Introduction to the Economics of Development

10. Humanities greatest invention? Is urbanisation the only route to development?

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This week

Is urbanisation the only route to development?

- Introduction to urban economics and development. Review article: Bryan, Glaeser, and Tsivanidis (2020)
- Macro lens: public policy in designing effective cities.
- Micro lens: Causal impact of agglomeration on wages. Bryan, Chowdhury, and Mobarak (2014)
- Macro-micro: Transport investments Tsivanidis (2023).

These slides are partly based on material from the BREAD-IGC Virtual PhD course on urban economics.

Macro lense

The fundamental question of cities

Why do they exist?

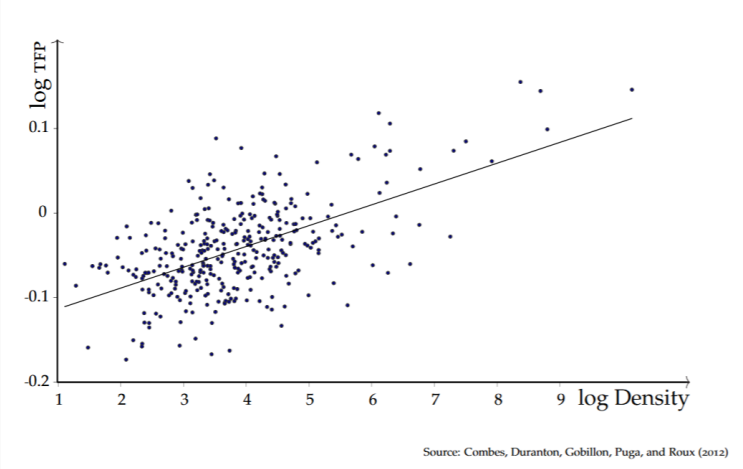
Answer: There are agglomeration benefits.

Well then, why don't we all live in one big city?

Answer: There are agglomeration costs.

The benefits — evidence

Bigger cities imply higher wages/ productivity (intensive margin).



Source: Combes, Duranton, Gobillon, Puga, and Roux (2012)

The benefits — evidence

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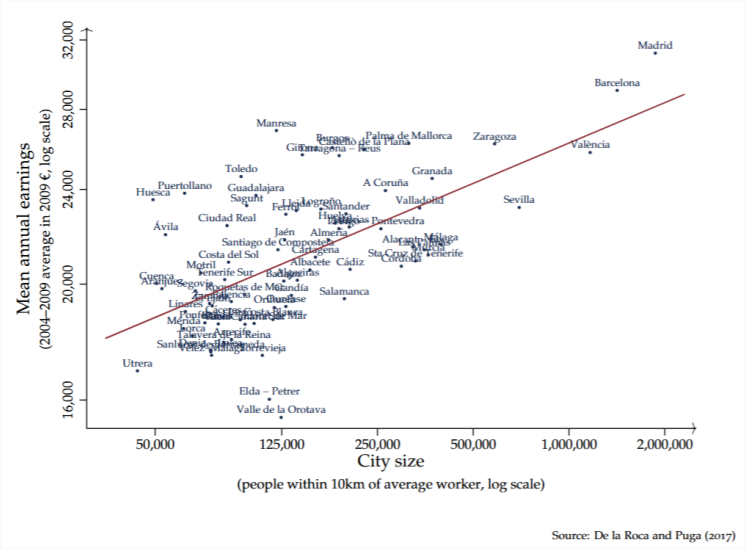
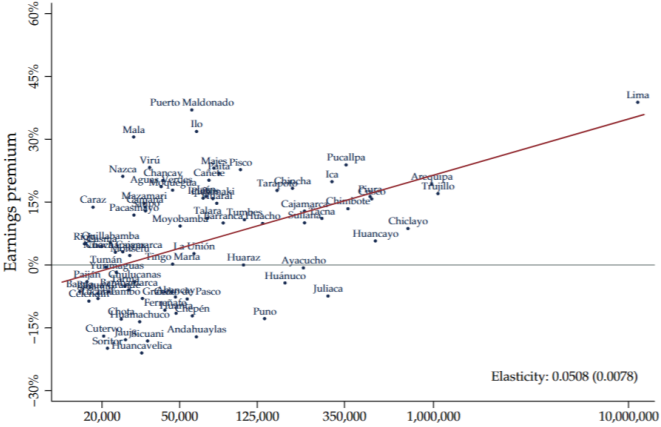


Source: De la Roca and Puga (2017)

The benefits — evidence

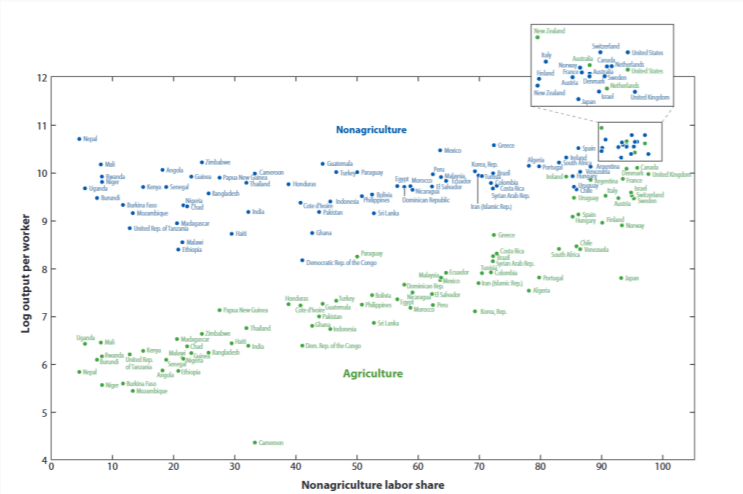
Bigger cities imply higher wages/ productivity (intensive margin).



Source: De la Roca, Parkhomenko, and Velásquez Cabrera (2024)

The benefits — evidence

Cities have higher wages than rural areas (extensive margin).



Source: Bryan, Glaeser, and Tsivanidis (2020)

Why are there benefits to working in cities?

Call these benefits agglomeration economies or agglomeration effects.

- Firms are closer to buyers and suppliers — large market access.
- Workers more efficiently sort into jobs "thick" labor markets create better matches.
- Knowledge effects, workers learn from the smart people around them.
- Non-monetary benefits: Amenities. Nice parks, great restaurants, theater, close to friends etc.
- Some intrinsic first-nature effect. Geography (port but also central location), climate, resource availability etc.

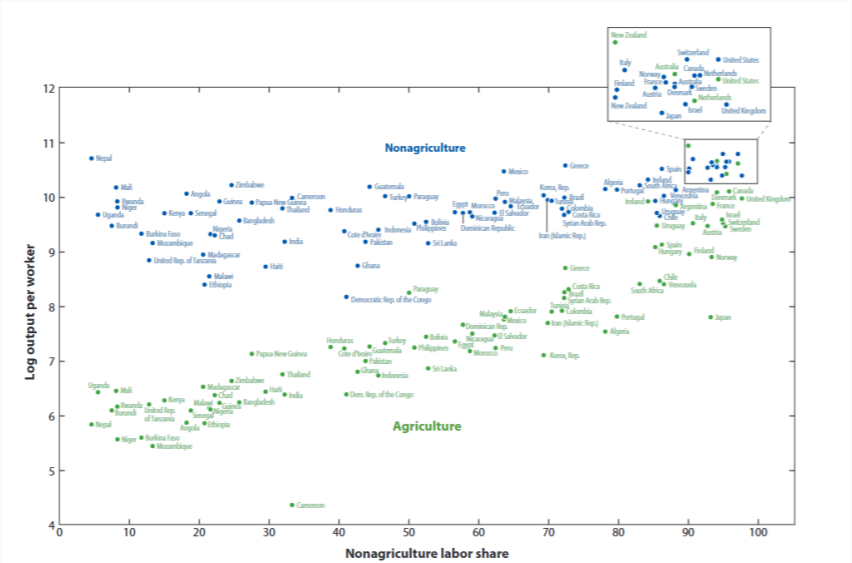
These are positive externalities writ large.

The alternative story: it's all (or mostly) sorting.

Agglomeration economies

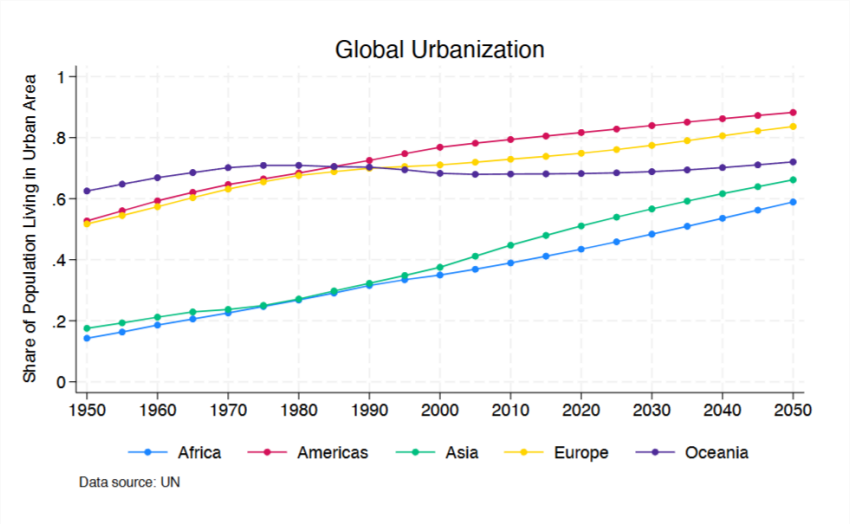
- Whether agglomeration economies exist, and their magnitude are crucial questions.
- If density causes productivity then we should encourage density!
- We will first consider some evidence that suggests density causes productivity.
- Then we will consider how to construct a productive city.
- But before that (1) what's on the table, and (2) the potential downsides of density

What's on the table



Source: Bruan, Clarger, and Tsivanidis (2020)

What's on the table — getting it right



what's on the table — getting it right

- Africa's urban population is likely to nearly triple between 2018 and 2050 (UN)
- Africa and India together account for almost 2/3 of the world's projective growth in urban population.
- Getting this urbanisation "right" is of 1-st order importance.

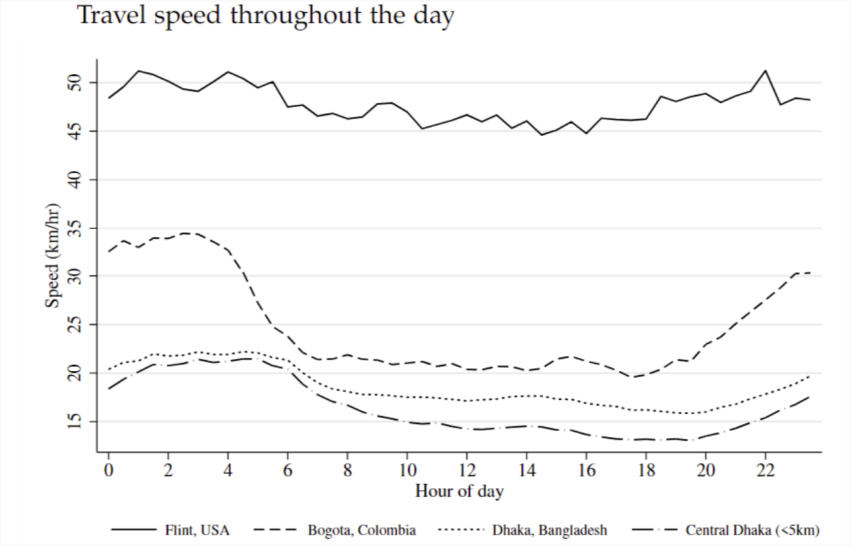
The other side of the coin

Why don't we all live in one humongous city?

- Negative externalities
- Congestion (on roads etc.)
- Congestion (house prices), land is finite!
- Disease
- Crime
- Urban slums

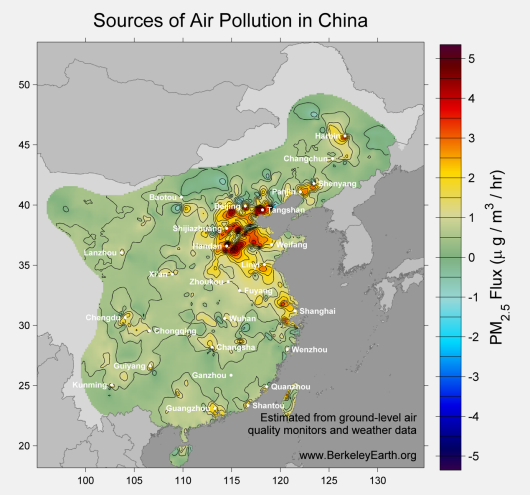
Getting cities wrong could be disastrous.

Congestion

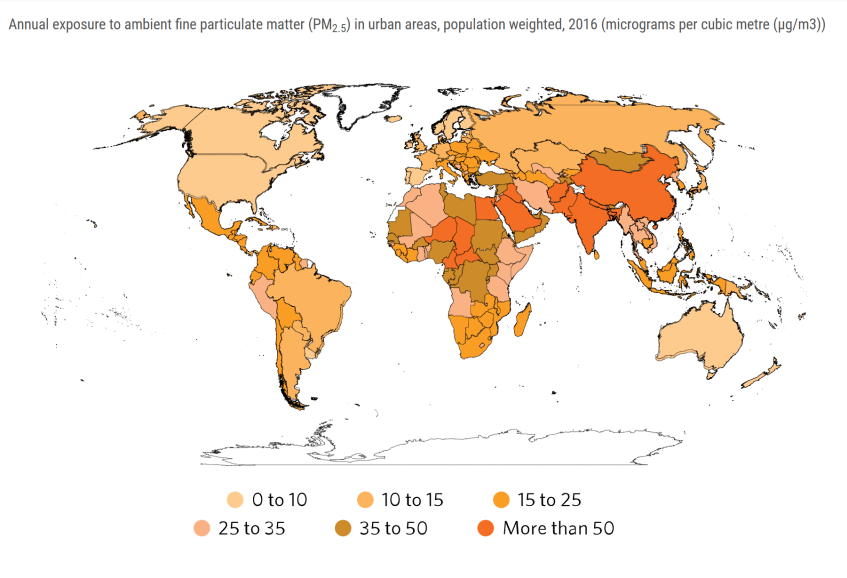


Akbar et al. (2023)

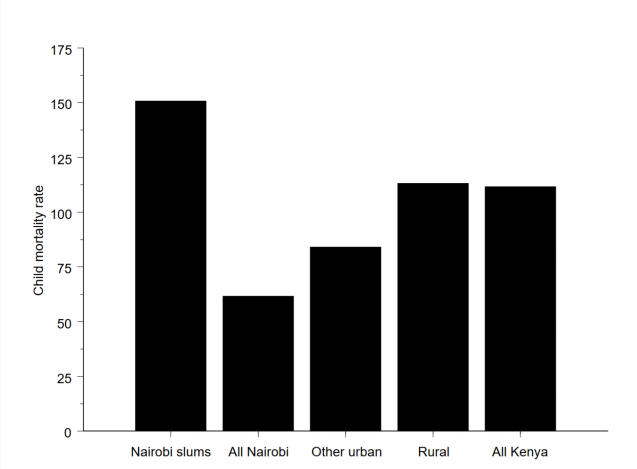
Pollution


Sources of Air Pollution in China
Harbin
Changchun
Shenyang
Baotou
Beijing
Tangshan
Shijiazhuang
Weifang
Lanzhou
Xi'an
Zhoukou
Hefei
Shanghai
Chengdu
Wuhan
Chongqing
Wenzhou
Changsha
Guiyang
Ganzhou
Kunming
Quanzhou
Guangzhou
Shantou
Estimated from ground-level air quality monitors and weather data
www.BerkeleyEarth.org
PM2.5 Flux (μ g / m3 / hr)
5
4
3
2
1
0
-1
-2
-3
-4
-5
50
45
40
35
30
25
20
100
105
110
115
120
125
130

Pollution

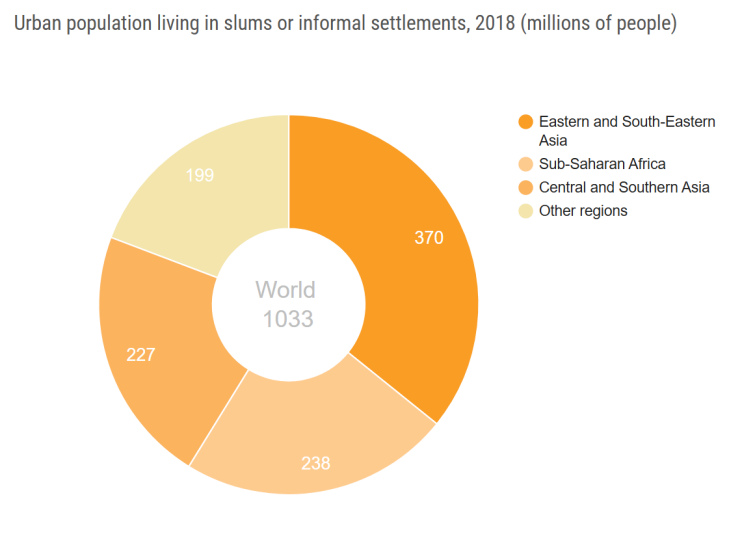

Annual exposure to ambient fine particulate matter ($PM_{2.5}$) in urban areas, population weighted, 2016 (micrograms per cubic metre (µg/m3))
0 to 10
10 to 15
15 to 25
25 to 35
35 to 50
More than 50

Health



African Population and Health Research Center (2002).

Slums


Urban population living in slums or informal settlements, 2018 (millions of people)
370
238
227
199
World
1033
Eastern and South-Eastern Asia
Sub-Saharan Africa
Central and Southern Asia
Other regions

Evidence on the causal effects of density on wages/ productivity

Overview

- We have seen that cities present a massive opportunity.
- This is only true if the effect of density is causal and not just sorting.
- Is the existence of cities, coupled with congestion costs, sufficient evidence?
- Estimating the causal effect of density is hard, we will consider two papers (1) Bryan, Chowdhury and Mobarak (2014) in detail and (2) Harari (2020) briefly.

Bryan, Chowdhury and Mobarak (2014)

UNDER-INVESTMENT IN A PROFITABLE TECHNOLOGY: THE CASE OF SEASONAL MIGRATION IN BANGLADESH

- A micro approach, we take the city as given.
- The premise: Rural "wages" are much lower than those in the city.
- What happens if we randomly incentivize rural households to find work in the city.
- RCT: Randomly incentivize rural households in Bangladesh to temporarily out-migrate during the lean season.

Identification

- We cannot separately identify the causal effect of density from selection with observational data on the rural-urban wage gap.
- It could be that people in the city are different from those in the countryside and that explains the wage gap.
- Ideal experiment: Randomly move some people to the city and see what happens to their wages.
- Unethical/ impossible.
- Instead randomly incentivise some people to move to the city.

The setting

- 100 villages in rural northwestern Bangladesh Rangpur region.
  - 57% or 5.3 million people in Rangpur are below the poverty line.

- Seasonal famine: monga. No work opportunities between planting and harvesting + grain prices rise. Routinely takes many households below subsistence levels.

- There exist nearby employment opportunities in urban centers but these are rarely taken up.

The experiment

- Randomly select 100 villages and conduct a census within each in June 2008
- Randomly select 19 households in each village from HH that (a) own little land and (b) missed meals in the last monga season.
- Randomly assign villages to four groups (I) Information, (II) Cash, (III) Credit, (IV) control.

I Information: 304 HH in 16 villages given information on job opportunities in local urban areas.

II Cash: 703 HH in 37 villages offered 8.5 USD conditional on migration. The cost of a bus ticket + information.

III Credit: 589 HH in 31 villages offered the same but in a 0-interest loan + information.

IV Control: 304 HH in 16 villages in the control group.

Ethical concerns?

Why do we need an RCT?

- Why can we not just compare outcomes of those who do and don't (seasonally) migrate?

First stage — does this tiny incentive actually change migration patterns

Table 2: Program Take-up Rates

	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*	39%			32%			7.0**
	(2.1)			(2.5)			(3.3)

Standard errors in parentheses. P-value is obtained from the testing 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.

*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.

What do we learn from positive re-migration rates?

Impact of migration on consumption expenditure

Regression:

$$Y_{ivj} = \alpha + \beta_1 Cash_{ivj} + \beta_2 Credit_{ivj} + \beta_3 Information_{ivj} + \varphi_j + v_{ivj}$$

Household i, in village v in sub-district j.

- Y_{ivj} is consumption in 2008.
- φ_j are sub-district fixed effects.
- $Cash_{ivj}$, $Credit_{ivj}$, $Information_{ivj}$ are treatment arm dummy variables relative to the control group.

This is an ITT (intent-to-treat) analysis using purely experimental variation.

Results

	ITT			ITT	ITT
	Cash	Credit	Info		
Panel A: 2008 Consumption					
Consumption of Food	61.876**	50.044*	15.644	48.642**	44.183*
	(29.048)	(28.099)	(40.177)	(24.139)	(23.926)
Consumption of Non-Food	34.885***	27.817**	22.843	20.367**	16.726*
	(13.111)	(12.425)	(17.551)	(9.662)	(9.098)
Total Consumption	96.566***	76.743**	38.521	68.359**	60.139**
	(34.610)	(33.646)	(50.975)	(30.593)	(29.683)
Total Calories (per person per day)	106.819*	93.429	-85.977	142.629***	129.901***
	(62.974)	(59.597)	(76.337)	(47.196)	(48.057)
Panel B: 2009 Consumption					
Consumption of Food	34.273	22.645	-30.736	43.983**	34.042*
	(23.076)	(23.013)	(29.087)	(17.589)	(18.110)
Consumption of Non-Food	3.792	31.328*	-8.644	21.009*	14.877
	(16.186)	(18.135)	(20.024)	(11.954)	(12.031)
Total Consumption	38.065	53.973	-39.380	64.992***	48.919*
	(30.728)	(34.057)	(39.781)	(23.958)	(24.713)
Total Calories (per person per day)	83.242	23.995	-81.487	95.621**	78.564*
	(52.766)	(62.207)	(60.141)	(39.187)	(40.600)
Controls?	No	No	No	No	Yes

But do we care about this

- These results are the impact of being in a given experimental arm.
- That's not what we actually care about.
- We care about the impact of migrating to a denser area on consumption.
- What we want to estimate (migrate is a 0-1 dummy variable):

$$Y_{ivj} = \alpha + \beta Migrant_{ivj} + \varphi_j + v_{ivj}$$

- But, we still need to use our experimental variation.
- To do this, we can look at the LATE (local average treatment effect).
- This gives the consumption effect of migration for those households that were induced to migrate by the intervention.

RCT and IV — match made in heaven?

We can estimate our equation of interest:

$$Y_{ivj} = \alpha + \beta Migrant_{ivj} + \varphi_j + v_{ivj}$$

Using our experiment to instrument for $Migrant_{ivj}$. In particular use $Cash_{ivj}$ and $Credit_{ivj}$.

IV assumptions

- Relevance. We already tested this!
- Exclusion restriction. In words: Cash and Credit treatment only impact consumption through their effect on migration.
- Can you think of potential threats to this?

IV assumptions

- Relevance. We already tested this!
- Exclusion restriction. In words: Cash and Credit treatment only impact consumption through their effect on migration.
- Can you think of potential threats to this?
- The RCT gives us the exclusion restriction.

LATE

- Using this method we can estimate the local average treatment effect.
- Why local?
- Recall, the IV focuses on variation in *migrate* that is due to *Cash* and *Credit*.
- There is a lot of variation in *migrate* not due to these variables.
- We can only speak to the impact of *migrate* on Y for those who *Cash* and *Credit* caused to change their *migrate* status.

Results

Table 3: Effects of Migration before December 2008 on Consumption Amongst Remaining Household Members

	ITT			ITT	ITT	IV	IV	OLS	Mean
	Cash	Credit	Info						
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 (per person per day)	106.819*	93.429	-85.977	142.629***	129.901***	842.673***	757.602***	317.495***	2090.26
	(62.974)	(59.597)	(76.337)	(47.196)	(48.057)	(248.510)	(250.317)	(41.110)	
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 (per person per day)	83.242	23.995	-81.487	95.621**	78.564*	510.327**	434.602**	20.361	2001.27
	(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	

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 Taka 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.

Interpretation of results

- Monthly consumption among HH induced to migrate was 20 USD higher due to migration (LATE) in the months after migration.
- Back of the envelope calculation suggests (monetary) returns of at least 273%.
- Households induced to migrate are more likely to also migrate in subsequent years despite the removal of incentives.

Conclusions

- High returns to migration. Density pays!
- Why didn't people migrate before?

Why didn't people migrate before?

- Risk, subsistence, and learning.
- It's costly to migrate, and risky you might not find any work.
- This is okay normally, but in this setting failed migration means starvation.
- Risks are too high! Small subsidy nullifies these risks.
- Learning: those who succeed learn and so future risks are lower incentivising re-migration.
- $+$ the non-monetary costs of migration are very large! Lagakos et al. (2023)

Harari (2020)

- City shape and compactness (density) is important.
- This is well known to urban planners etc. but economists have overlooked it.
- One reason is that it's hard to causally change city size/ shape/ density.
- No RCT available.
- We take an IV approach

What is the endogeneity problem the IV solves?

What is the endogeneity problem the IV solves?

- More spread out cities might be more spread out exactly because the gains to agglomeration are too small in these locations. So its not worthwhile to build up. (Reverse causality).

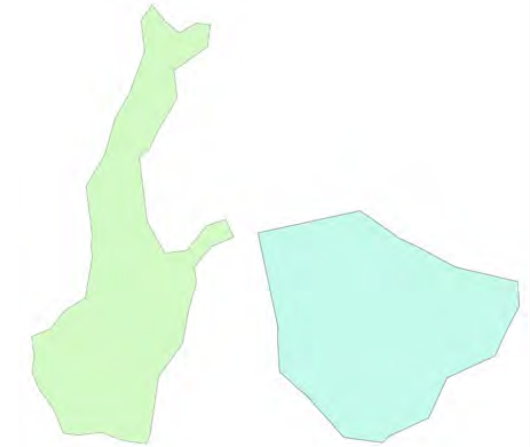
- Poor planning and governance could lead to spread out cities and ineffective cities (omitted variable, endogeneity).

Harari (2020)

- Construct an instrument for city shape/ density.
- Broad idea:
  - Founders of cities didn't consider the massive size cities could reach.
    - Example: London was 1.4km squared, now London now 1,572km squared.
  - Some cities have come across geographical constraints that founders never considered. Mountains, oceans, forests etc.
  - But some cities have not.
  - Whether or not constraints to sprawl exist for a given city is plausibly random.
- If your city had such constraints it's more likely to be built up i.e. denser.

Setting and example

India, 350 cities with data from 1950 (digitised city plans) to 2011 (night lights)



	Kolkata		Bangalore	
Shape metric		Normalized		Normalized
Disconnection, km	20.4	1.20	16.0	0.94
Remoteness, km	14.8	0.87	11.8	0.69

Findings

- More compact cities grow faster conditional on overall area.
- Individuals value compactness.
- Harari (2020) finds a willingness to pay for compactness of 5% for a 1 standard deviation more compact city.
- In a 1 standard deviation more compact city everything is 360m closer.

Other evidence

- Hicks et al. (2017) uses individual fixed-effects methods to show that urban workers in Kenya earn 26% more than rural workers.
- Alesina et al. (2019) show that intergenerational upward mobility is stronger in African cities.
- However, Marx et al. (2013) show that people who have stayed longer in slums in Kenya and Bangladesh earn less than new arrivals.
- Imbert et al. (2018) show in China using variation in agricultural prices that incumbents in cities receiving more migrants faced lower wages.
- Others have shown that cities cause higher patents (Jaffe et al. 1993) foreign direct investment (Guimaraes et al. 2000), and education (Muralidharan and Sundararaman, 2015).

Summary of the evidence

- It is widely accepted that although selection plays an important role cities are causally related to productivity, innovation, and human capital accumulation.
- However, not all cities are similarly effective.
- And, negative externalities disincentivise movement to productive urban areas.
  - These negative externalities are particularly visible in many developing contexts.
- Remaining question: How do we make cities more productive and more attractive.

Endogenising the city

Endogenising the city

What levers are available to policy makers?

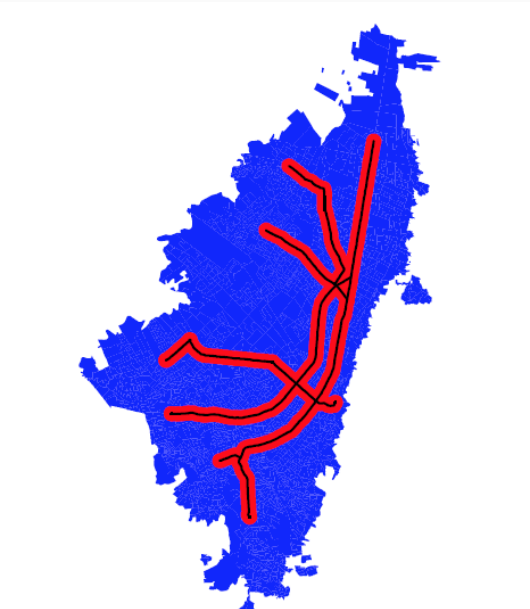
- Land use regulation (allow building up).
- Provision of public goods (parks).
- Subsidise behaviour with positive externalities
- Build transport infrastructure.

For now, we will focus on the last lever with the motivating example of TransMilano in Bogotá.

TransMilano (Tsivanidis 2023)

TransMilano is a BRT (Bus Rapid Transit) system.

TransMilano



How do we study this?

- Obviously a RCT is out of the question.
- How about an IV approach?
- Key problem: What is "treatment"?
- Being on the BRT line, being 1km away from the line? The BRT reducing your commute by an amount? The BRT reducing the commute time to your firm for many people? ???
- Everyone (workers and firms) are affected in some way, and in very heterogeneous ways depending on where they are.
- Then of course people and firms might react by moving, house prices might change, this might impact local demand and so prices.....
- I'm afraid to say that we need some theory.

We will discuss a simplified version of the theory Tsivanidis (2023) uses.

A type of quantitative spatial economics model.

Using this framework we can analyse the aggregate and distributional effects of TransMilano across the whole of Bogotá.

We need to model individual decisions to understand how changing transport costs affect their choices.

We will focus on one decision: Migration.

Spatial unit of analysis i are blocks.

Why do people move?

- Nicer neighborhood. Higher amenities nice park etc. A_i.
- Higher real wages (taking house prices into account) w_i/P_i.
- Closer to current location, friends, favorite bar, family, etc. low migration cost μ_{ij}, where $\mu_{jj} = 1$.
- Some random component (you like being by a big road, you like being near Indian restaurants, you like neighborhood X because your best friend lives there etc. etc.). ε_i

What is the value of a location

- Consider those who are born in a given location j.
- At this stage individuals do not see their random location-specific utility component ε_i — you don't know your preferences yet.
- But we can write the potential "value" of each location to an individual.
- To simplify matters assume it takes a multiplicative form.

$$\underbrace{v_{ij}}_{\text{value of } i \text{ for those born in } j} =$$

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$$\underbrace{v_{ij}}_{\text{value of } i \text{ for those born in } j} = \underbrace{A_i}_{\text{amenity}} \times$$

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- To simplify matters assume it takes a multiplicative form.

$$\underbrace{v_{ij}}_{\text{value of } i \text{ for those born in } j} = \underbrace{A_i}_{\text{amenity}} \times \underbrace{\frac{w_i}{P_i}}_{\text{real wages}} \times$$

What is the value of a location

- Consider those who are born in a given location j.
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Do you move, if so where to?

Start in location j and look over all possible other locations i you could move to.

You are **more likely** to move to i if it is nicer (high A_i), has higher real wages (w_i/P_i), is close to your current location (μ_{ij} is low), and if the other options from j don't look great.

Where you actually move to will depend also on ε_i but here we talk in term of probability before you observe these preference shocks

Put this together:

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A closer look

$$\underbrace{\pi_{ij}}_{\text{Probability someone in } i \text{ moves to } j} = \frac{A_i \frac{w_i}{P_i} \mu_{ij}^{-1}}{\sum_k A_k \frac{w_k}{P_k} \mu_{kj}^{-1}}$$

We call the denominator consumer market access: $CMA_j = \sum_k A_k \frac{w_k}{P_k} \mu_{kj}^{-1}$.

If it is large it means that j has many well paid (high w_k/P_k) or attractive (high A_k) locations nearby (low μ_{kj}).

So: $\pi_{ij} = A_i \frac{w_i}{P_i} \mu_{ij}^{-1} CMA_j^{-1}$

You are **more likely** to move to i if it is nicer (high A_i), has higher real wages (w_i/P_i), is close to your current location (μ_{ij} is low), and if the other options from j don't look great (CMA_j is low).

An expression for population

The probability those born in j move to i is given by π_{ij}.

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We can sub-in our expression for π_{ij} to find

$$L_i = \sum_j A_i \frac{w_i}{P_i} \mu_{ij}^{-1} CMA_j^{-1} L_j$$

$$L_i = A_i \frac{w_i}{P_i} \sum_j \mu_{ij}^{-1} \frac{L_j}{CMA_j}$$

Intuition

$$L_i = A_i \frac{w_i}{P_i} \sum_j \mu_{ij}^{-1} \frac{L_j}{CMA_j}$$

The population of i is larger if...

1. i is a more attractive place to live: A_i is high.
2. Real wages are higher in i: $\frac{w_i}{P_i}$ is high.
3. i is close to (low μ_{ij}) other locations with large populations (high L_j) and these other locations don't have good alternative options (low CMA_j)

Linking back to TransMilano

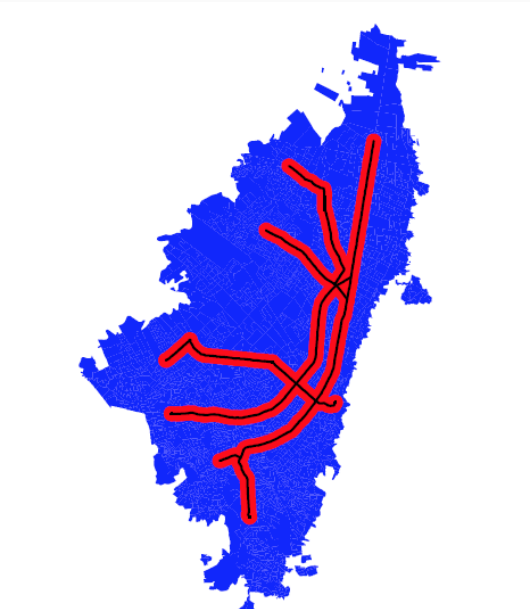
$$L_i = A_i \frac{w_i}{P_i} \sum_j \mu_{ij}^{-1} \frac{L_j}{CMA_j}$$

TransMilano changes transport costs: μ_{ij}.

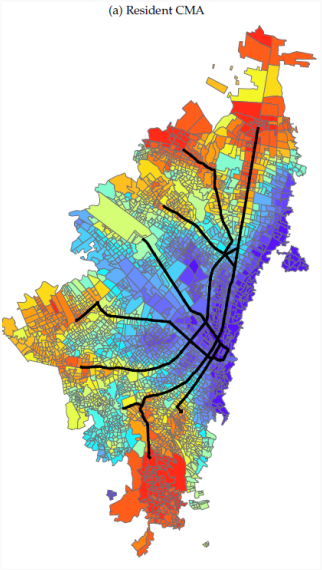
The model allows us to trace out the heterogeneous impact of such changes on the whole city.

- Direct effect: $L_i = A_i \frac{w_i}{P_i} \sum_j \mu_{ij}^{-1} \frac{L_j}{CMA_j}$
- Indirect effects.
  - Through CMA_j
  - Through L_j
  - Extend the model to also allow wages and prices to adjust

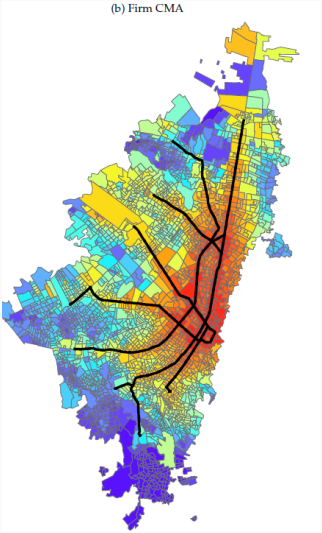
Back to transmilano



Transmilano — Key variable is worker CMA_i



Transmilano — analogous firm CMA_i



The overall impact of transmilano

- Tsivanidis (2023) uses a more involved version of the above model to look at the total impact of transmilano.
- Closed city: GDP rises 2.98% and property prices fall slightly.
- Open city: GDP per-capita rises 5.67% and the population increases by 9.51% and property prices rise by 5.28%.
- Benefits far exceed the costs.
- Distributional outcomes: inequality increases by 0.55% Because high-wage jobs are concentrated in the center which becomes better connected.

Summary

Summary

- The boundaries of cities are defined by positive and negative agglomeration forces. Externalities writ large.
- In a developing country city often the potential upsides are larger, and costs greater.
- Evidence suggests that density is causally related with wages, human capital, innovation etc.
  - Bryan et al. (2014) and Harari (2020). IV, LATE, ITT.
- How to make cities more productive and attractive.
  - Transportation infrastructure and the case of Transmilano. Developed a simplified version of the theory from Tsivanidis (2023), a quantitative spatial economics model.

The question

Humanities greatest invention? Is urbanisation the only route to development?