shares are from the U.S. Census Bureau. Metropolitan area population shares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

Boustan et al. (2013)

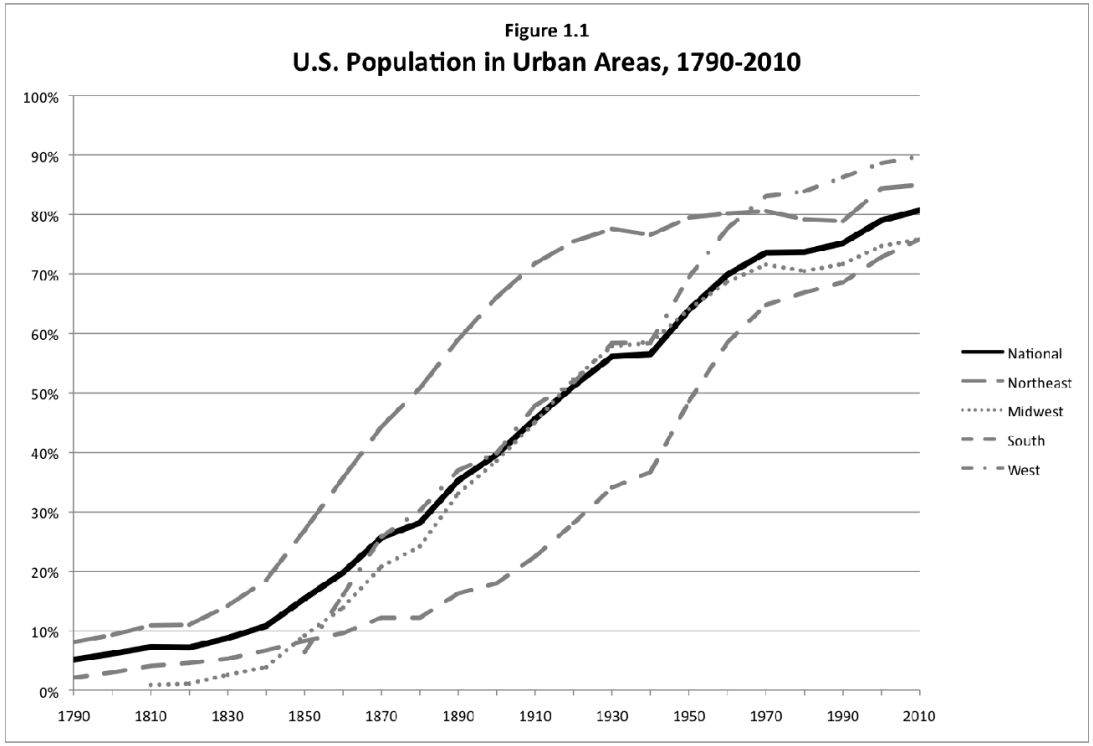


Figure 1.1: Before 1950, the urban share only includes residents living in incorporated places. From 1950 onward, the urban share includes residents living in both incorporated and unincorporated places. Data on urban population shares and region definitions are from the U.S. Census Bureau.

Boustan et al. (2013)

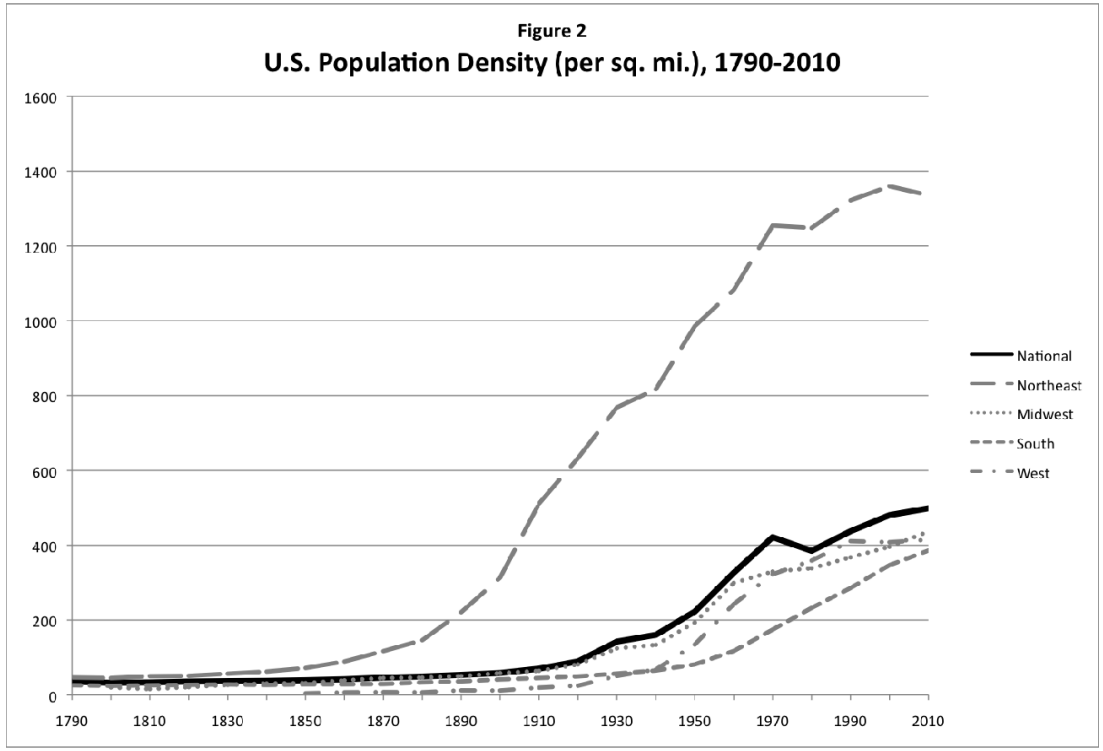


Figure 2: Population densities were calculated from Haines (2010). Region definitions follow the Census.

Boustan et al. (2013)

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

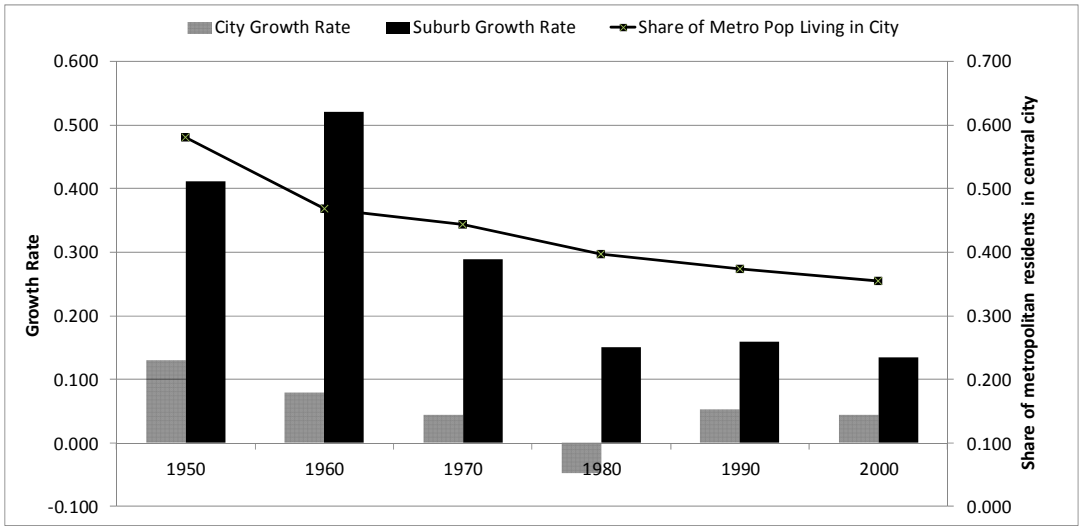


Figure 5: Source is Boustan and Shertzer (2013). Values refer to the decade ending in the census year on the *x*-axis. Sample includes 103 metropolitan areas anchored by a city that had at least 50,000 residents in 1970. City and county population are taken from the City and County Data Books. The 1970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

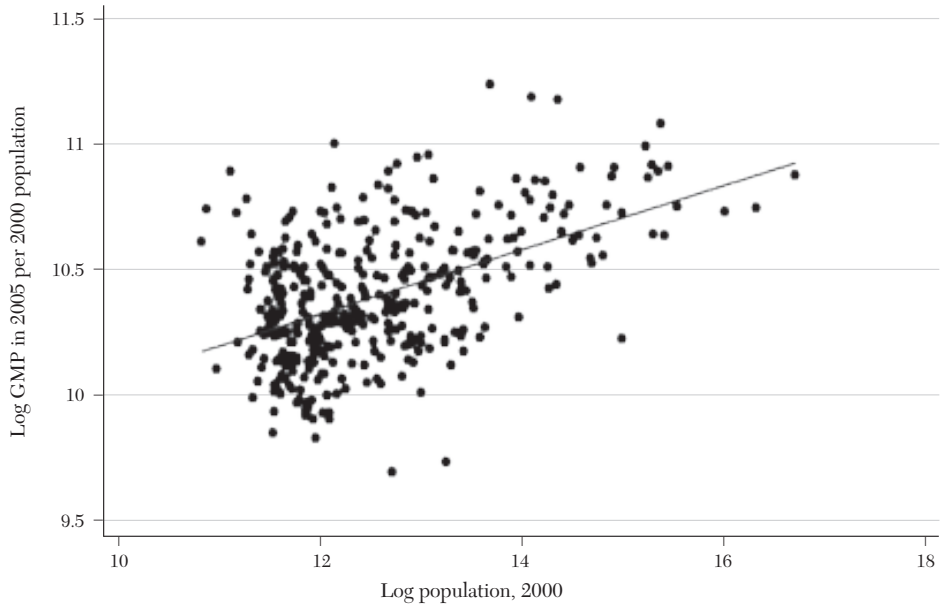


Figure 1. Productivity and City Size

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 $\log GMP\ per\ capita = 0.13\ [0.01] \times \log population + 8.8\ [0.1]$.
$R^2 = 0.25$ 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’.

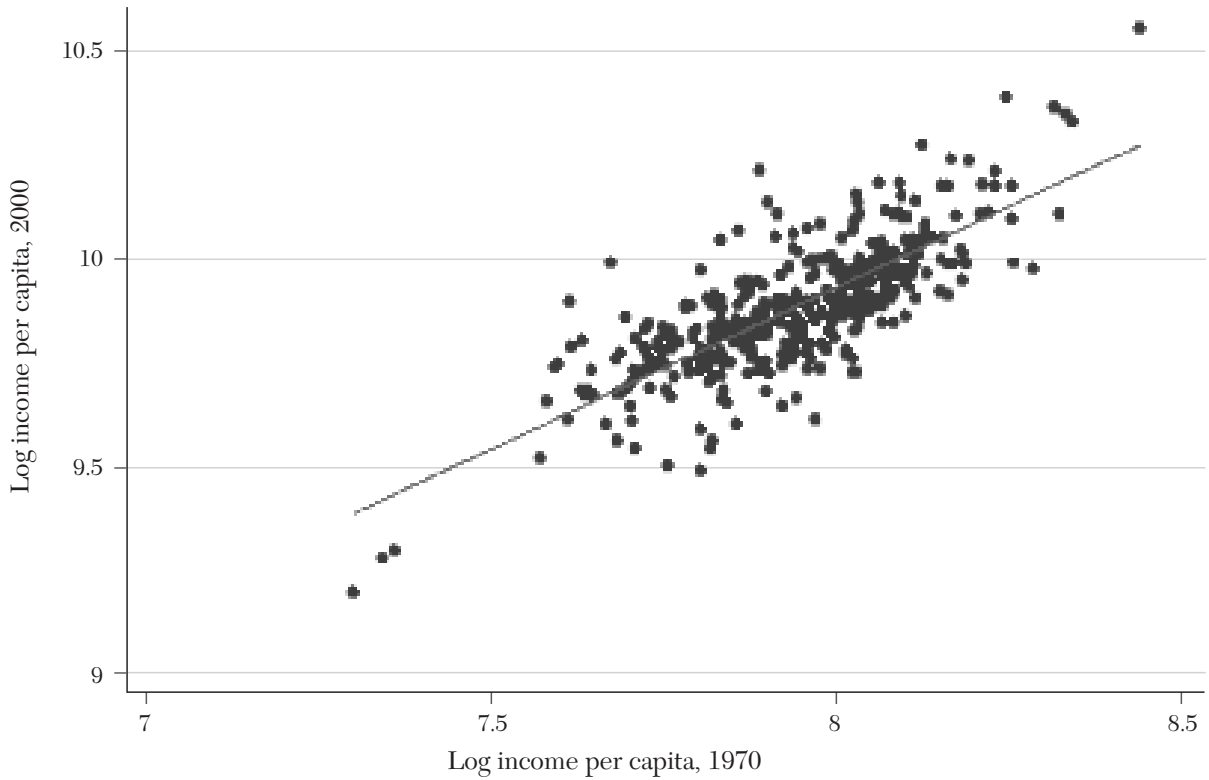
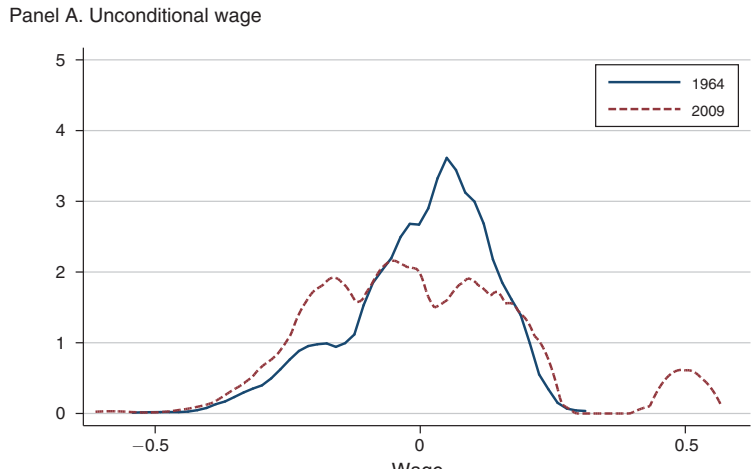


Figure 2. Income Over Time

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] × *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 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

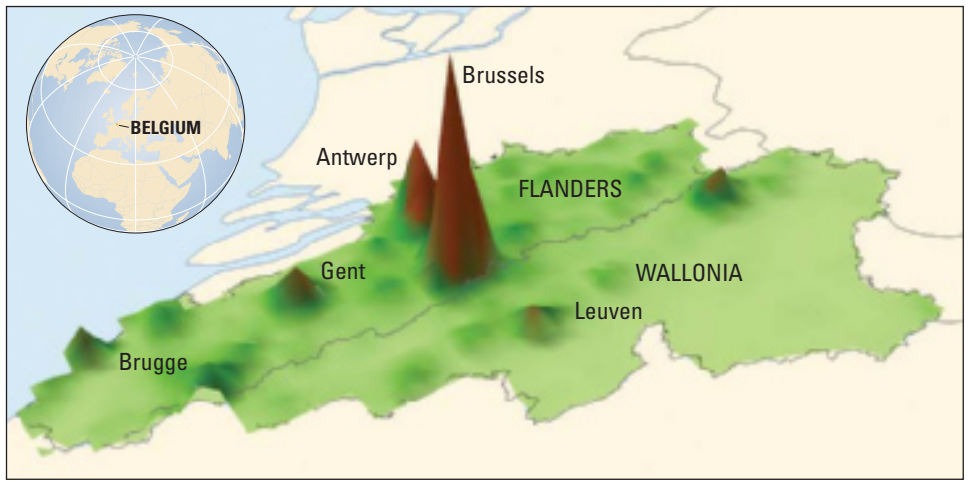
Notes. 341 observations. Standard error between brackets. $Density_{a,t}$ is the density of employment in employment area a and year t; $Emp_{a,t}$ is total employment; $Diversity_{a,t}$ is the diversity of employment as measured by an inverse-Herfindahl index, $Diversity_{a,t} = Emp_{a,t}^2 / \sum_k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

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.

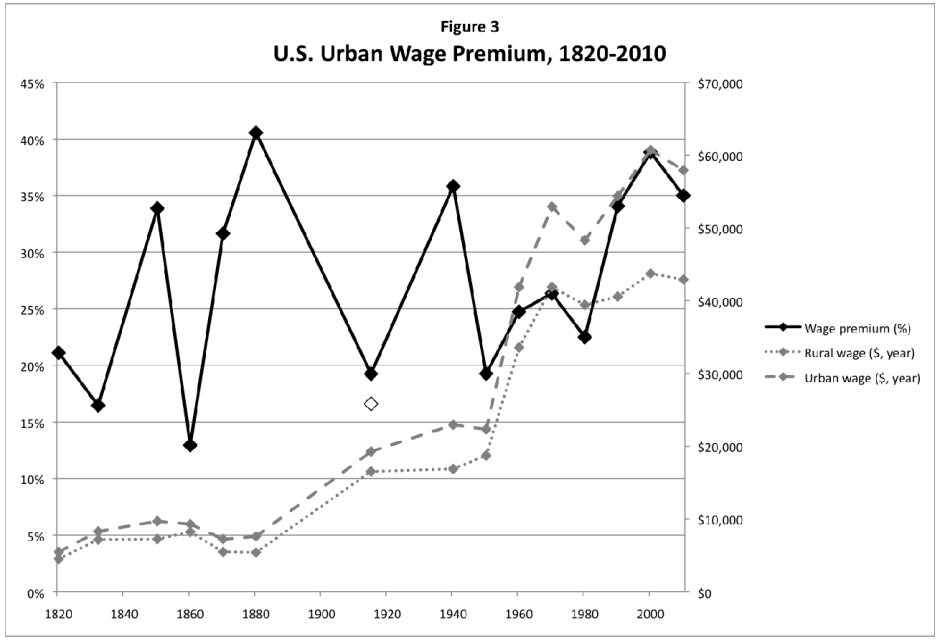
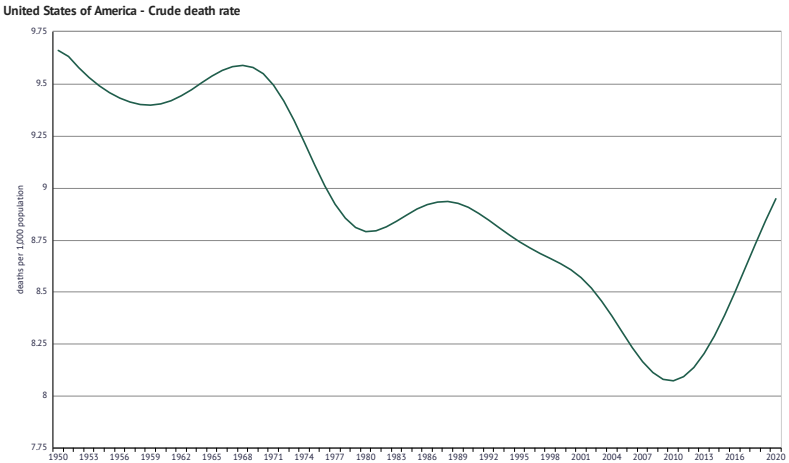


Figure 3: All dollar figures for the period 1913 to 2010 are inflation-adjusted to 2010 values using the urban consumer price index from the BLS; David and Solar's (1977) historical cost of living estimates are used for years prior to 1913. The values for 1820 and 1832 are from Sokoloff and Villaflor (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.

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

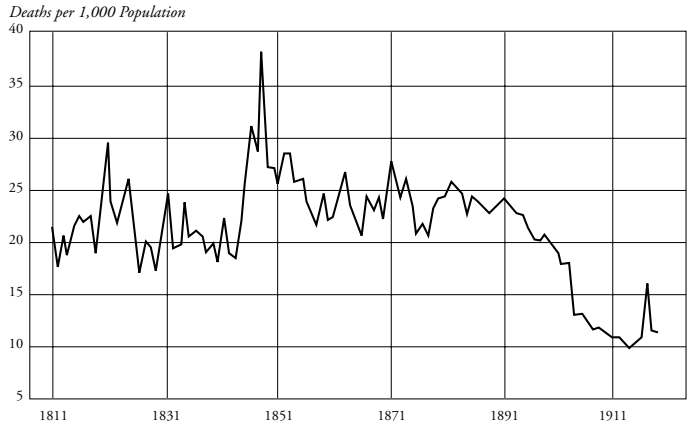


Fig. 3 *Crude Death Rate*
Philadelphia, 1802-1920

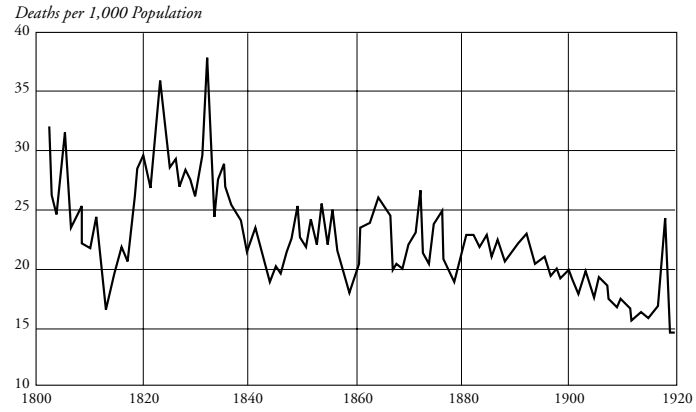


Fig. 1 *Crude Death Rate*
New York City, 1804-1900

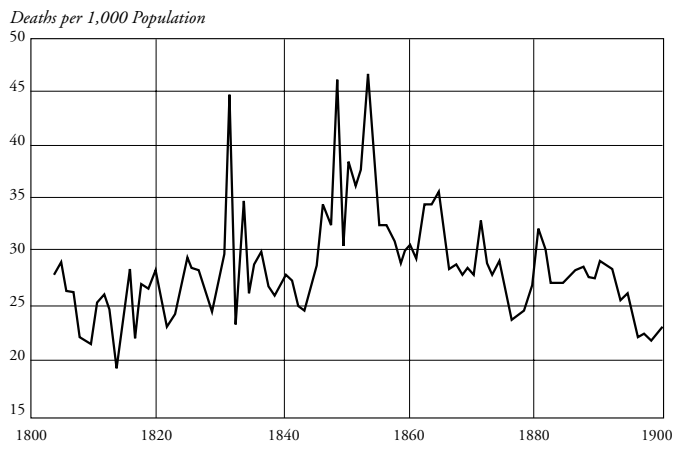
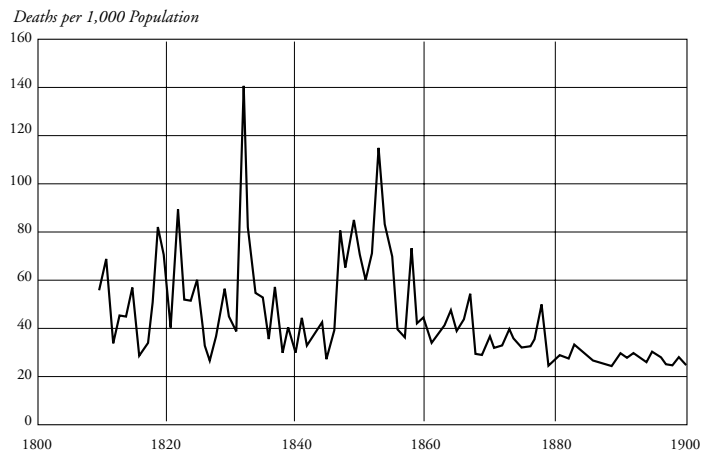


Fig. 5 *Crude Death Rate*
New Orleans, 1810-1900



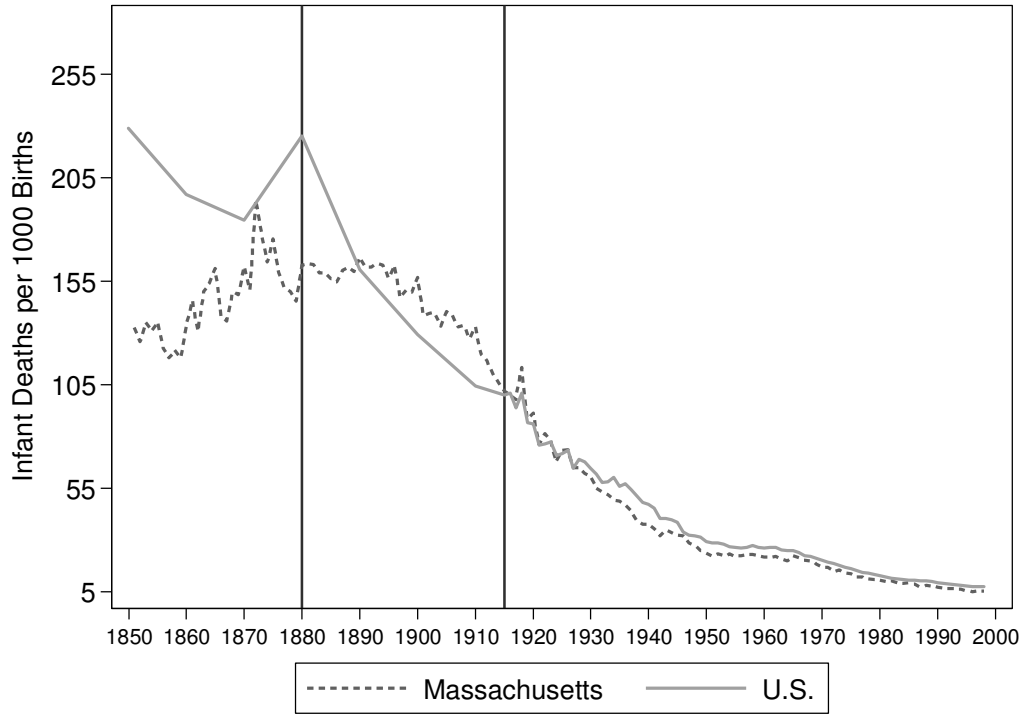
Haines (2001). Crude death rates were 20-80 in 19th century US cities, and fell in the 20th century.

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

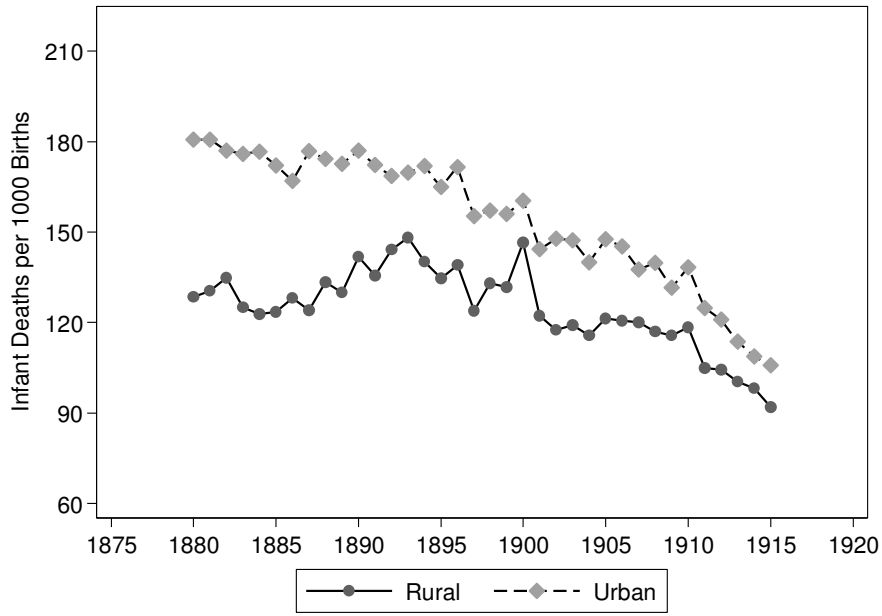


Alsan and Goldin (2019). Infant mortality in the US and Massachusetts in the 19th century was terrifyingly high.

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.

Urbanization in the developed world I

There were a number of really important changes as the US economy developed over the 19th and 20th centuries and the industrial revolution unfolded.

- From 1800 to 2016 an increase in US per capital income from 1980$ to 55,000$, a 27 fold decrease.
- Over this time, the urban wage premium changed much less dramatically, and seems to have been about constant at 30%.
- Doubling city size increases per capita output by about 5% in modern cities. This was likely the case historically, too.
- From 1820 to 2012 a decrease in the agricultural share of employment from 77% to 1.5%. This means non-ag employment increased from 23 to 98.5%.

Urbanization in the developed world II

- From 1790 to 2010 an increase in the urban share of population from 5% to 80%, a 18 fold decrease. A shift from agricultural to manufacturing employment accompanied this migration. From at least 1950 on, most of this growth was in the suburbs.
- An about 50% decrease in the crude death rate, a 20-40 fold decrease in infant mortality, and a decrease in the urban mortality premium from about 40% to about zero.

Urbanization in the developed world III

Summing up,

- Urbanization accelerated with the beginning of the industrial revolution, and was accompanied by dramatic increases in income.
- Modern cities are more productive as they are bigger. The same was almost surely true of cities early in the industrial revolution.
- Developed world cities were very unhealthy places in the 19th century. The urban mortality decreased rapidly in the early 20th century and is essentially zero by around 1950.

These facts suggest that we think of urbanization in the developed world as reflecting the trade-off between income and illness that came with living in larger 19th century cities.

The Monocentric City Model and Urbanization I

Let's see how we do trying to explain this phenomena with the monocentric city model with amenities. To do this, let

$$A_R, A_U \sim \text{Urban and rural amenities}$$
$$c_R = w_R \sim \text{Rural consumption}$$

and define $\overline{u} = u(A_R c_R)$. Note that we have rural consumption equals rural wages. Implicitly, land rent for agriculture is free, and since farmers live where they work, they don't commute.

Thus, the reservation utility level determined by rural income and amenities. Otherwise, everything is the same as the monocentric city model with amenities.

The Monocentric City Model and Urbanization II

Each household chooses their location, commutes to work and divides w between commuting and c. This means that a household's problem is

$$\max_{c,x} u(A_U c)$$
$$\text{s.t. } w = c + R(x)\bar{\ell} + 2t|x|$$

For now, fix A_R and c_R. With spatial equilibrium, everyone gets the same utility, so they must have the same level of consumption,

$$c^*(A_U) = u^{-1}(\bar{u})/A_U$$

The Monocentric City Model and Urbanization III

Therefore, for all x in the city,

$$w - c^*(A_U) = R(x)\overline{\ell} + 2tx.$$

Let $\overline{x}$ denote the most remote occupied location. At this location, we must have

$$w - c^*(A_U) = \overline{R}\overline{\ell} + 2t\overline{x}.$$

Reorganizing, we have

$$\overline{x} = \frac{w - c^*(A_U) - \overline{R}\overline{\ell}}{2t}.$$

The Monocentric City Model and Urbanization IV

Since the city extends from $-\overline{x}$ to $\overline{x}$ and each household consumes an exogenously fixed amount of land

$$\begin{aligned} N^* &= \frac{2\overline{x}}{\overline{\ell}} \\ &= \frac{w - c^*(A_U) - \overline{R}\overline{\ell}}{2t}\frac{2}{\overline{\ell}} \\ &= \frac{w - c^*(A_U) - \overline{R}\overline{\ell}}{t\ell} \end{aligned}$$

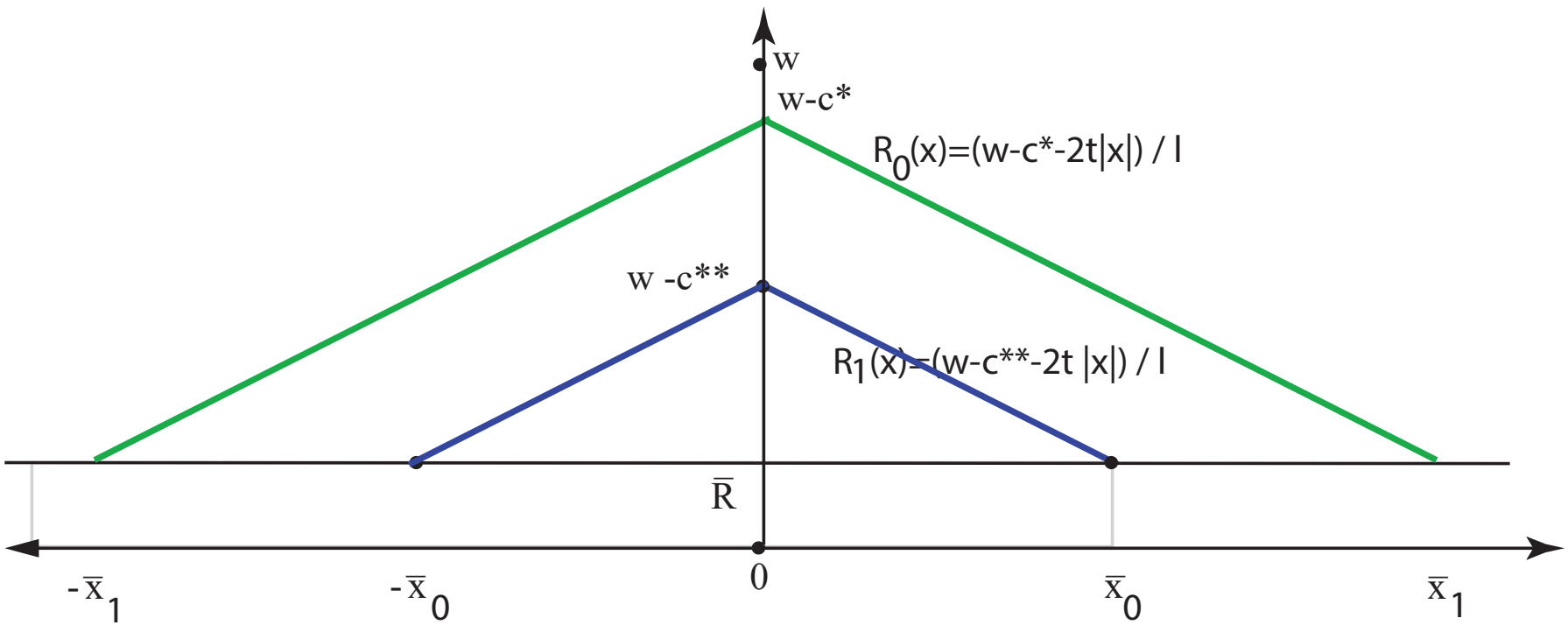
Looking at the expression for N^*, city population, we see that it is increasing in w and A_U and decreasing in c_R.

The Monocentric City Model and Urbanization V

The model makes the right qualitative predictions. As urban income increases, cities get larger. As deaths decrease, the urban amenity increases and city size increases.

The Monocentric City Model and Urbanization VI

Graphically, we have



The Monocentric City Model and Urbanization VII

Issues:

- We fixed rural wage and amenity. This is probably wrong, but not too hard to generalize.
- Transportation costs also fell a lot during this time. What should this do to city size? More on this later.
- How can we check whether the urban wage premium or mortality premium is more important?
- We've cheated a bit. We have a model of a single city. Our data describe urban share. We could also accommodate people in more smaller cities. We will talk about this issue a little more when we talk about systems of cities.

Aside: Potatoes I

- Facts from ‘unified theory’
- Results from potatoes

Urbanization in the developed world I

- The industrial revolution and consequent economic growth are probably the single most important fact in economic history.
- This process occurred jointly with a concentration of people into cities and a shift of employment from agriculture to manufacturing (and then into services).
- It is natural to think that the concentration of people into cities is somehow, a cause of economic growth. The persistent urban wage premium is evidence for this, and we'll return to this issue later.
- The monocentric city and the idea of spatial equilibrium seems to do a pretty good job of explaining the process of urbanization,

Urbanization in the developed world II

- People move to the cities for because they are more productive there.
- The rate at which people move to cities is limited by how dangerous they are. The move from a mostly agricultural economy, to a mostly urban one, takes 100 years.

- Understanding why people are more productive in cities is an open question. This is one of the main topics of urban economics, and we'll take it up later.

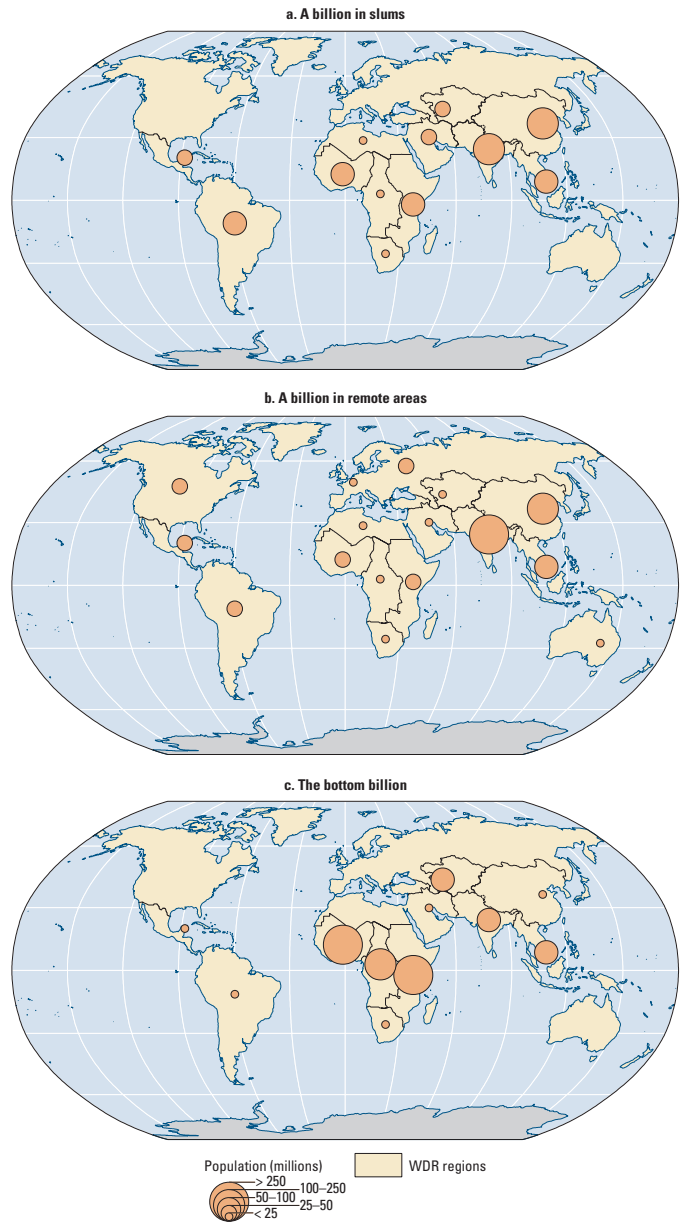
Urbanization in the developing world I

- Use the monocentric city model to understand urbanization in the developing world.
- Basic idea: Urbanization in the developing world is clearly different than it was in the developed world.
  - The urban wage premium is probably larger than the modern or historical urban wage premium in developed countries.
  - Developing world cities are not obviously as dangerous as were early developed world cites.
  - Many other ‘amenitities’ in developing world look better than in the countryside.

Urbanization in the developing world II

- In order for spatial equilibrium and the monocentric city model to work to explain why people stay in the countryside, we need a ‘villan’, some cost of urban migration. We can eliminate some cadidates, it’s probably not high urban unemployment, mortality, or that rural residents don’t know about urban opportunities. It could be social networks, or exposure to crime, or less obvious health risks.
- ... or the model could be wrong.

Map 1 The biggest development challenges—at the local, national, and international geographic scales



Sources: Panel a: United Nations 2006a; panel b: WDR 2009 team, based on household survey data; panel c: Collier 2007.

Scott (2009)

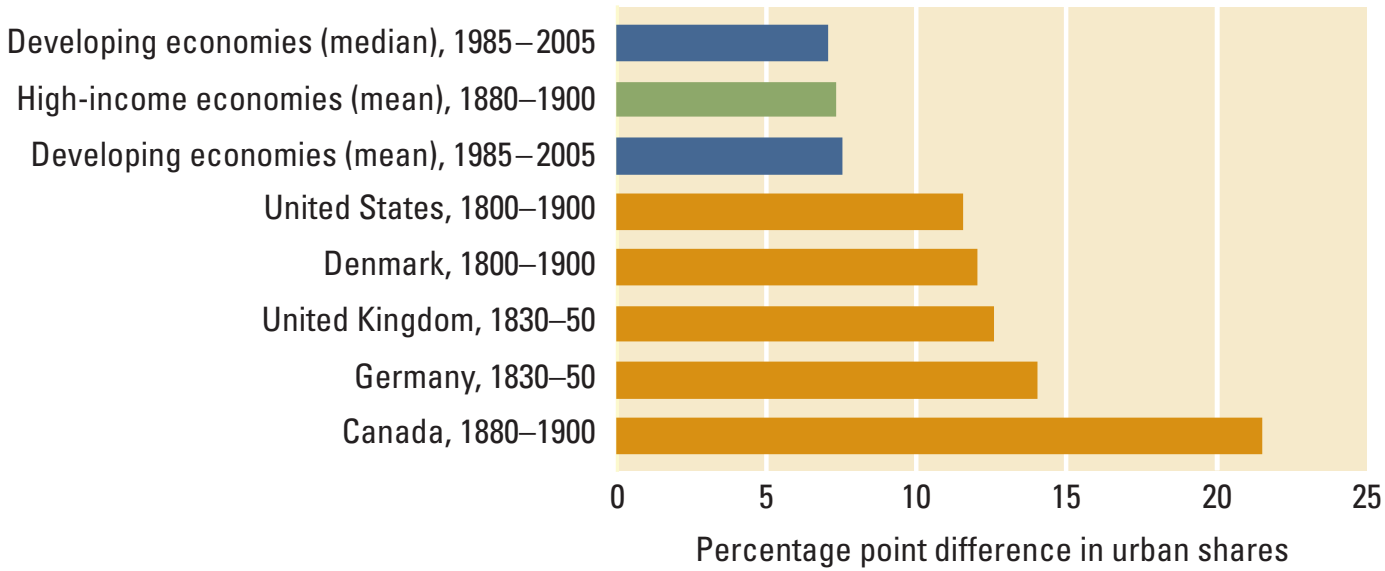
Urbanization rates around the World

	% Urban 2018	Urbanization rate %/year, 2010-15
S. Asia	35.8	1.2
S.S. Africa	41.5	1.4
S.E. Asia	48.9	1.3
LAC	80.7	0.3
Europe	74.5	0.25
North America	82.2	0.21

LAC, Europe and North America are all highly urbanized and the urban share is stable. S. Asia, S.E. Asia, and S.S. Africa are less than half urbanized and the urban share is growing rapidly. This is where the world is building cities.Henderson and Turner (2020)

Developed vs developing world urbanization rates

Figure 5 In charted waters: the pace of urbanization today has precedents
Change in urban shares since 1800



Source: WDR 2009 team calculations based on data from various sources (see figure 1.13).

Scott (2009) Developing world countries are building cities fast compared most developed world countries, but there are examples of developed world countries developing vary fast, too.

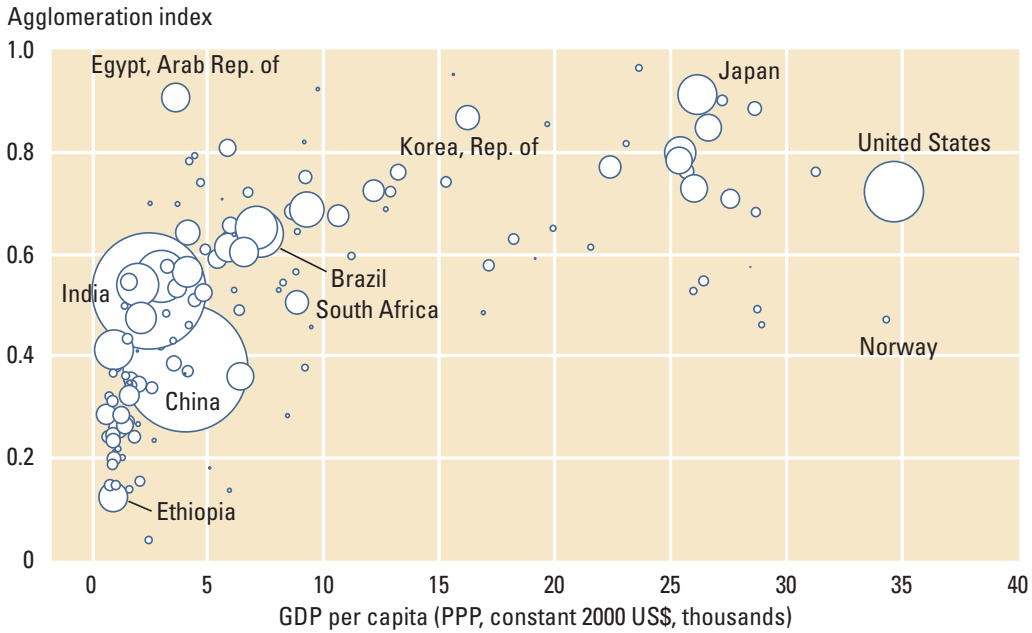
Income at urban share

	Year $>$ 40% Urban	1990 GDP/person
S. Asia	2010	3537
S.S. Africa	2018	1481
LAC	1950	2500
US	1900	6250

LAC, S.S. Africa, S. Asia began building cites at much lower levels of income than that of the US when it was at the same urban share. This makes it harder to pay for infrastructure and state capacity to make the cities work. Henderson and Turner (2020)

Development and Slums I

Figure 1.7 Shares of population living in urban agglomerations rise with the level of development

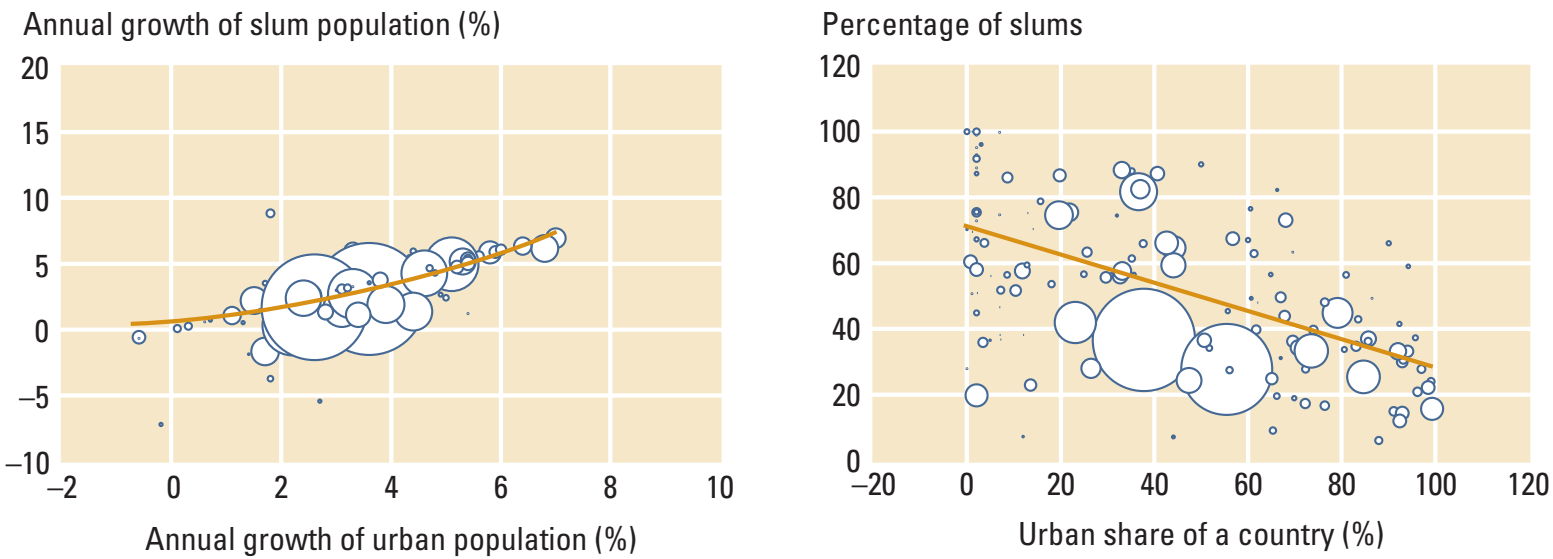


Sources: Calculated by WDR 2009 team using Nelson (2008) and World Bank (2006g).
Note: The size of each circle indicates the population size of that country. PPP = purchasing power parity. The agglomeration index uses the following criteria: density of 150 persons per kilometer or more, access time of 60 minutes or less to a sizable settlement, defined as one that has a population of more than 50,000.

Scott (2009) Urbanization and development goes together.

Development and Slums II

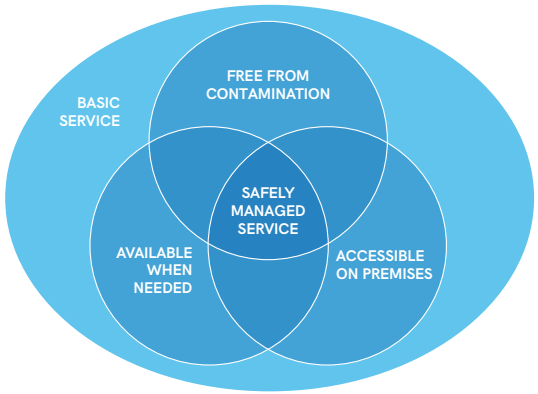
Figure 1.12 Slums grow with the pace of urbanization, and fall with its level

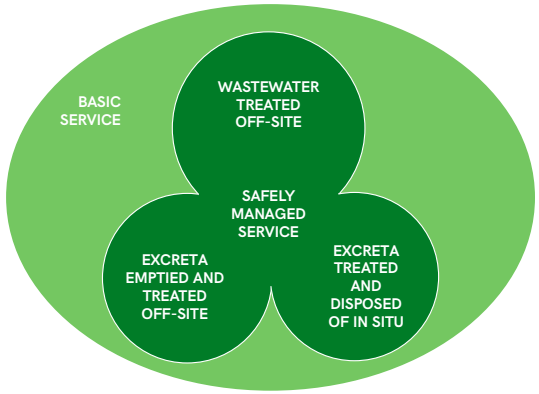


Source: Kilroy 2008.

Scott (2009) Poor countries house their urban residents in slums before they house them in nicer cities

World availability of water and sewer I





SERVICE LEVEL	DEFINITION
SAFELY MANAGED	Drinking water from an improved water source that is located on premises, available when needed and free from faecal and priority chemical contamination
BASIC	Drinking water from an improved source, provided collection time is not more than 30 minutes for a round trip, including queuing
LIMITED	Drinking water from an improved source for which collection time exceeds 30 minutes for a round trip, including queuing
UNIMPROVED	Drinking water from an unprotected dug well or unprotected spring
SURFACE WATER	Drinking water directly from a river, dam, lake, pond, stream, canal or irrigation canal

Note: Improved sources include: piped water, boreholes or tubewells, protected dug wells, protected springs, rainwater, and packaged or delivered water.

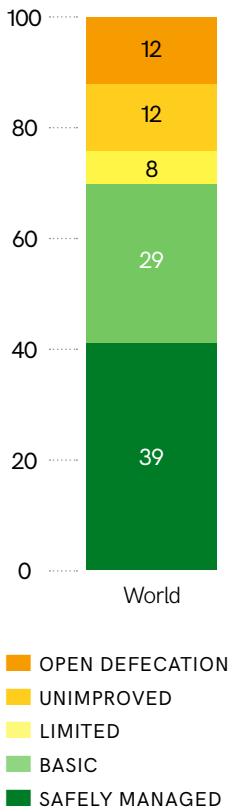
SERVICE LEVEL	DEFINITION
SAFELY MANAGED	Use of improved facilities that are not shared with other households and where excreta are safely disposed of in situ or transported and treated offsite
BASIC	Use of improved facilities that are not shared with other households
LIMITED	Use of improved facilities shared between two or more households
UNIMPROVED	Use of pit latrines without a slab or platform, hanging latrines or bucket latrines
OPEN DEFECATION	Disposal of human faeces in fields, forests, bushes, open bodies of water, beaches or other open spaces, or with solid waste

Note: improved facilities include flush/pour flush to piped sewer systems, septic tanks or pit latrines; ventilated improved pit latrines, composting toilets or pit latrines with slabs.

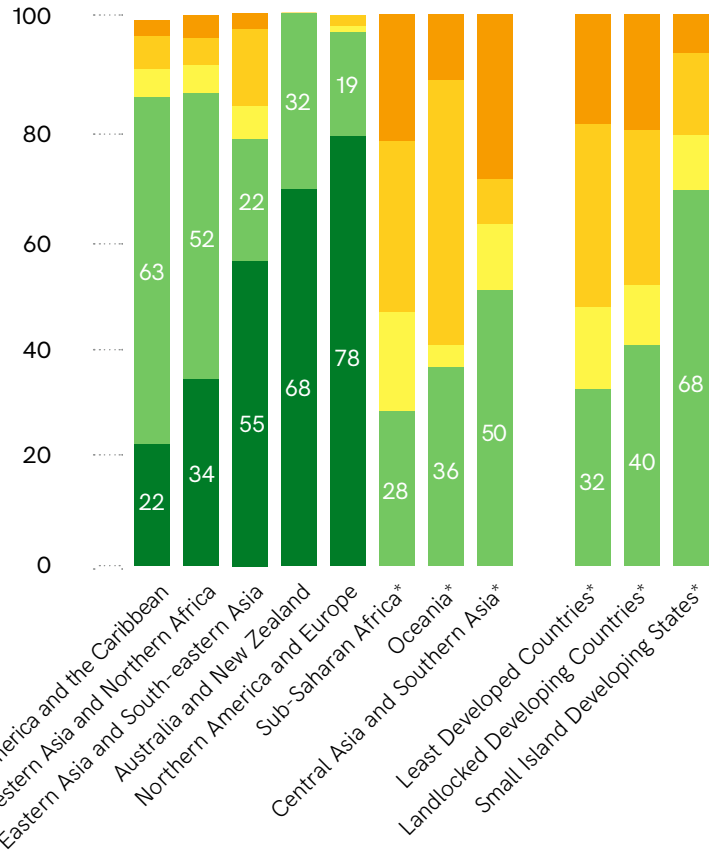
World Health Organization (2017)

World availability of water and sewer II

Two out of five people used safely managed sanitation services in 2015

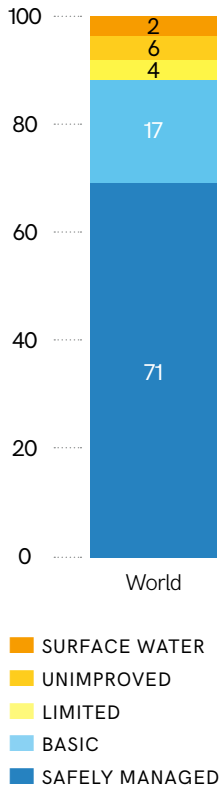


Estimates of safely managed sanitation services are available for five out of eight SDG regions

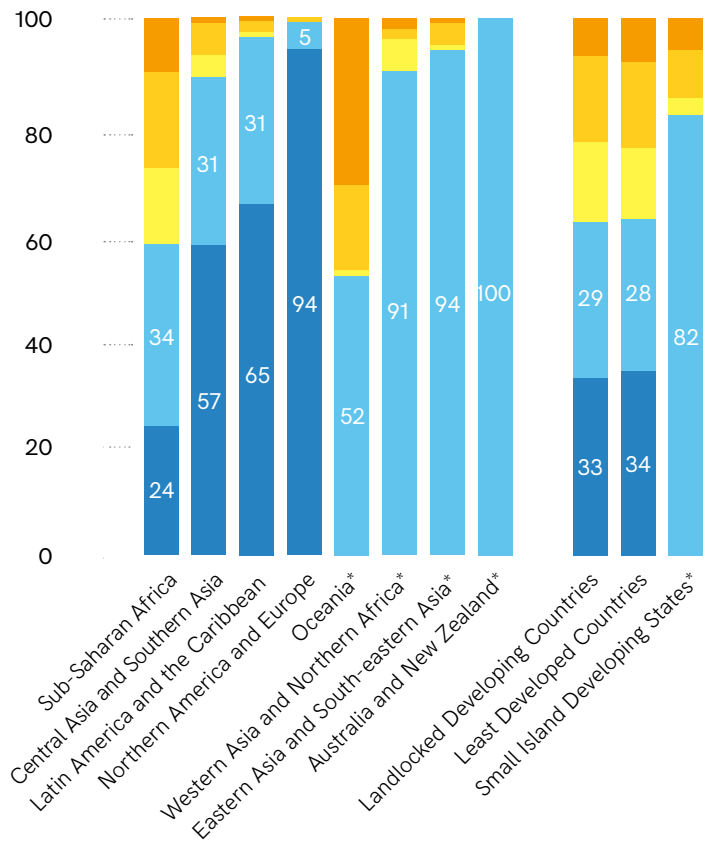


World availability of water and sewer III

7 out of 10 people used safely managed drinking water services in 2015



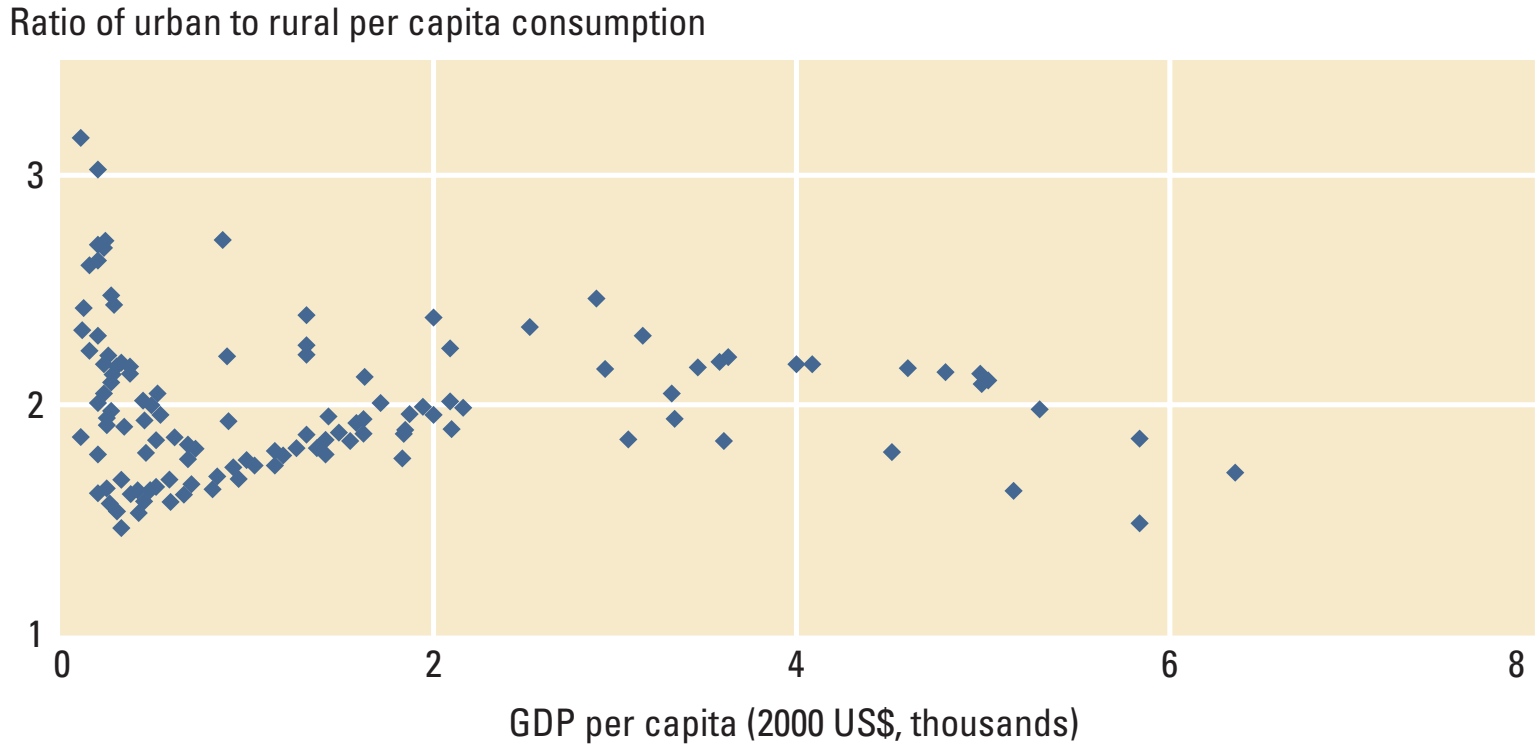
Estimates of safely managed drinking water services are available for four out of eight SDG regions



World availability of water and sewer IV

Water and sewer service is in short supply in much of the world, especially developing country slums. Sewers are scarcer than piped water.

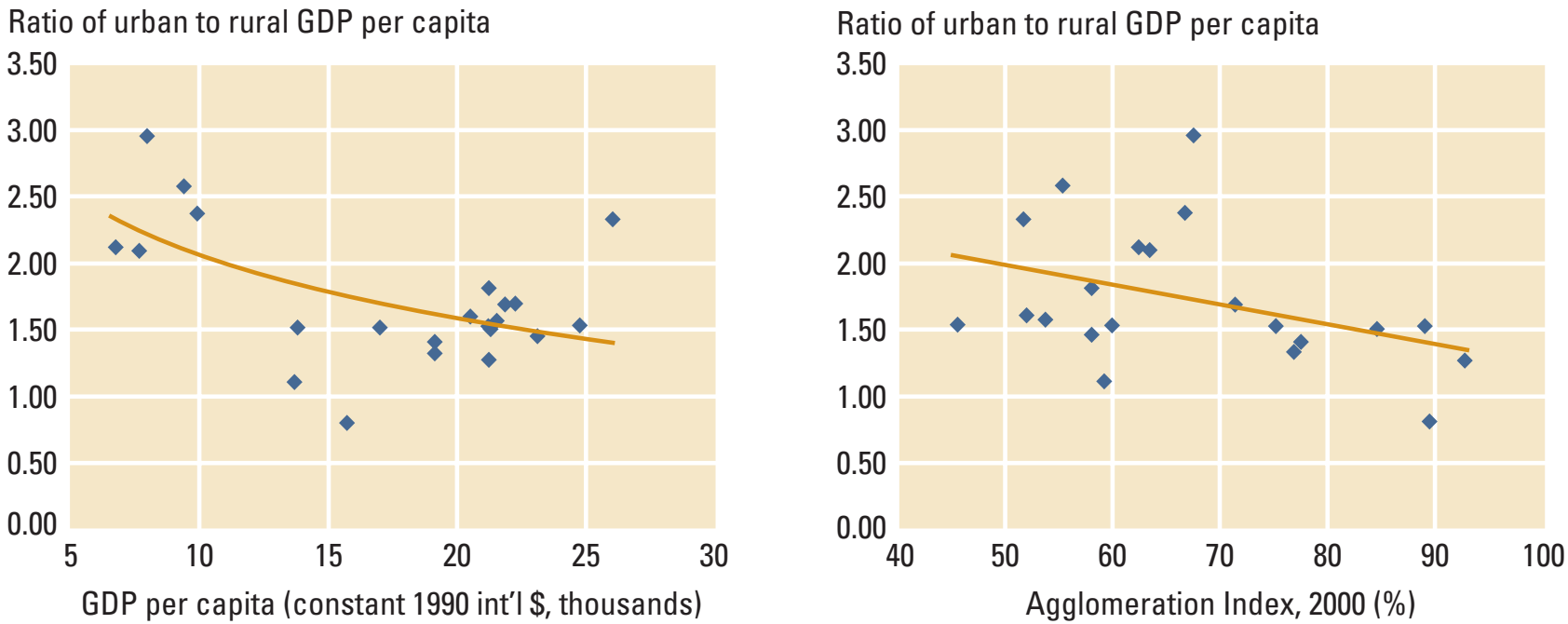
Urban wage premium I



Scott (2009) The urban wage/productivity premium is consistent across all levels of country income, though it is more variable in really poor countries. People are not moving to these cities for the plumbing. They are going for the opportunities.

Urban wage premium II

Figure 1.9 Rural-urban disparities in GDP per capita tend to be smaller in richer OECD countries



Source: WDR 2009 team, based on data from OECD (2007), pp. 1–256.

Scott (2009)

Urbanization in the developing world: Summary I

- Most city building is happening in Asia and Africa. The rest of the world is already highly urbanized.
- The wage/consumption premium in poor countries looks big compared to the US, 100% vs 35%.
- The consumption premium looks bigger than the wage premium.
- The incidence of slums in developing world cities seems high, and at least some basic infrastructure is scarce.
- Developing countries are building their cities when they are poor compared to when developed countries built cities.

Urbanization in the developing world: Summary II

Is this all consistent with the story we told about urbanization in the DEVELOPED world? Cities were dangerous and the rate of urbanization reflected the trade off between urban mortality and urban productivity premia?

To check we need systematic evidence on urban and rural productivity and amenities...

Urban vs rural outcome in the developing world I

Henderson and Turner (2020) tries to compare urban vs rural outcomes in the developing world, using consistent data across a range of countries and outcomes.

They rely on two main types of data,

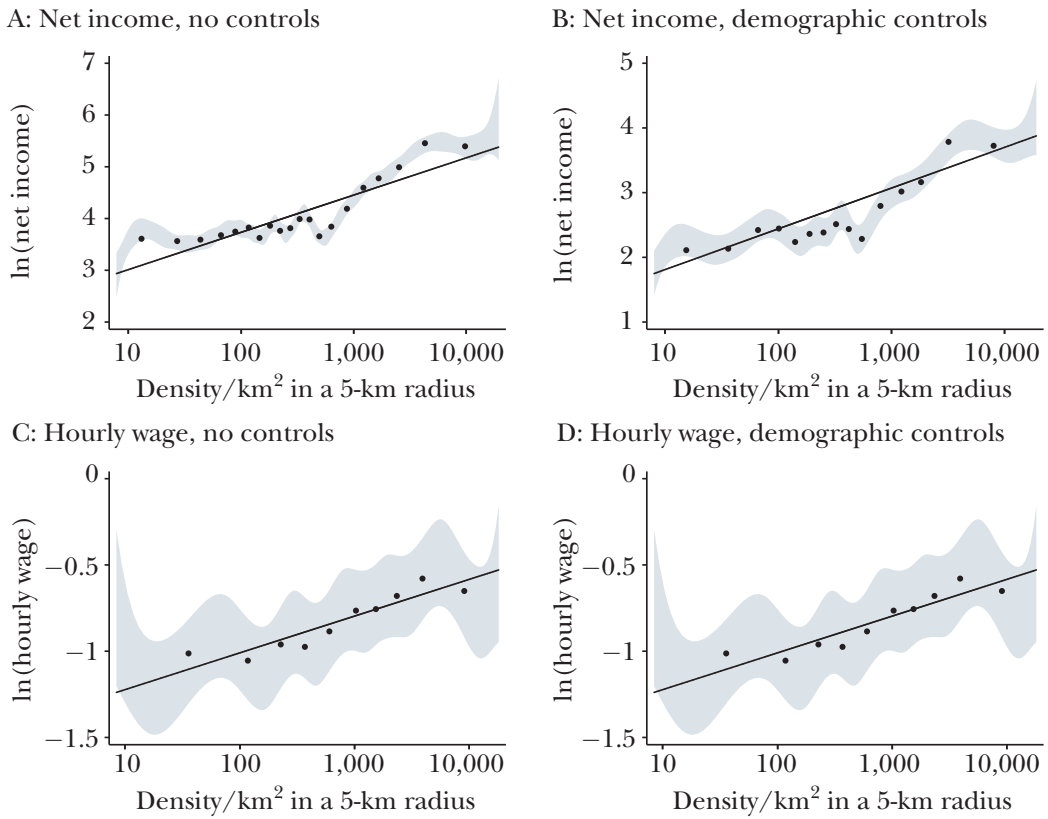
- Gridded population data from the Global Human Settlements project (2015). These are ‘best guess’ estimates of population in every one square kilometer cell on a regular grid. This data prorates population from coarser census units to cell using high resolution satellite data that shows built up areas.
- Geocoded survey data describing demographic characteristics of respondents and economic outcomes across much of the developing world, Africa in particular.

Urban vs rural outcome in the developing world II

This lets us look at how outcomes vary with nearby density (in a 5km disk), conditional on the demographics of the survey respondent.

Figure 3

Log of Household Net Income and Hourly Wage versus log Population Density



Note: Binscatter plots of LSMS net income of respondent household and of hourly wage, against the log of GHS population density in a 5km disk around the survey respondent. Log population density is censored below at about 8/km^2. Left panels have no controls. Right panels includes demographic controls and country fixed effects. Shading indicates 95 percent 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. LSMS survey countries are listed in table A2. Linear regression based on results in table A1a, which provides more details about the sample. Slope coefficients and standard errors of best linear fits are; (a) 0.313 (0.016) (b) 0.317 (0.014) (c) 0.118 (0.015) (d) 0.049 (0.009). Details in online Appendix.

- All panels show income/wages increasing with density. All show plots of

$$\ln(W) = A_0 + A_1 \ln(\text{Density}) + A_2 \text{Demographics} + \varepsilon$$

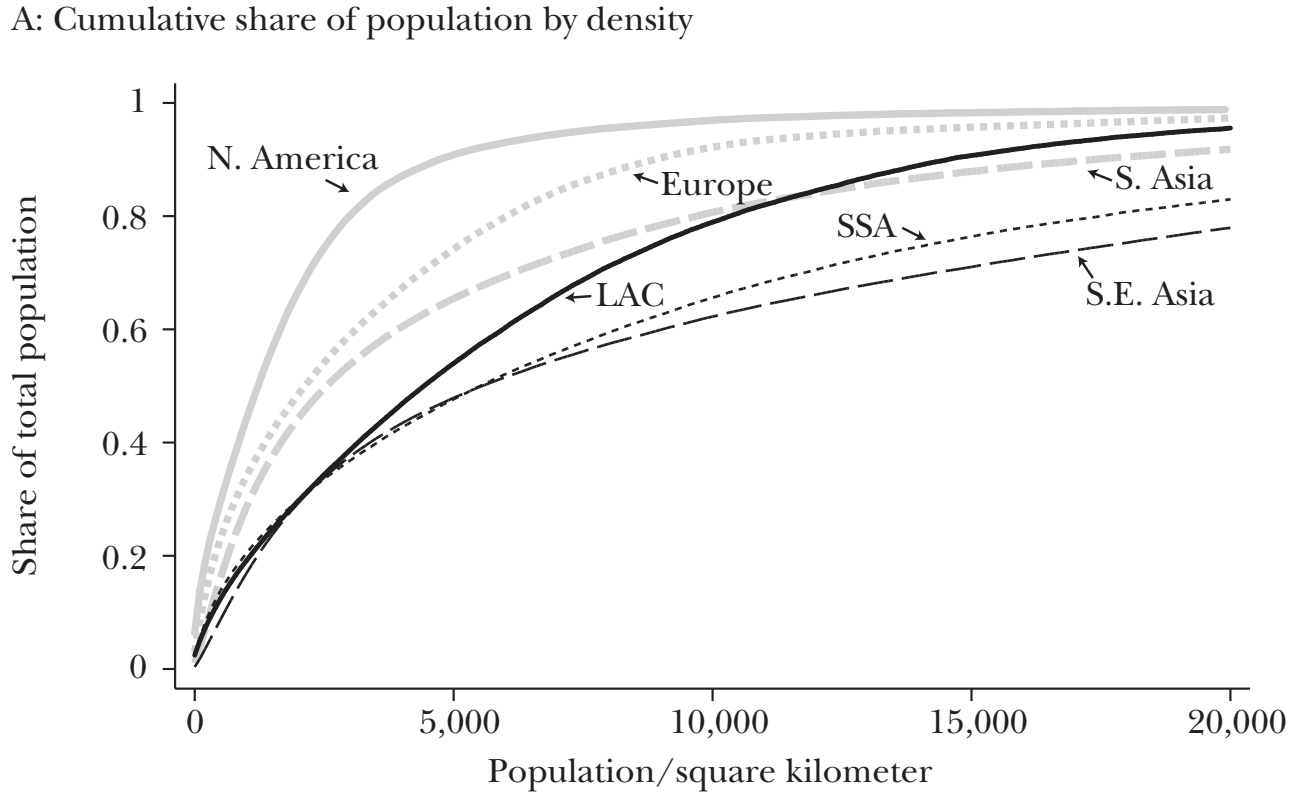
or

$$\ln(W) = A_0 + A_1 \ln(\text{Density}) + \varepsilon$$

So the slope of the relationship is an elasticity.

- Panel (c) is wages not conditional on density. On average, doubling density increases wages by 12%. Conditioning on demographics (age, sex, education) in panel (d) reduces this to 5%. For Household income, the elasticity is about 30% with and without controls.

- Comparing to the earlier results for France, unconditional density wage elasticity of wages is 5% for France versus about 12% for our mostly African sample. This result is common. The urban wage premium seems to be larger in poor countries than rich.



- Person weighted distribution of population density.
- This is very different from area weighted, which would show most cells with almost no population.
- The 20th percentile for population density in SSA is about 1000. The 80th is about 20,000.

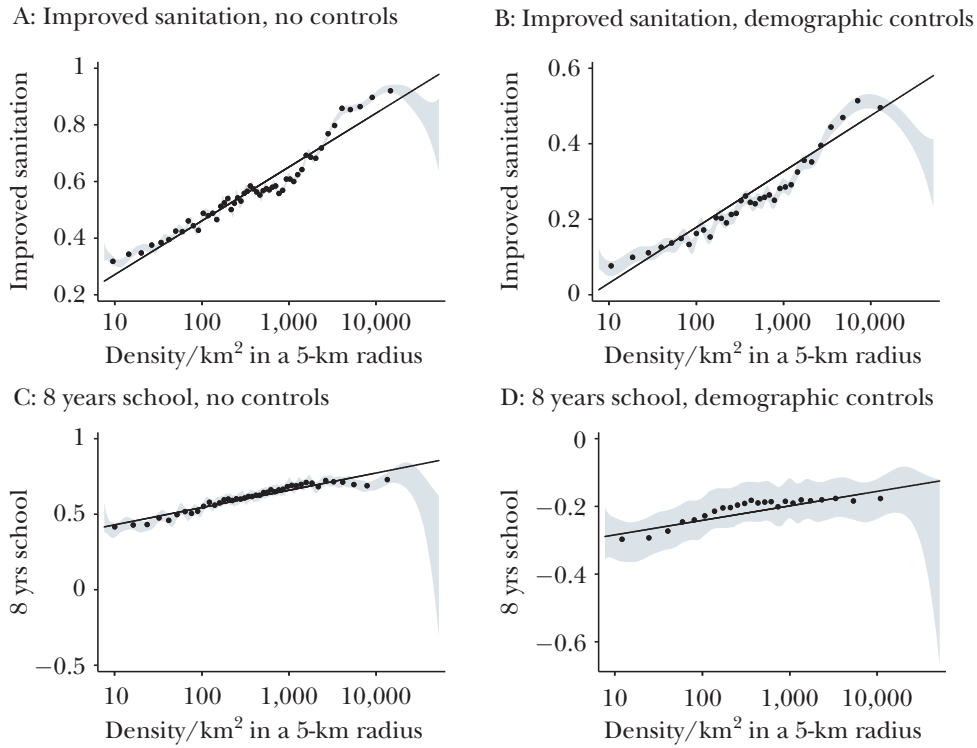
How much would this change household income?

$$\begin{aligned}
\ln Y_1 &= A_0 + 0.32 \ln(20000) + A_1 \text{Demographics} + \varepsilon \\
-\ln Y_0 &= A_0 + 0.32 \ln(1000) + A_1 \text{Demographics} + \varepsilon \\
\hline
\ln Y_1 - \ln Y_0 &= 0.32(\ln(20000) - \ln(1000)) \\
\implies \ln \frac{Y_1}{Y_0} &= 0.32 \ln(20) \\
\implies \ln \frac{Y_1}{Y_0} &= \ln(20^{(}0.32)) \\
\implies \ln \frac{Y_1}{Y_0} &= \ln(2.6) \implies \frac{Y_1}{Y_0} = 2.6
\end{aligned}$$

So an average household increases its income by a factor of 2.6 by moving from the 20th to the 80th percentile of density. Why don't more people move?

Figure 4

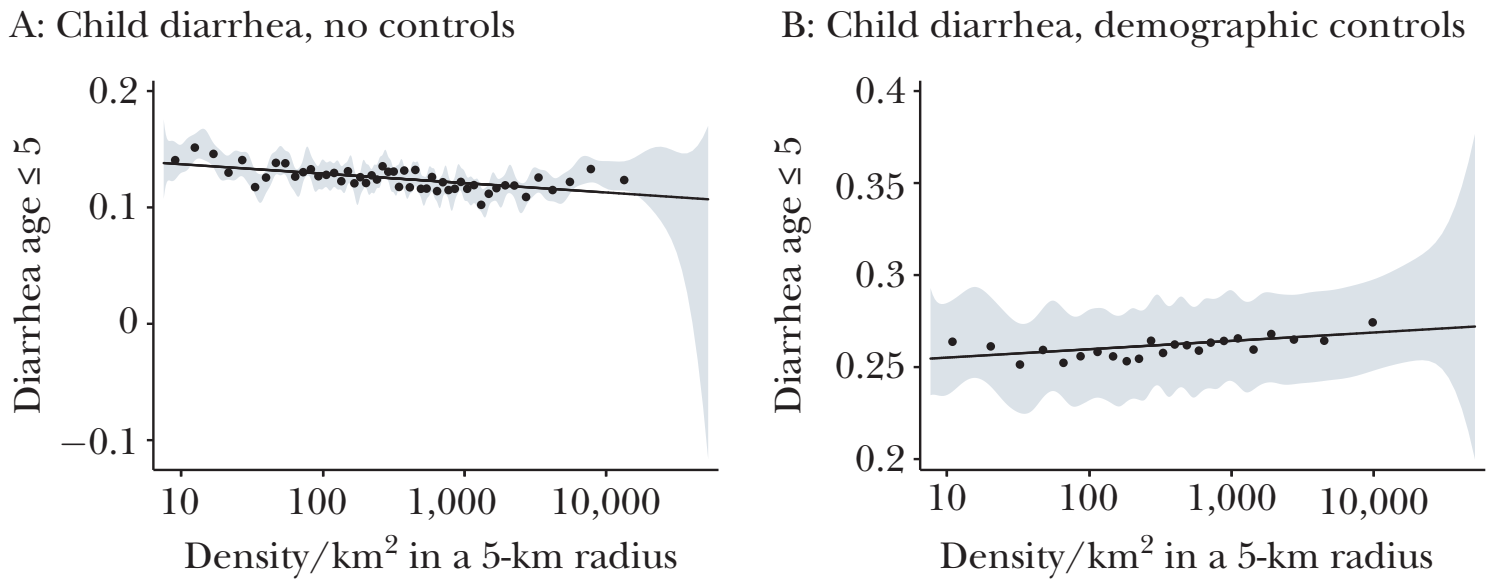
Access to Improved Sanitation and Probability of Children Receiving Eight Years of School versus log Population



Note: Binscatter plots of a DHS indicator variable that is one if a respondent household has access to improved sanitation and of an indicator that is one if a household child 16 years old completed eight years of school, against the log of GHS population density in a 5km disk around the survey respondent. Log population density is censored below at about 8/km^2. Left panel is unconditional. Right panel includes demographic controls and country fixed effects. Shading indicates 95 percent confidence band. DHS survey countries are listed in table A2. Linear regression based on results in table A1a, which provides more details about the sample. Slope coefficients and standard errors of best linear fits are; (a) 0.083 (0.001) (b)0.063 (0.001) (c) 0.050 (0.001) (d) 0.016 (0.001). Details in online Appendix.

Figure 5

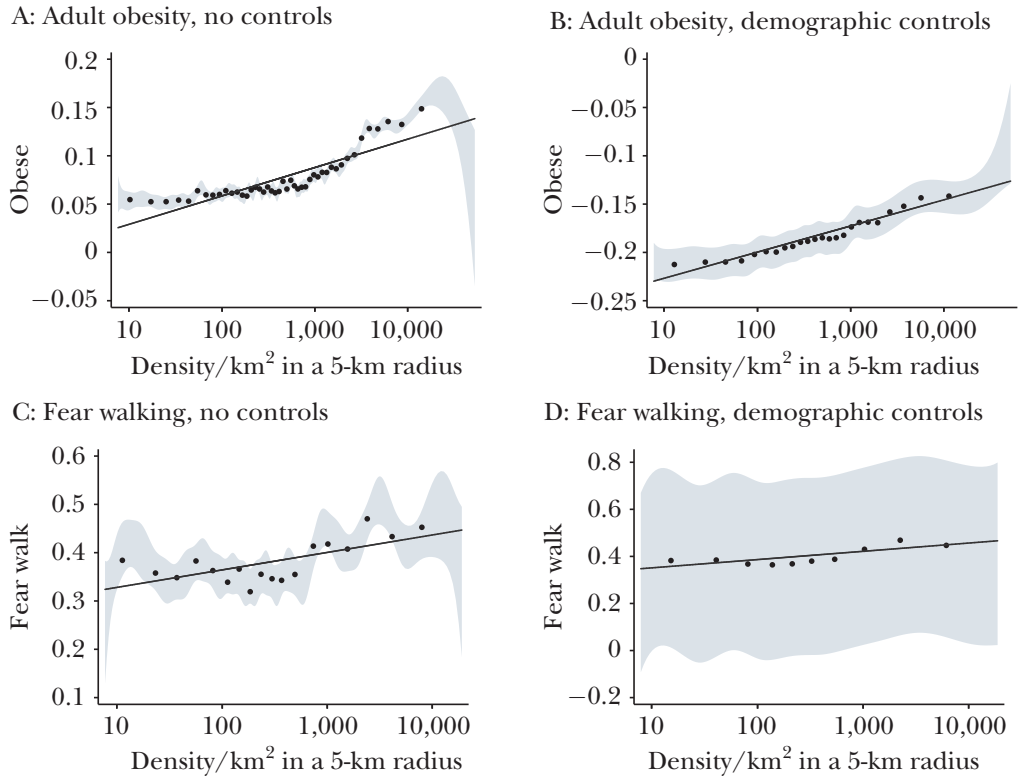
Diarrhea Last Two Weeks for Children Five and under versus log Population Density



Note: 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 at about 8/km^2. Left panel is unconditional. Right panel includes demographic controls and country fixed effects. Shading indicates 95 percent confidence band. DHS survey countries are listed in table A2. Linear regression based on results in table A1b, which provides more details about the sample. Slope coecients and standard errors of best linear fits are; (a) –0.004 (0.0005) (b) 0.003 (0.0004). Details in online Appendix.

Figure 6

Adult Obesity and Self-Reported Fear of Walking Outside versus log Population Density



Note: Binscatter plots of a DHS indicator that is one if the survey respondent is obese or reported being afraid for their safety while walking outside, against the log of GHS population density in a 5km disk around the survey respondent. Log population density is censored below at about 8/km^2. Left panel is unconditional. Right panel includes demographic controls and country fixed effects. Shading indicates 95 percent confidence band. DHS survey countries are listed in table A2. Linear regression based on results in table A1b, which provides more details about the sample. Slope coefficients and standard errors of best linear fits are; (a) 0.013 (0.0005) (b) 0.010 (0.0003) (c) 0.016 (0.004) (d) 0.016 (0.003). Details in online Appendix.

Rural vs Urban: Summary I

- These figures let us see rural vs urban incomes and amenities. Exactly the factors that should affect spatial equilibrium.
- The household income premium looks huge.
- Some amenities appear to improve with density, sanitation, schooling, access to contraception. Some look worse. Child mortality is marginally higher, so is sickness. Exposure to crime is a little higher, and women are slightly more likely to be victims of domestic violence. Lifestyle diseases are worse, but it's not clear if this is really a bad thing.

Rural vs Urban: Summary II

- Does this fit with our story for the developing world? Maybe, but it seems like a stretch. The crude death rates in US cities were 40% higher than the countryside. None of the problems we see in cites is obviously of the same importance.
- How do we explain that not everyone moves to cites (to triple their income)?
  - The idea of spatial equilibrium is just wrong, and we don't know how to think about the problem.
  - Some of the problems we see in developing world cities are more important than they look.
  - People in the developing world are really attached to their rural homes.

Rural vs Urban: Summary III

This last, ‘rural amenities’, is the current favorite resolution of this puzzle. Let’s see how it works in the monocentric city model, and look at some of the evidene/stories about it.

The Monocentric City Model and Rural Amenities I

Recall how we set up the monocentric city model with rural amenities,

$$A_R, A_U \sim \text{Rural and Urban amenities}$$
$$c_R, c_U \sim \text{Rural and Urban consumption}$$

and define $\overline{u} = u(A_R c_R)$.
Thus, the reservation utility level determined by rural income and amenities.

Otherwise, everything is the same as the monocentric city model with amenities.

The Monocentric City Model and Rural Amenities II

Each urban household chooses their location, commutes to work and divides w between commuting and c. This means that a household's problem is

$$\max_{c,x} u(A_U c)$$
$$\text{s.t. } w = c + R(x)\bar{\ell} + 2t|x|$$

Everyone, urban and rural, should get the same utility, so

$$\bar{u} = u(A_R c_R) = u(A_U c_U) \tag{1}$$
$$c^*(A_U) = u^{-1}(\bar{u})/A_U$$

The Monocentric City Model and Rural Amenities III

In addition, to make things easy, assume rural rent is zero and that farmers don't commute. This means that

$$c_R = w_R \tag{2}$$

Finally, the estimates we just saw show that there is a big difference between rural and urban wages. To be specific, suppose it's a factor of 2.6 (what we just calculated). Then,

$$w_U = 2.6 \times w_R \tag{3}$$

The Monocentric City Model and Rural Amenities IV

For urban residents, equilibrium in the moncentric city model requires that

$$\begin{aligned} c_U &= w_U - R(x)\bar{\ell} - 2tx \\ &= w_U - 2t\bar{x} \end{aligned} \tag{4}$$

Substituting 2 and 4 into 1, we get

$$A_R w_R = A_U[w_U - 2t\bar{x}]$$

Finally, using 3, we get

$$A_R w_U / 2.6 = A_U[w_U - 2t\bar{x}]$$

$$\implies A_R = (2.6 - \frac{2t\bar{x}}{w_R})A_U.$$

The Monocentric City Model and Rural Amenities V

Lets call $\frac{2t\bar{x}}{w_R} = \alpha$. This is the fraction of total household resources devoted to commuting. This is probably less than 0.2 and is surely less than 1/2. So, we have

$$\begin{aligned} \implies A_R &= (2.6 - \alpha)A_U \\ &> 2.1 \times A_U \end{aligned}$$

That is, in order for us to have a spatial equilibrium where rural residents don't want to move to the city, and where doing so increases income by a factor of 2.6, we need rural amenities to be a lot bigger than urban amenities.

Why might this occur? There are three main hypotheses.

- Unemployment is high in cities.

The Monocentric City Model and Rural Amenities VI

- People don’t know about the opportunities available in the city.
- People just like to stay where they are born.

Let’s look at the case for each.

Urban unemployment I

This idea was first developed by Harris and Todaro (1970)

- Suppose people who move t the city are unemployed with probability p, but they are never unemployed in the countryside.
- Then we could observe $w_U > w_R$, but because we are not observing wages for the unemployed, this wold not be the wage people were using to make migration decisions.
- Rather, people would be comparing the expected urban wage (or the expected utility of the wage) to the rural wage. That is, spatial equilibrium would be based on a comparison of pw_U and w_R, not w_R and w_U.
- This is a widely cited argument. However,

Urban unemployment II

- Household income is not subject to this reporting problem. Surveys report incomes for all households, not just those with jobs. It looks like household incomes go up with urbanization, even after we allow for the fact that some households may face unemployment.
- There could be rural unemployment, too. Certainly, ‘underemployment’.

- My view: Urban employment risk likely contributes to the existence of the observed rural-urban wage gap, but it doesn’t seem important enough to explain all or even most of it.

Information I

Anther possibility is that rural residents simply don't know that better jobs are available in the cities. They would move if they knew, but they don't. In this case, if we could just each them about these opportunities, then we could shift a lot of people out of rural poverty into the more productive urban economy.

Bryan et al. (2014) do a very nice experiment to assess this hypothesis.

Information II

Rural Bangladesh is subject to regular famines, each year during the months leading up to the harvest.

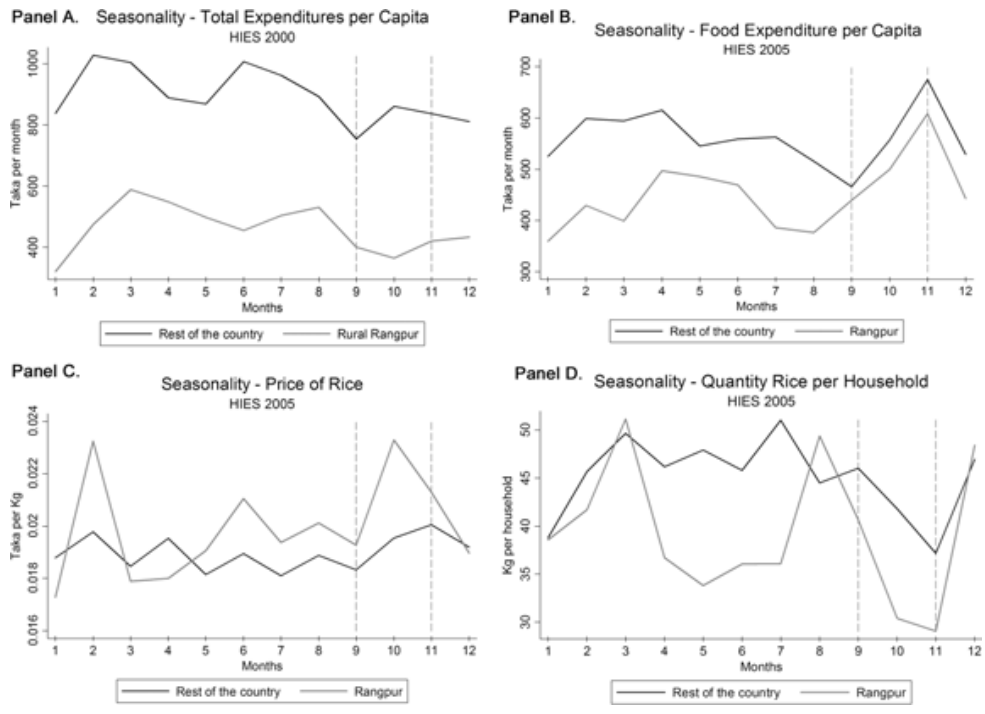


FIGURE 1.—Seasonality in consumption and price in Rangpur and in other regions of Bangladesh. *Source*: Bangladesh Bureau of Statistics 2005 Household Income and Expenditure Survey.

Information III

- Better employment is available in the cities, and it is possible to migrate to the city during the famine season, work, and send money home.
- To understand why more people don't do this, Bryan et al. (2014) selected households from rural villages at random to either be 'treated' or 'control'. There were three main treatments
  - Cash transfer conditional on a household member migrating to the city to work during the famine season. The transfer was about equal to the cost of a round trip bus ticket (8.50USD)
  - Credit for the same amount, same terms. This is the same, but 8.50 is a loan, not a gift.
  - Information about the opportunities available in the city.

Information IV

- Because households are randomly assigned to treatment ‘arms’, comparing outcomes for treated households to those for untreated households gives us the effect of the treatment, no econometrics required.

Information V

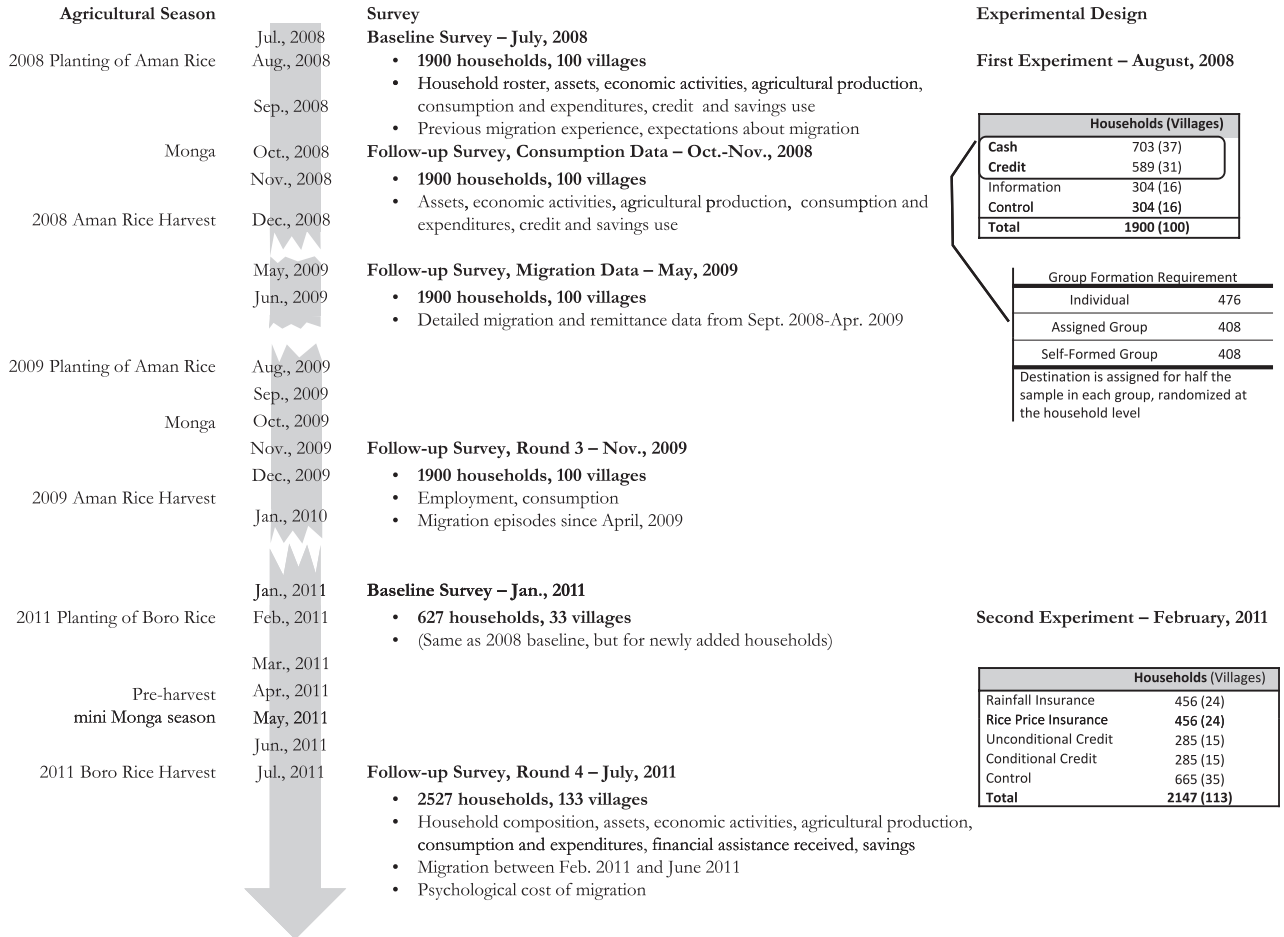


FIGURE 2.—Trial profile and timeline.

Information VI

- The research design depends critically on being able to randomize treatments.
- This table shows that they appear to have been successful. Observable characteristics of treatment and control households are statistically indistinguishable.
- Could treated households still be, for example, more ambitious, than typical households? This could happen if ‘more ambitious’ people get in line to participate in the experiment. This problem sometimes occurs in experiments.

Information VII

TABLE I

RANDOMIZATION BALANCE ON OBSERVABLES AT BASELINE[a]

	Incentivized		Non-Incentivized			
	Cash	Credit	Control	Info	Diff. (I – NI)	*p*-Value
Consumption of food	805.86	813.65	818.68	768.64	15.84	0.638
	(19.16)	(40.91)	(31.76)	(18.00)	(33.57)	
Consumption of non-food	248.98	262.38	248.4	237.35	12.23	0.278
	(5.84)	(6.74)	(9.28)	(7.99)	(11.20)	
Total consumption	1054.83	1076.03	1067.08	1005.99	28.06	0.465
	(21.11)	(42.08)	(34.55)	(22.77)	(38.29)	
Total calories (per person per day)	2081.19	2079.51	2099.3	2021.31	20.25	0.585
	(20.34)	(22.76)	(30.44)	(32.56)	(36.99)	
Calories from protein (per person per day)	45.66	45.3	46.26	44.75	−0.01	0.992
	(0.54)	(0.57)	(0.77)	(0.85)	(0.92)	
Consumption of meat products	25.04	18.24	27.13	20.71	−1.97	0.594
	(2.58)	(2.0)	(3.24)	(2.90)	(3.69)	
Consumption of milk and eggs	11.74	9.77	9.96	10.77	0.48	0.675
	(0.79)	(0.80)	(1.12)	(1.19)	(1.13)	
Consumption of fish	42.17	39.86	41.36	45.98	−2.56	0.496
	(1.83)	(1.79)	(2.76)	(2.89)	(3.74)	

Information VIII

PROGRAM TAKE-UP RATES[a]

	Incentivized	Cash	Credit	*Not Incentivized*	Info	Control	*Diff. (I − NI)*
Migration rate in 2008	58.0%	59.0%	56.8%	36.0%	35.9%	36.0%	22.0***
	(1.4)	(1.9)	(2.1)	(2.0)	(2.8)	(2.8)	(2.4)
Migration rate in 2009	46.7%	44.6%	49.1%	37.5%	34.4%	40.5%	9.2***
	(1.4)	(1.9)	(2.1)	(2.0)	(2.8)	(2.9)	(2.5)
Migration rate in 2011[b]	39%			32%			7.0**
	(2.1)			(2.5)			(3.3)

[a]Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Diff. Incentivized − Not Incentivized tests the difference between migration rates of incentivized and non-incentivized households, regardless of whether they accepted our cash or credit. No incentives were offered in 2009.

[b]For re-migration rate in 2011, we compare migration rates in control villages that never received any incentives to the subset of 2008 treatment villages that did not receive any further incentives in 2011. Note that migration was measured over a longer period (covering the main monga season) in 2008 and 2009, and a different time period (the mini-monga season) in 2011.

This table shows that people changes their behavior in response to the subsidy, but not in response to information.

- Subsidy increases share of households with a migrant worker from 36 to 58%, a 22% increase! This is a huge effect from a small intervention.

Information IX

- In the year after the intervention, the share of treated households with a migrant worker is 47%, versus 38% in untreated households, even there is no incentive offered this year.
- In the second year after the intervention, the share of treated households with a migrant worker is 39% versus 32% for untreated households. Again, no incentive in this year.

Information X

TABLE III

EFFECTS OF MIGRATION BEFORE DECEMBER 2008 ON CONSUMPTION AMONGST REMAINING HOUSEHOLD MEMBERS[a]

	ITT								
	Cash	Credit	Info	ITT	ITT	IV	IV	OLS	Mean
				Panel A: 2008 Consumption					
Consumption of food	61.876**	50.044*	15.644	48.642**	44.183*	280.792**	260.139**	102.714***	726.80
	(29.048)	(28.099)	(40.177)	(24.139)	(23.926)	(131.954)	(128.053)	(17.147)	
Consumption of non-food	34.885***	27.817**	22.843	20.367**	16.726*	115.003**	99.924*	59.085***	274.46
	(13.111)	(12.425)	(17.551)	(9.662)	(9.098)	(56.692)	(51.688)	(8.960)	
Total consumption	96.566***	76.743**	38.521	68.359**	60.139**	391.193**	355.115**	160.696***	1000.87
	(34.610)	(33.646)	(50.975)	(30.593)	(29.683)	(169.431)	(158.835)	(22.061)	
Total calories	106.819*	93.429	−85.977	142.629***	129.901***	842.673***	757.602***	317.495***	2090.26
(per person per day)	(62.974)	(59.597)	(76.337)	(47.196)	(48.057)	(248.510)	(250.317)	(41.110)	

(*Continues*)

Information XI

TABLE III—*Continued*

	ITT								
	Cash	Credit	Info	ITT	ITT	IV	IV	OLS	Mean
				Panel B: 2009 Consumption					
Consumption of food	34.273	22.645	−30.736	43.983**	34.042*	230.811**	186.279*	1.687	872.69
	(23.076)	(23.013)	(29.087)	(17.589)	(18.110)	(100.536)	(96.993)	(14.687)	
Consumption of non-food	3.792	31.328*	−8.644	21.009*	14.877	110.324*	74.216	6.133	323.31
	(16.186)	(18.135)	(20.024)	(11.954)	(12.031)	(65.333)	(63.792)	(10.312)	
Total consumption	38.065	53.973	−39.380	64.992***	48.919*	341.135**	260.495**	7.820	1196.01
	(30.728)	(34.057)	(39.781)	(23.958)	(24.713)	(137.029)	(131.851)	(21.044)	
Total calories	83.242	23.995	−81.487	95.621**	78.564*	510.327**	434.602**	20.361	2001.27
(per person per day)	(52.766)	(62.207)	(60.141)	(39.187)	(40.600)	(221.010)	(216.670)	(28.392)	
Controls?	No	No	No	No	Yes	No	Yes	No	

[a]Robust standard errors in parentheses, clustered by village. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Each row is a different dependent variable (in column 1). In the IV columns, these dependent variables are regressed on "Migration," which is a binary variable equal to 1 if at least one member of the household migrated and 0 otherwise. The last column reports sample mean of the dependent variable in the control group. All consumption (expenditure) variables are measured in units of Takas per person per month, except Caloric Intake which is measured in terms of calories per person per day. Some expenditure items in the survey were asked over a weekly recall and other less frequently purchased items were asked over a bi-weekly or monthly recall. The denominator of the dependent variable (household size) is the number of individuals who have been present in the house for at least seven days. Additional controls included in columns 5 and 7 were: household education, proxy for income (wall material), percentage of total expenditure on food, number of adult males, number of children, lacked access to credit, borrowing, total household expenditures per capita measured at baseline, and subjective expectations about monga and social network support measured at baseline.

- To learn effects of treatment, let's look at 'Intent to Treat'. This is the effect on households offered the conditional subsidies, not on those that chose to use it, once offered.

Information XII

- The first table shows that consumption goes up a lot for these households.
- Cash and credit are about the same. Telling people about the city doesn't change their behavior very much.
- The second table shows that this effect persists during the year after the experiment.

Information XIII

Summing up

- Getting poor rural people to the cities, even for seasonal work, increases their income.
- This is consistent with the data we saw earlier documenting a large rural-urban wage gap.
- This experiment shows a really big effect on migration behavior from a subsidy the size of a bus ticket.
- But, the effect wears off after two years.
- That is, even after they learn about the urban labor market, most treated households revert to their pre-treatment behavior.

Information XIV

- At the margin, households seem to be making decisions they are happy with (score one for homo economicus).
- Can we use these results to say anything about the welfare implications of migration? Probably not without knowing a lot more about urban labor demand. What if each incentivized rural migrant takes a job from an unincentivized rural migrant?

Social Networks I

- The rural population in developing countries is often very poor (we just saw that many of them were willing to migrate to the city for a season in response to a subsidy of less than 10$).
- Perhaps for such poor people, their social networks are important enough to offset the benefits of a higher urban wage, far from people who can help them get a loan (often for consumption) or find a job.
- There has been a lot of research investigating this. The following table from Munshi (2014) provides some evidence about their importance.

Social Networks II

Percent of Loans by Source and Purpose in India

Purpose:	*Investment*	*Operating expenses*	*Contingencies*	*Consumption expenses*	*All*
Source:					
Bank	64.11	80.80	27.58	25.12	64.61
Caste	16.97	6.07	42.65	23.12	13.87
Friends	2.11	11.29	2.31	4.33	7.84
Employer	5.08	0.49	21.15	15.22	5.62
Moneylender	11.64	1.27	5.05	31.85	7.85
Other	0.02	0.07	1.27	0.37	0.22
Total	100.00	100.00	100.00	100.00	100.00

Source: Munshi and Rosenzweig (2014). Data are from the 1982 Rural Economic Development Survey (REDS).
Notes: Statistics are weighted by the value of the loan and sample weights. Investment includes land, house, business, etc. Operating expenses are for agricultural production. Contingencies include marriage, illness, and others.

Could this be worth a wage increase of 260%?

Explaining the rural urban wage gap: Summary

The large rural-urban wage gap in developing countries is a challenge to the idea of spatial equilibrium. How can people be indifferent between locations when the income difference is so great? Maybe the idea of people moving to equilibrate utility across places is just wrong?

- There is a large rural urban wage gap in developed countries, too, but not as large, and we can rationalize it if we think people trade off the urban mortality premium against the wage. Developed world cities were dangerous places when these countries were urbanizing. This is not obviously true for developing countries.
- Looking at how observable amenities vary with density in developing countries is a mixed bag. Some things, like access to improved sanitation and piped water, or contraception and primary education, are better. Others are worse. children are

Urbanization in the developing world: Summary I

- Most urbanization today is happening in poor countries in Asia and Africa. The rest of the world is already pretty highly urbanized.
- There are lots of problems with developing world cities. They are being built in places that are poor relative to when developed countries built their cities. Basic infrastructure is scarce, sewers in particular, slums are common.
- But, they do not seem to be as squalid and dangerous as developed world cities were while they were being built.

Urbanization in the developing world: Summary II

- On the other hand, developed world cities appear to be places of tremendous opportunity. Indeed, as grim as they are, we should probably see slums as successes, not failures. They are places where people can escape the still worse poverty of the countryside.
- We face two puzzles
  - Understanding why people ‘stick’ to rural places. It is hard to point to an explanation that seems important enough. Amenities and social networks are our leading candidates, but they are hard to observe and quantify.
  - Understanding which of the onerous features of developed world cities can be most cost-effectively resolved? How can we allocate scarce dollars to city building in the way that will lead to the largest reductions in squalor and misery?

Urbanization in the developing world: Summary III

These two questions have only recently begun to attract the attention of urban and development economists and are areas of active research.

Alsan, M. and Goldin, C. (2019). Watersheds in child mortality: The role of effective water and sewerage infrastructure, 1880–1920. *Journal of Political Economy*, 127(2):586–638.

Bolt, J. and Van Zanden, J. L. (2014). The maddison project: collaborative research on historical national accounts. *Economic history review*, 67(3):627–651.

Boustan, L. P., Bunten, D. M., and Hearey, O. (2013). Urbanization in the united states, 1800-2000. Technical report, National Bureau of Economic Research.

Bryan, G., Chowdhury, S., and Mobarak, A. M. (2014). Underinvestment in a profitable technology: The case of seasonal migration in bangladesh. *Econometrica*, 82(5):1671–1748.

Glaeser, E. L. and Gottlieb, J. D. (2009). The wealth of cities: Agglomeration economies and spatial equilibrium in the united states. *Journal of economic literature*, 47(4):983–1028.

Haines, M. R. (2001). The urban mortality transition in the united states, 1800-1940. In *Annales de démographie historique*, number 1, pages 33–64.

Harris, J. R. and Todaro, M. P. (1970). Migration, unemployment and development: a two-sector analysis. *The American economic review*, pages 126–142.

Henderson, J. V. and Turner, M. A. (2020). Urbanization in the developing world: too early or too slow? *Journal of Economic Perspectives*, 34(3):150–73.

Hsieh, C.-T. and Moretti, E. (2019). Housing constraints and spatial misallocation. *American Economic Journal: Macroeconomics*, 11(2):1–39.

Munshi, K. (2014). Community networks and the process of development. *Journal of Economic Perspectives*, 28(4):49–76.

Scott, A. J. (2009). World development report 2009: reshaping economic geography.

World Health Organization (2017). Progress on drinking water, sanitation and hygiene: 2017 update and sdg baselines.