

# Revisiting Economic Geography

DEC Policy Research Talk  
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# Outline

The WDR 2009 provided an intuitive framework for understanding the role of economic geography for development

Focus on cities, but urbanization is actually quite difficult to measure (urbanization and growth in Africa)

Why do urbanization and income usually rise together?

Critical role of infrastructure, specifically transport:

For agglomeration economies: higher productivity/wages in cities

For the geography of production: benefits of large-scale transport investments

# Sao Paulo, Brazil



# Thimphu, Bhutan



world development report

2009

# RESHAPING ECONOMIC GEOGRAPHY



THE WORLD BANK

# WDR 2009 Report structure



## WDR 2009 main messages

*Don't fight density:* economic growth will be unbalanced, but development can still be inclusive

Economic integration helps get the benefits of concentration *and* the long-term benefits of convergence in living standards

Rules of thumb for policy

# Policy makers tend to think about spatial targeting first

## Policy priorities for economic integration

### Geographic policy challenge

L = local  
 N = national  
 I = international

### *Institutions*

Spatially  
 blind

### *Infrastructure*

Spatially  
 connective

### *Interventions*

Spatially  
 targeted

1-D L. Incipient urbanization  
 N. Sparse lagging areas  
 I. Close to world markets



2-D L. Intermediate urbanization  
 N. Dense lagging areas  
 I. Distant from world markets

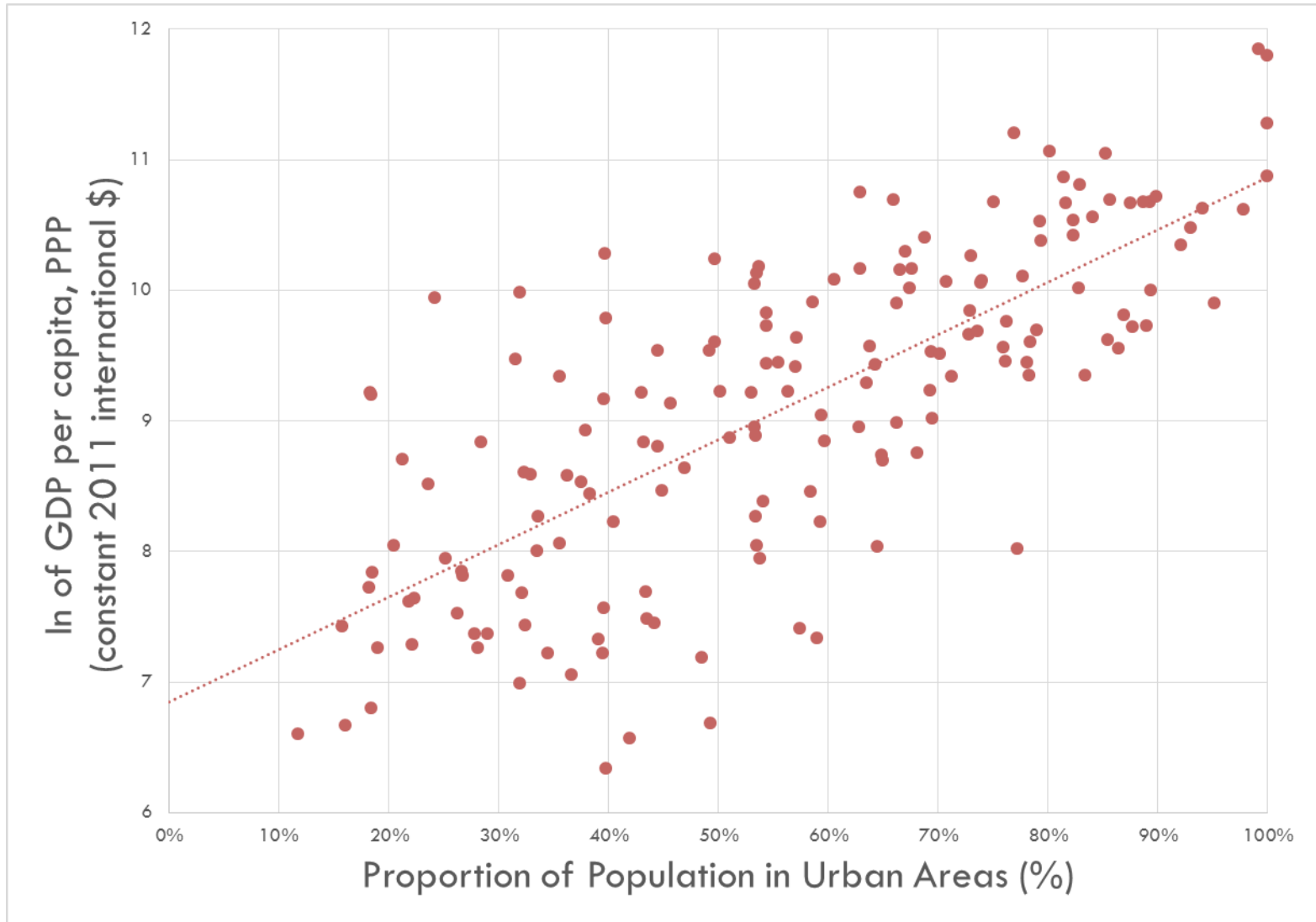


3-D L. Advanced urbanization  
 N. Dense lagging areas and  
 divisions  
 I. Distant from markets and  
 small economies



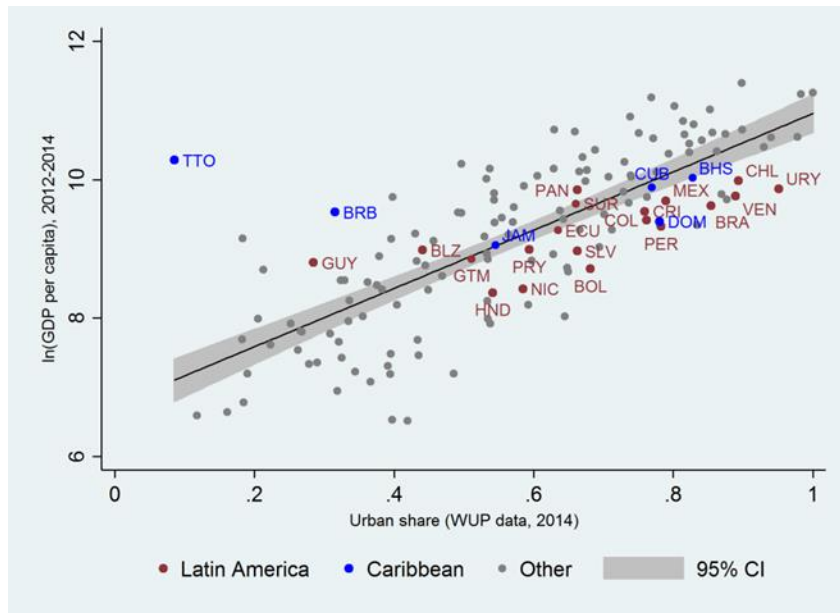


# Urbanization and income



# LAC appears more urbanized than incomes would suggest

## UN World Urbanization Prospects



# What is urban?

UN World Population Prospects is the standard source for urbanization statistics, but each country has its own definition:

- Minimum population threshold – 103 countries
- Minimum population density threshold – 11 countries
- Economic characteristics (non-agricultural activity) – 16 countries
- Other characteristics (infrastructure & services) – 30 countries
- No objective criteria (areas listed by name or designation) – 99 countries

Similar to each country having a different poverty line

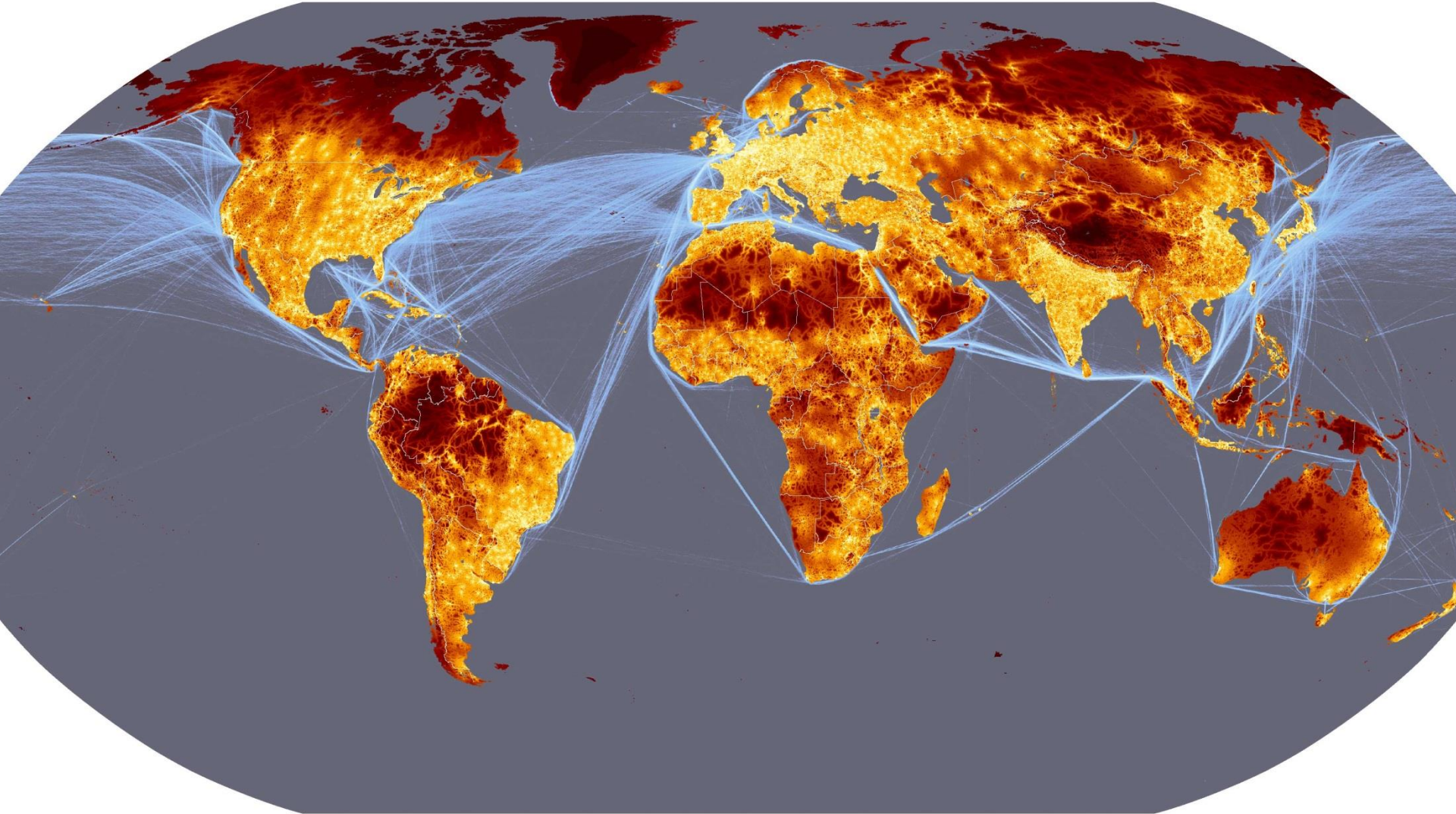
How can we compare urbanization across countries?

Compute *agglomeration index* using global spatial data sets:

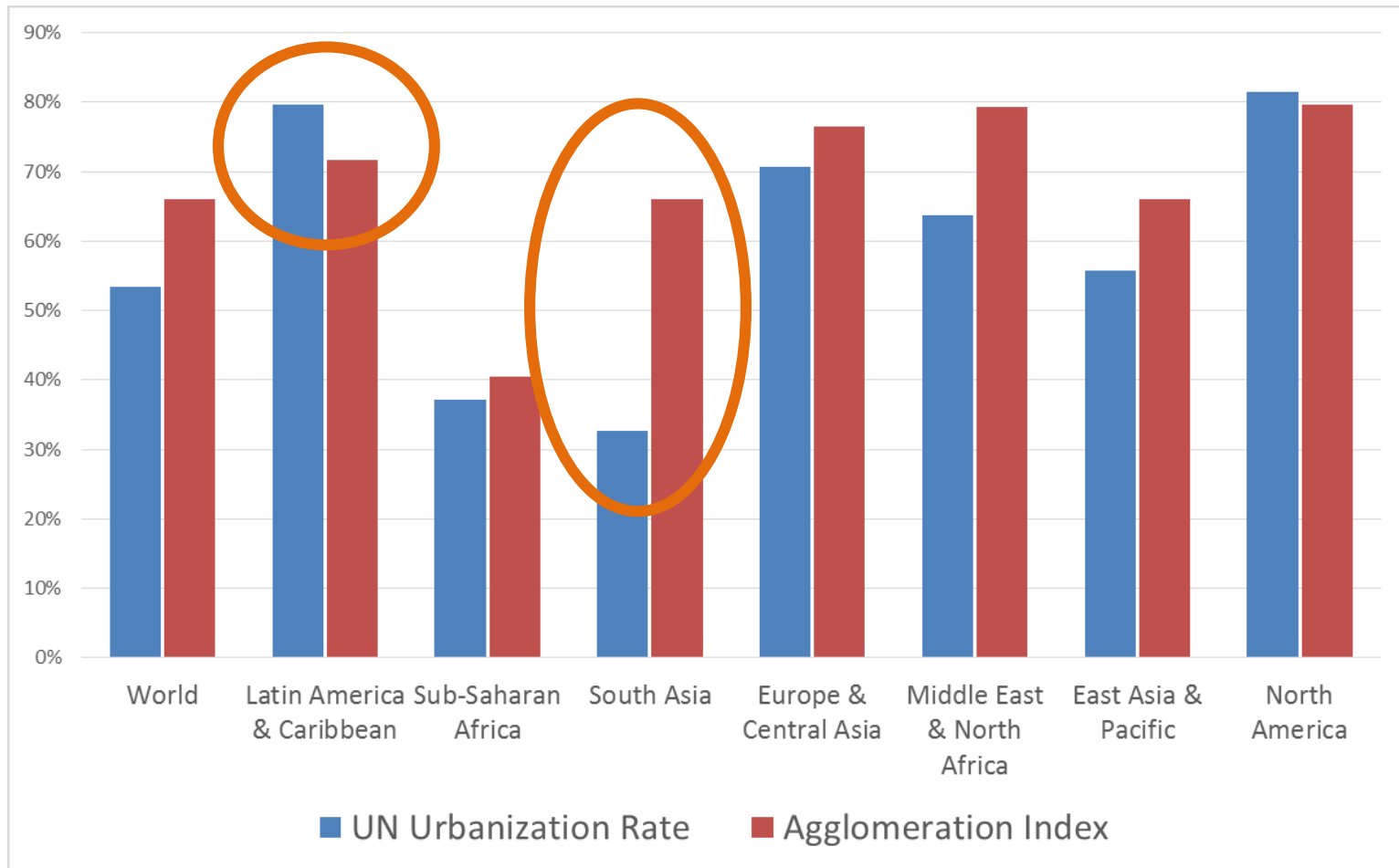
Minimum population density

Maximum travel time from large city

# Travel time to major cities: A global map of accessibility

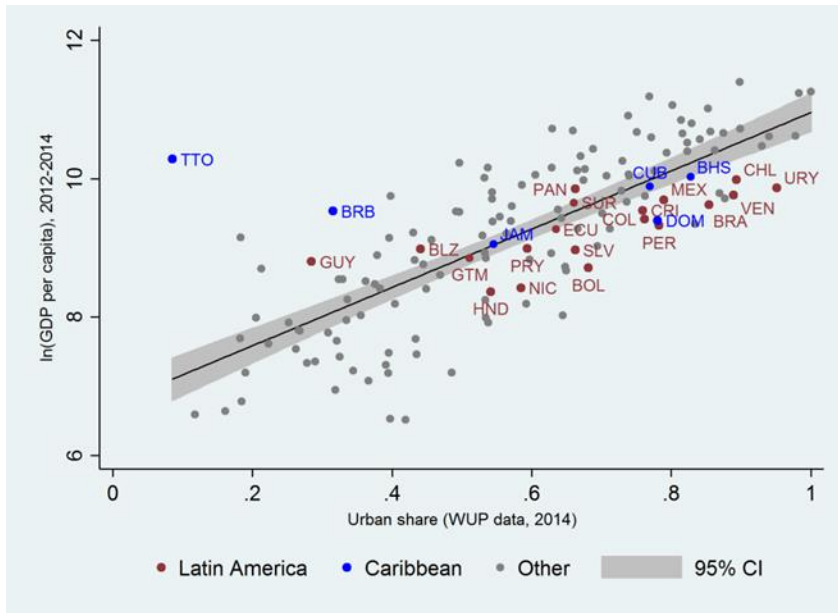


## LAC seems less urbanized, South Asia and MENA more urbanized using the agglomeration index

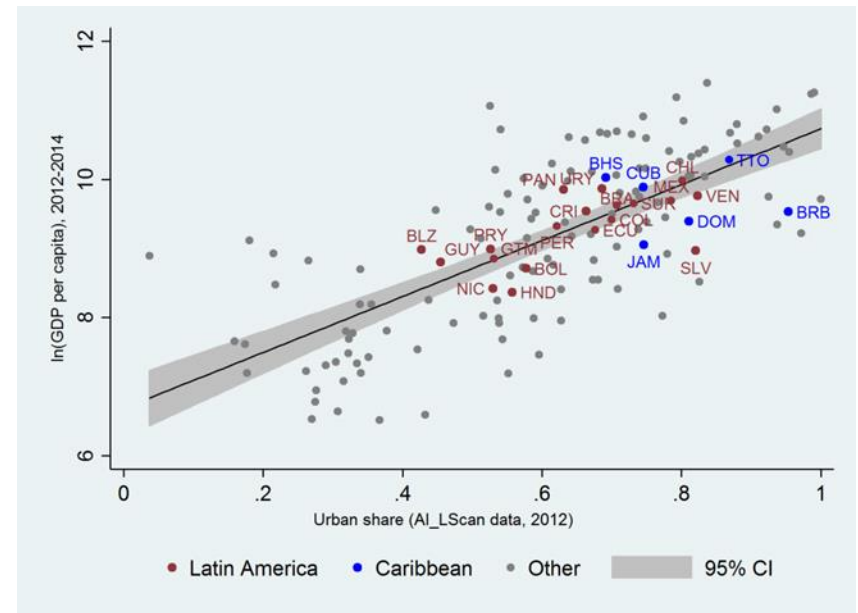


# Using the agglomeration index, LAC follows the trend

## UN World Urbanization Prospects



## Agglomeration index



# Besides urbanization, GDP is also poorly measured

Example: Of the 10 worst growth performers in Africa in versions 6.1 and 6.2 of the Penn World Tables, only 5 were on both lists

Same revision: The standard deviation of the revisions of countries' average growth over the period 1970-1999 was 1.1% per year (when the average growth rate over this period was 1.56% per year!)

Need to be creative for data-poor regions (two examples from KCP funded research)

- Change framework of analysis and rely on indicators that are better measured

- Use proxies for GDP that can be independently measured

# 1. Is urbanization different in Africa?

Urbanization without growth in sub-Saharan Africa (Fay and Opal 2000)

Consumption cities fed by natural resource rents?  
(Gollin, Jedwab & Vollrath 2016)

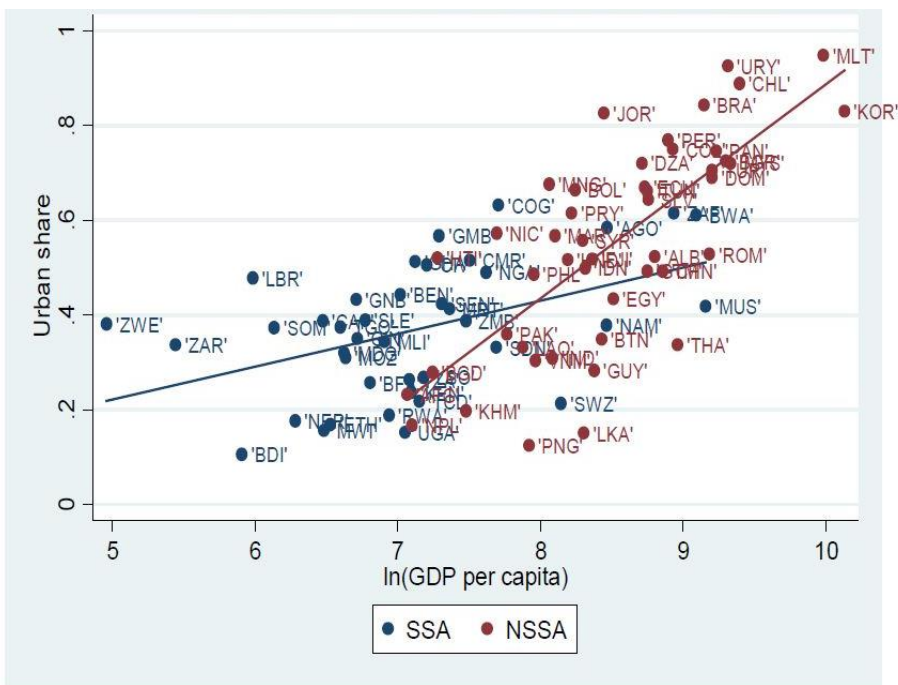
Measurement problem? GDP tends to be poorly measured in Africa

So instead, use an endogenous growth framework:  
*human capital accumulation* (“effective technology”) driving technological progress, rural & urban productivity growth and corresponding labor shifts

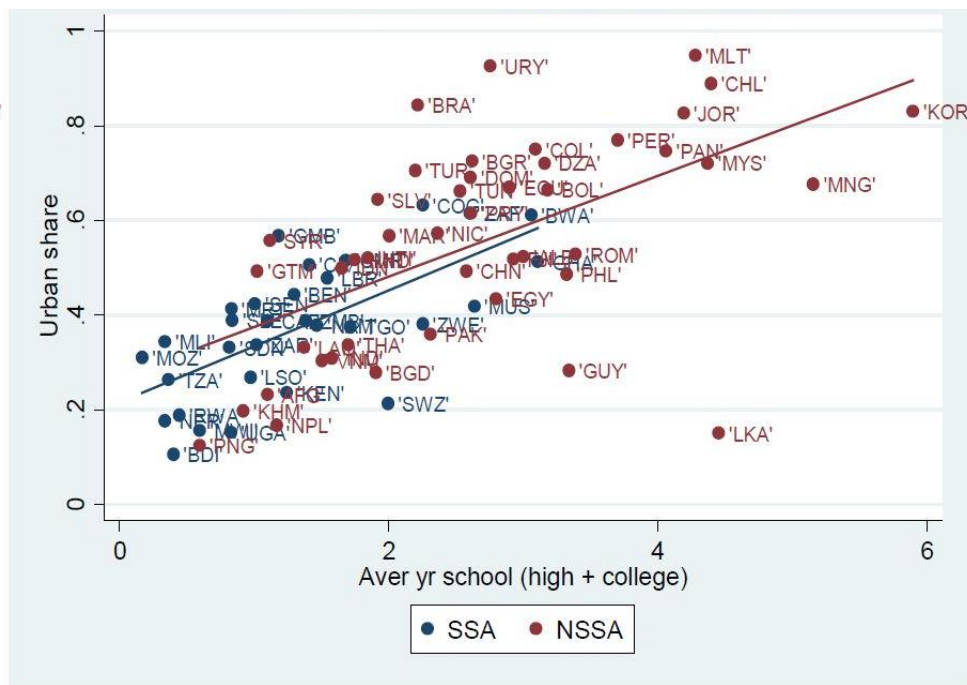


# When, instead of income, urbanization is matched to “effective technology” (educational attainment), the African experience matches global patterns

(a) Per capita income



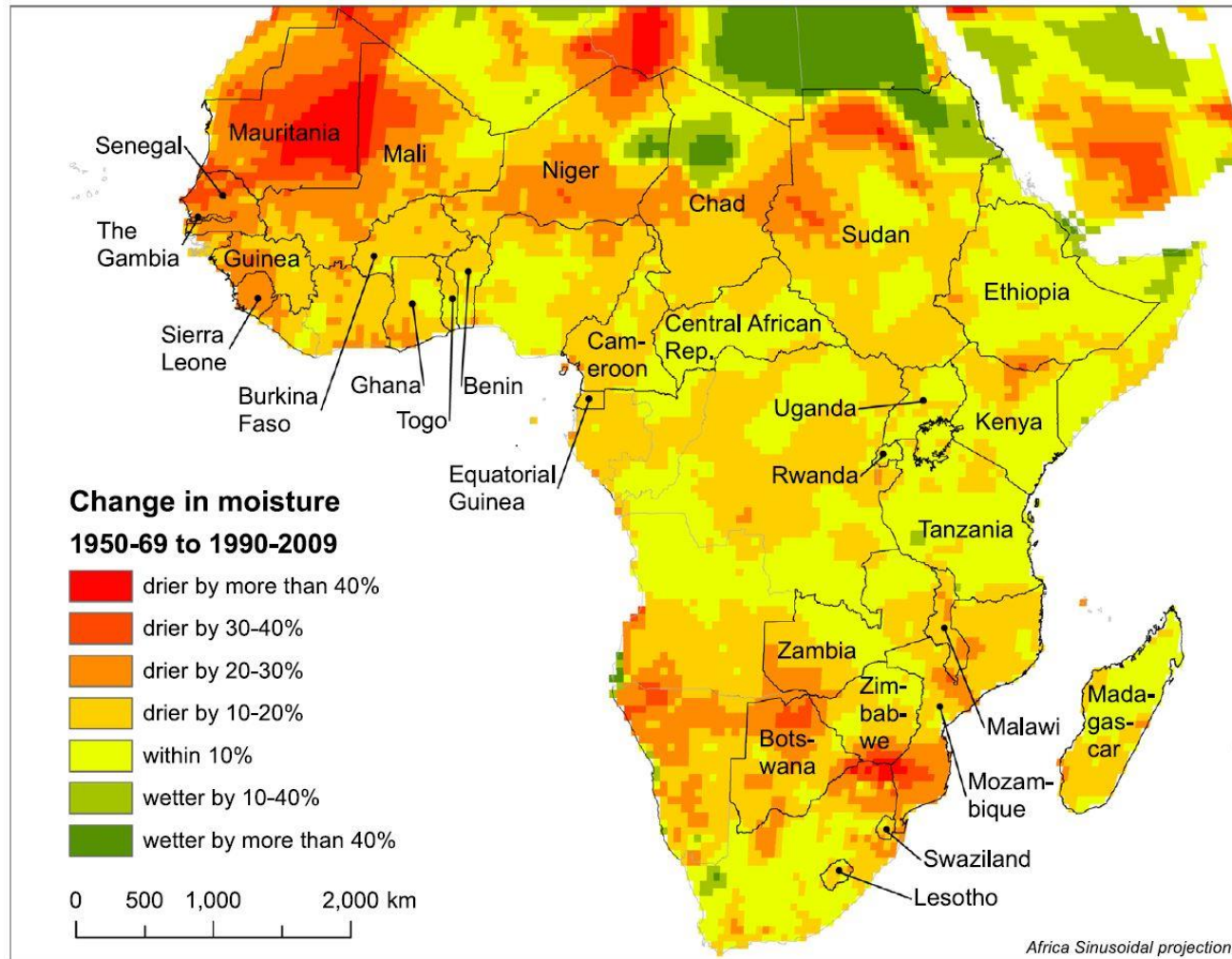
(b) Effective technology



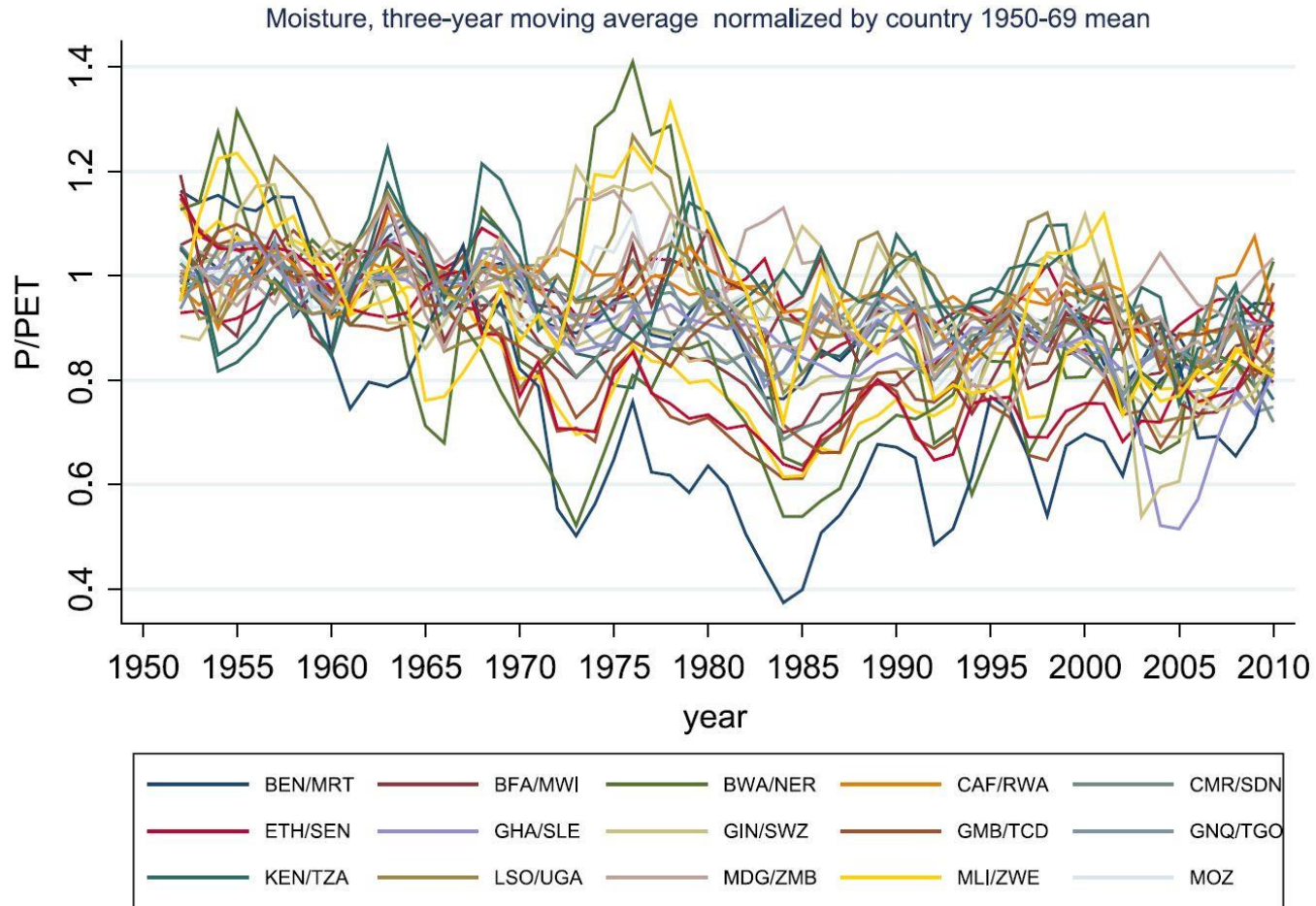
## 2. Has climate change driven urbanization in Africa?

Importance of push factors (also conflict, poor services)

Climate variability and change:  
Moisture availability is declining, especially in already drier areas



# Downward trend in moisture availability



## Do these climatic changes push people into urban areas by making agriculture less productive?

Strong evidence, but only where manufacturing of tradable goods is likely to be present and able to absorb new labor

Does this push into cities increase urban incomes (proxied by lights)?

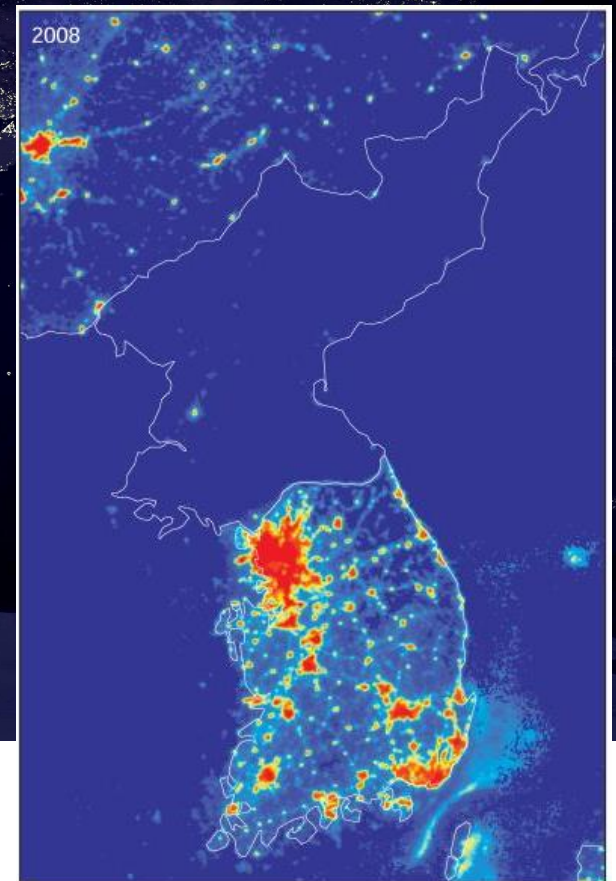
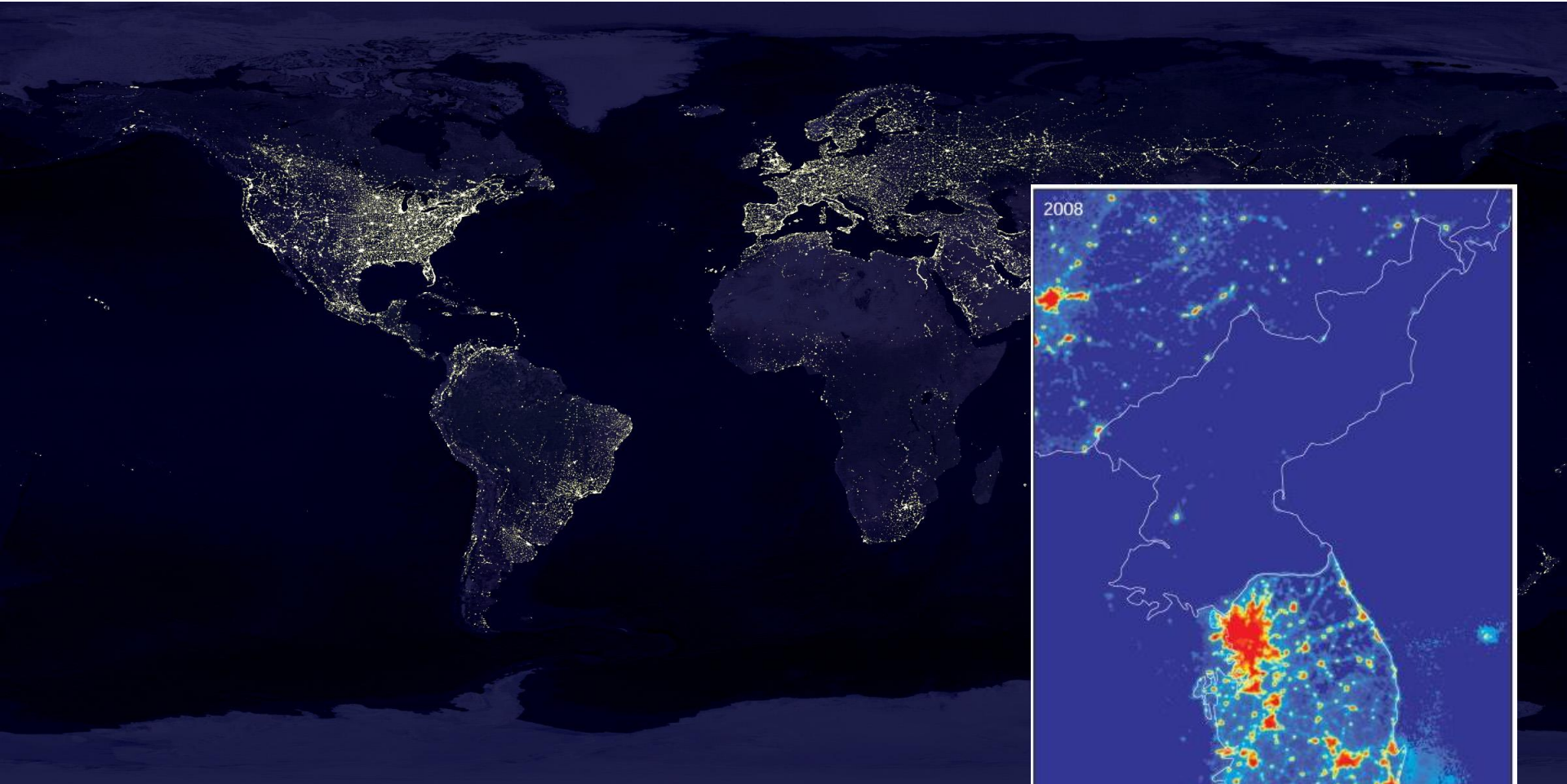
Yes, but again only where manufacturing is likely (only about a quarter of sample regions)

Importance of adaptation

But technology adoption in African agriculture (new seeds, irrigation) has been slow

Promote structural transformation and city management to absorb future migrants (GPSURR African urbanization program)

# Changes in nighttime lights as a proxy for GDP changes



*Universal Transverse Mercator projection*

# Policy research priorities: Urbanization measurement

Develop a new, consistent database for urbanization

Leverage high resolution, high frequency satellite data

# Urban agglomeration economies

# What explains the strong association between urbanization and income?

Limitations of cross-country studies, so we look at effects of cities on worker or firm productivity to ask:

*Does agglomeration cause higher wages, productivity, and other outcomes?*

Understanding is key for informing big urbanization debates

Are cities too large or not large enough?

What are the market failures that inhibit agglomeration economies?

But difficult to establish causality: more qualified workers will be attracted to more productive cities

Control for individual characteristics: 30-50% of observed effects



# Agglomeration effects

General range of estimates (reviewed in Duranton 2015):

10 percent increase in population or employment  
associated with 0.2 – 1 percent higher wages or productivity

These tend to be quite a bit larger in developing countries (~ 4x)

What are the sources and mechanisms (Marshall 1890)?

*Sharing*: Deeper networks of buyers/suppliers, specialized inputs

*Matching*: Greater chance to find the right worker, supplier or investor

*Learning*: More opportunities for knowledge spill-overs

Many other factors, including transport

# Role of transportation

Take an urban systems perspective

Concept of market access / market potential (**MP**):  
distance-discounted sum of incomes or population at all potential destinations or sources

“Social physics” school of geography (1950s)

Krugman model:

MP in a model of increasing returns (various types of scale economies)  
and monopolistic competition (differentiated products, love of variety)

Some examples

# Agglomeration economies and productivity in Indian industry

Impact of market access (or potential) on firm productivity in 1990s India

Use a combination of plant level and spatially detailed transport network data (incl. quality)

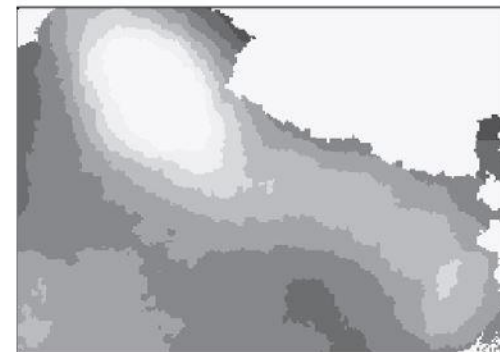
Heterogeneous impacts by sector. E.g., 10 percent improvement in market access raises productivity by 1.5 percent in machine tool sector

No significant effect for other sectors (e.g., cotton textiles; metals and alloys)

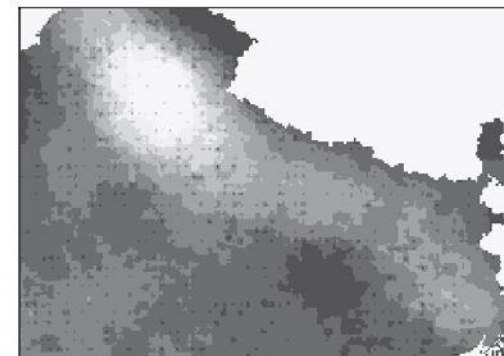
Generally poor transport shelters unproductive firms from competition

## Market access

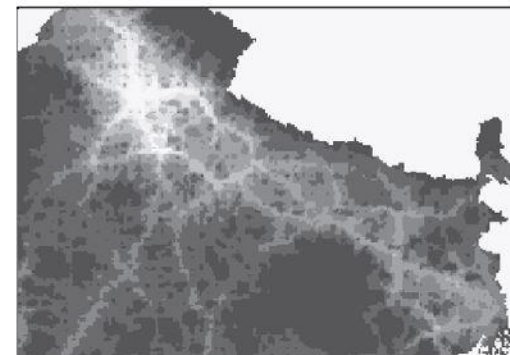
(1) Using Euclidean distance



(2) Using Network Distance



(3) Using network distance and network travel time



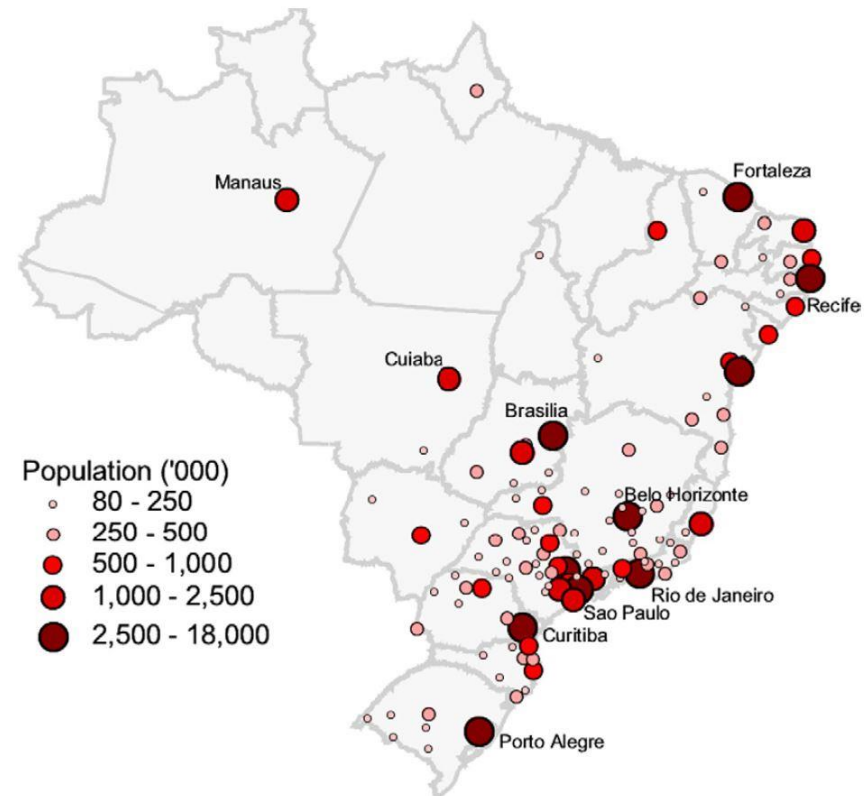
# Agglomeration economies and city growth in Brazil

Why are some cities more successful than their peers?

Domestic market access has “enormous and dominating” impact on differential city growth rates

1 percent increase in market potential increases city size by 2 percent

Expect small benefits from transport policies that favor secondary cities (0.1 – 0.5 % increase in aggregate income)



# Agglomeration economies and firm location in Indonesia

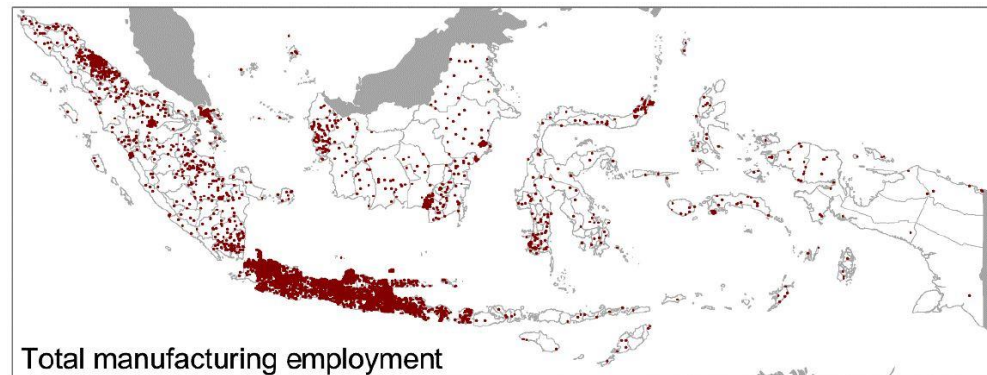
Location choice model evaluating:

- *“natural” advantage* (infrastructure endowments, wage rates, natural resource endowments)
- *production externalities* (firm co-location)

Transport infrastructure has limited effect in attracting industry to secondary industrial centers outside of Java

Concentration effect dominates

Very difficult to promote relocation to lagging regions



# Policy research priorities: Urbanization and growth

Replication of key new studies in developing countries

Better understanding of the specific sources and mechanisms leading to agglomeration economies (and how to encourage them)

Better measurement of congestion costs that offset some (all?) of the agglomeration economies

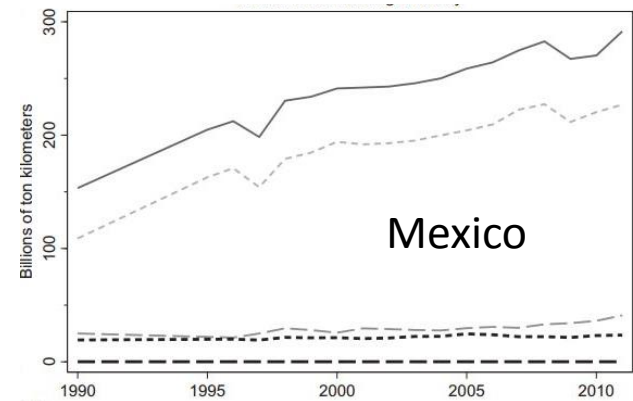
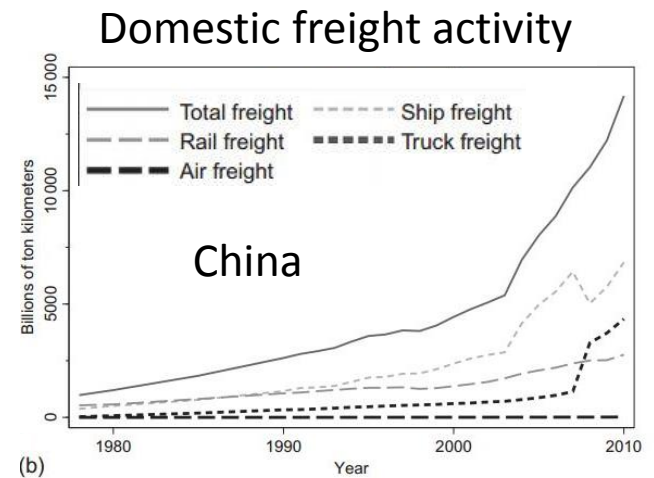
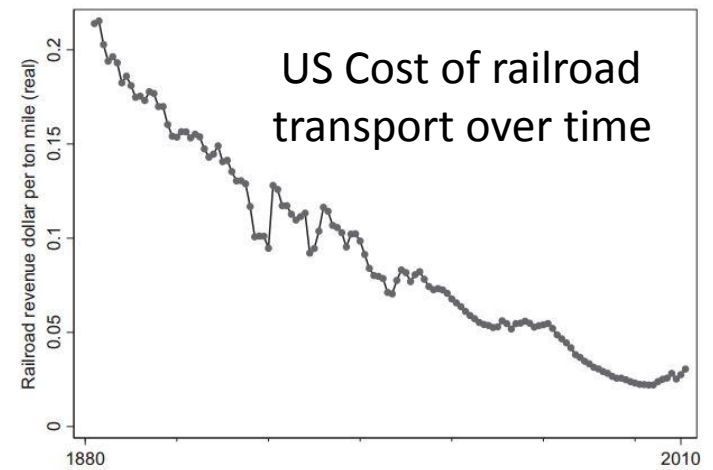
# Transport

# Transport

Enormous reduction in the cost of transportation (better infrastructure and better technology such as containers)

And corresponding growth of transport volumes

Now about 3 percent of US economy, with freight charges a very small share of the value of final output





# Transport affects many aspects of the economy

Impacts on geography of production are not always intuitive

A large drop in transport costs in the 1900s caused Britain to trade more with neighbors than with distant countries

- Intra-industry trade and specialization

- Trade in parts/components and love of variety

Most trade is still over short distances and not always by cheapest mode

- Importance of agglomeration economies

- Time costs > freight costs

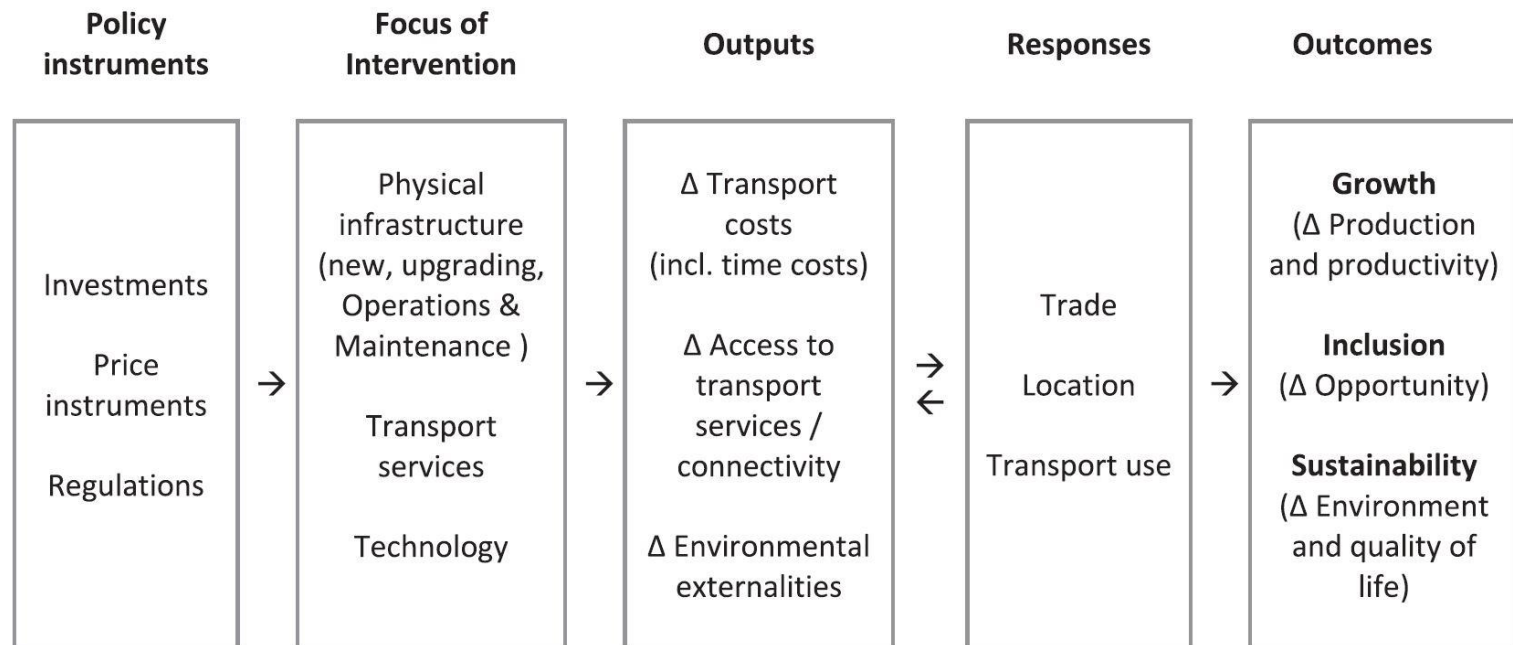
Reports about the 'death of distance' have been greatly exaggerated

# Transport investments are some of the largest infrastructure investments ever made

US Interstate Highway network: 42,795 miles, \$130 billion (1991 USD)

China National Highways: first 21,747 miles, \$120 billion (current USD)\*

## What are the impacts of transport policies?



\* By 2015 the network was more than 70,000 miles

# Why transport impact estimation is difficult

- Often no easy price mechanism for services such as road use
- Impacts permeate entire economy in subtle ways and with lags
- Is growth additional or just a shift from other locations?
- Investments are not made randomly
  - Do roads cause economic growth or are roads built where the economy would grow anyway?

## [Is public expenditure productive?](#)

DA [Aschauer](#) - *Journal of monetary economics*, 1989 - Elsevier

Abstract This paper considers the relationship between aggregate productivity and stock and flow government-spending variables. The empirical results indicate that (i) the nonmilitary public capital stock is dramatically more important in determining productivity ...

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- Does politics drive the placement of investments?



*“Your people will remember you for the money you saved by not building a pyramid.”*



# Estimation of impacts of large scale transport investments

A lot of interesting recent work

Addressing the placement problem (endogeneity)

- Planned routes that were never built

- Historical routes that baked in current patterns

- “Inconsequential areas” that just happen to be crossed by new transport links

- Natural experiment (new capital)

# Generally consistent and robust positive economic impacts of intercity infrastructure

6 - 8% higher long-term earnings in **US** rural counties with highway access in a number of service sectors (Chandra & Thompson 2000, Michaels 2008)

3% increase in farm wages in counties served by railroad in 19<sup>th</sup> Century **US** (Haines and Margo 2008)

17% higher real agricultural income in colonial **Indian** districts with rail access (Donaldson 2015)

Increases in plant productivity in districts near the **Indian** Golden Quadrilateral highway system (Ghani et al. 2013)

6% decrease in per capita income in **China** with doubling of distance to road or rail (Banerjee et al. 2012)

Lower GDP growth among non-targeted connected peripheral counties in **China** after highway construction, instead of spillovers from metro areas (Faber 2014)

Half of per capita GDP growth due to improved road access in **Brazil** (Bird and Straub 2014)

6% decrease in light intensity (as proxy for economic activity) with doubling travel cost to primate city in **Africa** (Storeygard 2016)

# More structural analysis: Chinese highways

Focus on geographically disaggregated impacts

China's National Expressway Network (NEN):

Part of a national strategy to promote catch-up of lagging inland regions

Is it working?

Hybrid estimation-calibration of a 'new economic geography' model  
(e.g., Fujita, Krugman and Venables 1999)

- Urban and rural sector (wages and aggregate income)

- Crucial role of market access (market potential)

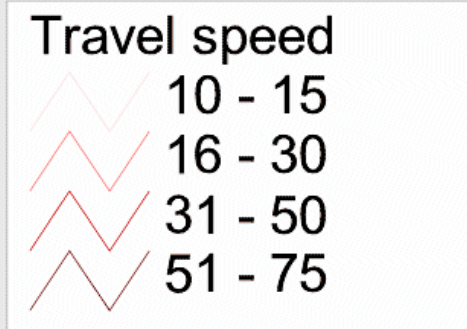
Retrospective analysis

- Estimate urban and rural wages and income after (substantial) NEN construction

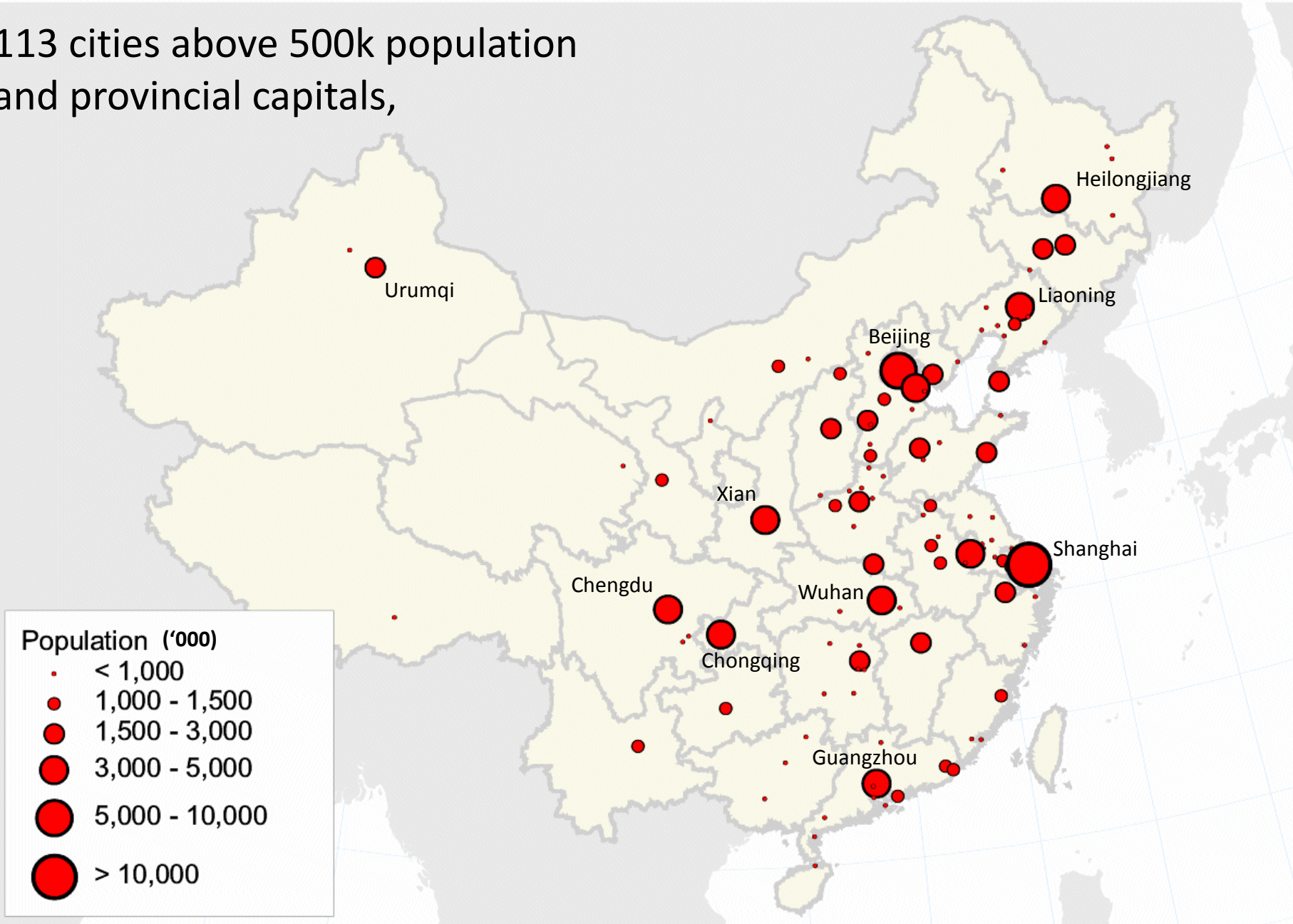
- Simulate outcomes with level of market access if the network had not been built



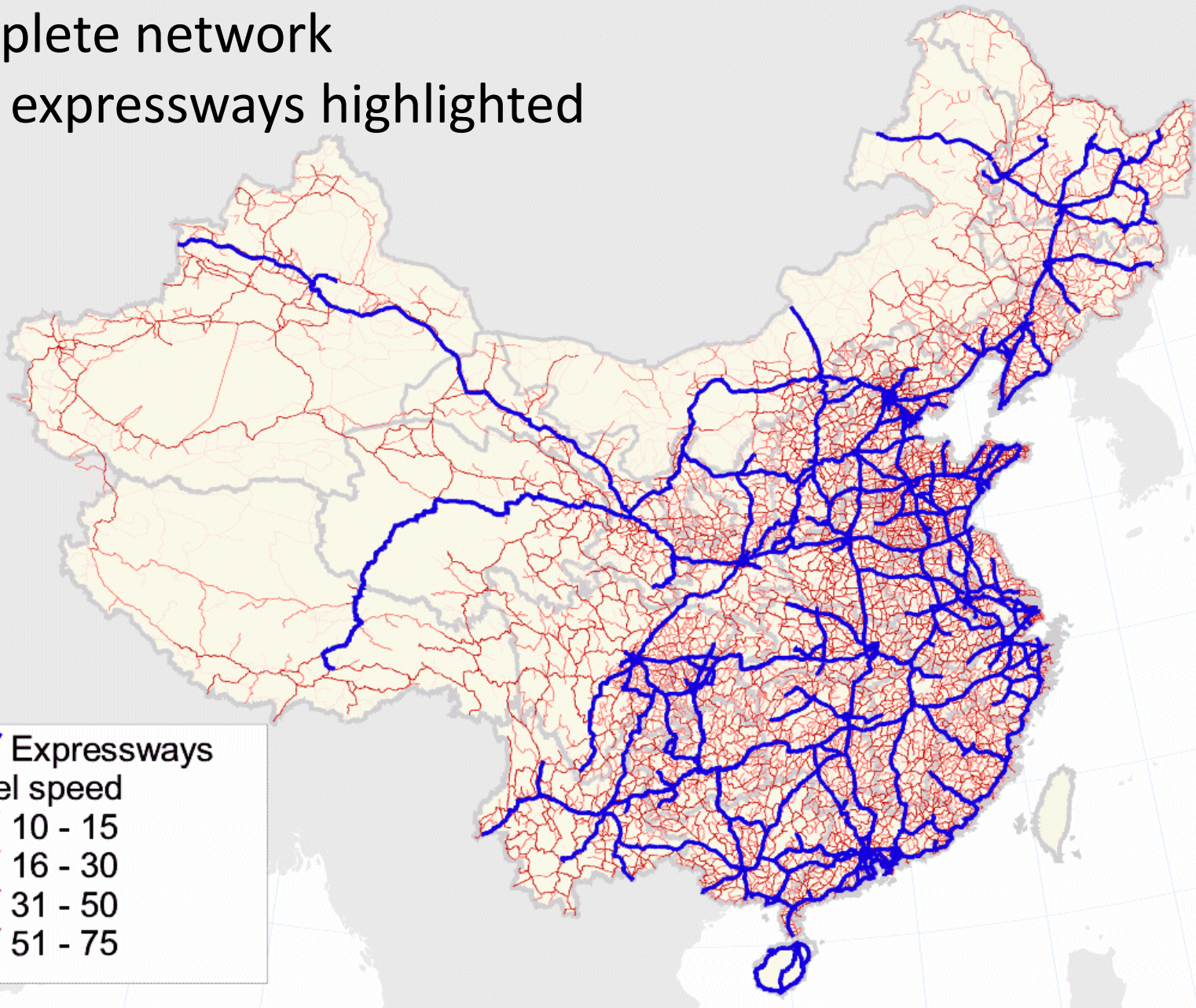
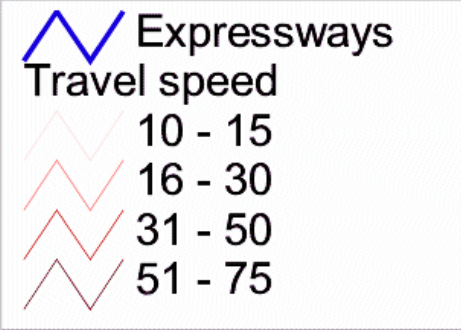
# Base network



# 113 cities above 500k population and provincial capitals,



# Complete network with expressways highlighted



# Importance of network links

## Base network



Importance: number of times link is used when connecting each city with all other cities; unused links not shown

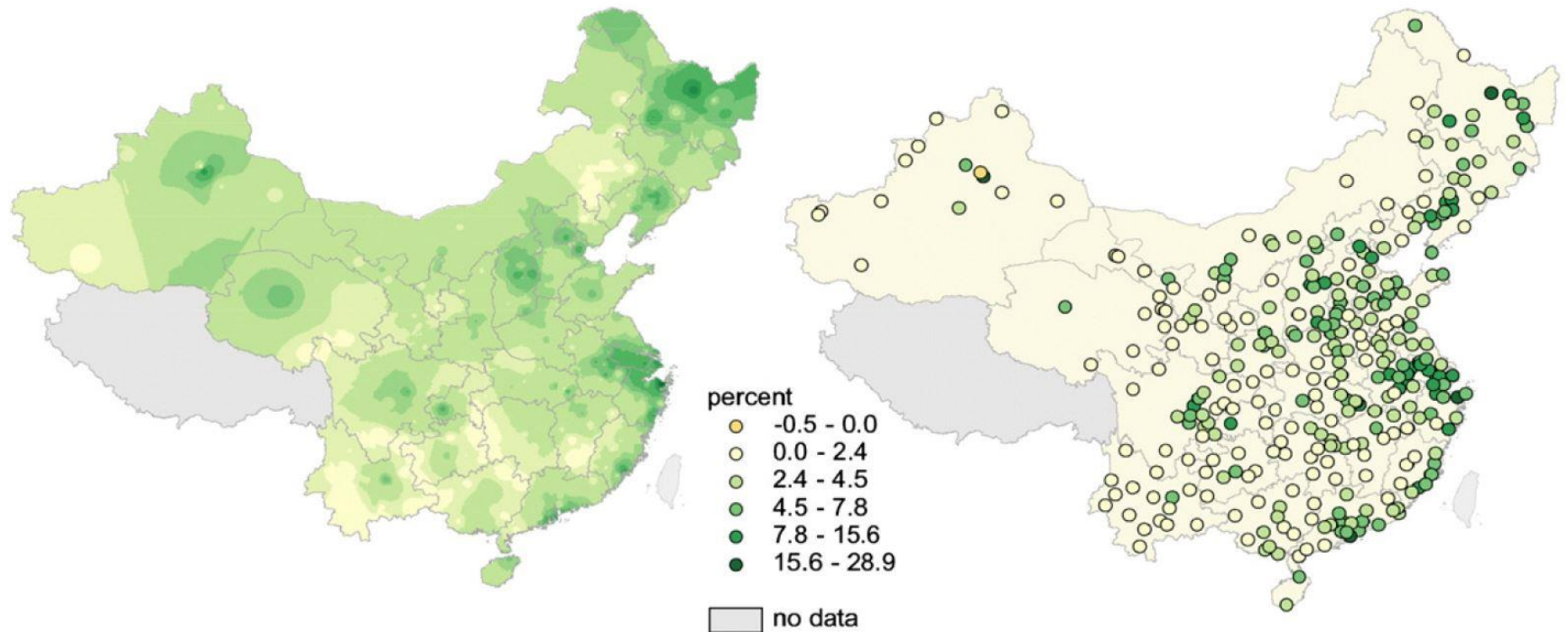
# Importance of network links

## Base network + highways



Importance: number of times link is used when connecting each city with all other cities; unused links not shown

# Impacts estimated for 331 prefectures



Spatial impacts of the NEN on prefectural real income levels

Chinese real income with new highways was approximately 6 percent higher than it would have been with no investment

One-off level effect

Real incomes increased in almost all prefectures

Largest increases occurred in Eastern China, so investments have so far not reduced spatial disparities

Mixed effects on wages

(declines in either urban or rural wages in about 1/3 of prefectures)

This approach—like others such as Faber 2014—assumes no labor mobility (at most semi-realistic even for China)

# Two major Chinese spatial policies

Large scale infrastructure investments (Highways – NEN)

Restrictions on labor mobility (Hukou system)

Loss of public service entitlements when moving

Recently (partly) relaxed

Estimate effects of both policies on real incomes, population, urbanization, rural-urban income gap

Considering changes in market access and differences in amenities across prefectures (combines Roberts et al 2012 & Tabuchi and Thisse 2002)

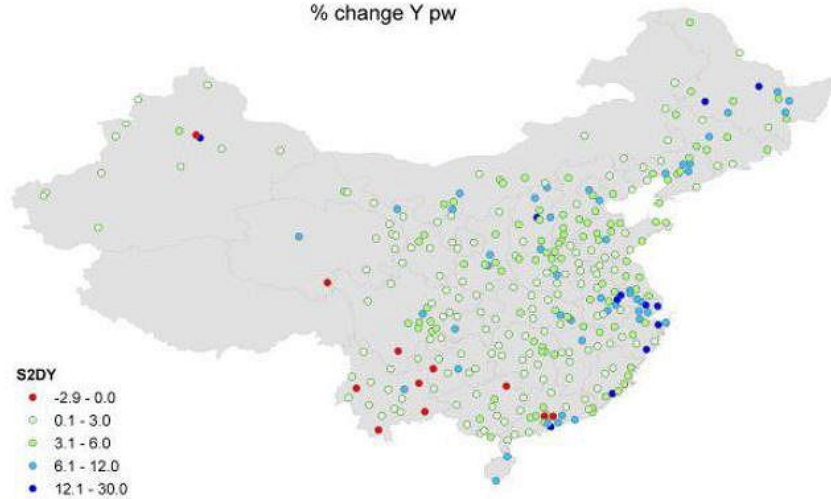
Scenarios: NEN vs. non-NEN, Hukou vs. no-Hukou



# Spatially disaggregated results

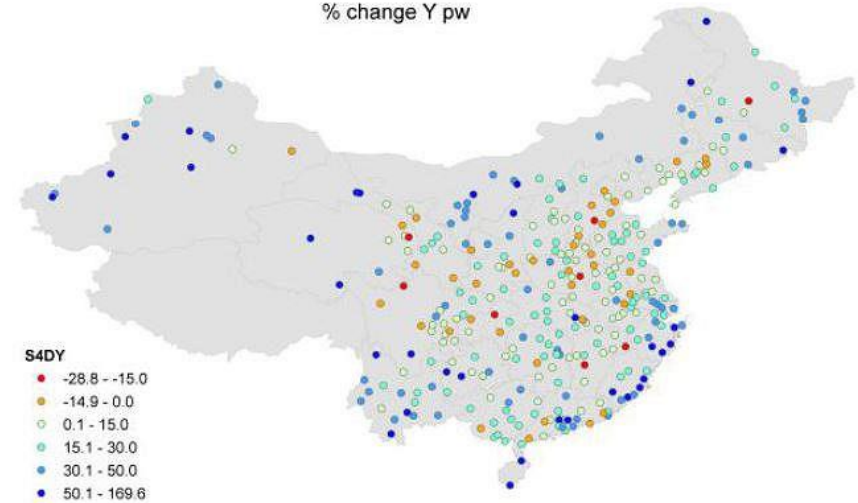
Scenario 2: NEN vs. no NEN, RESTRICTED labor mobility

% change Y pw



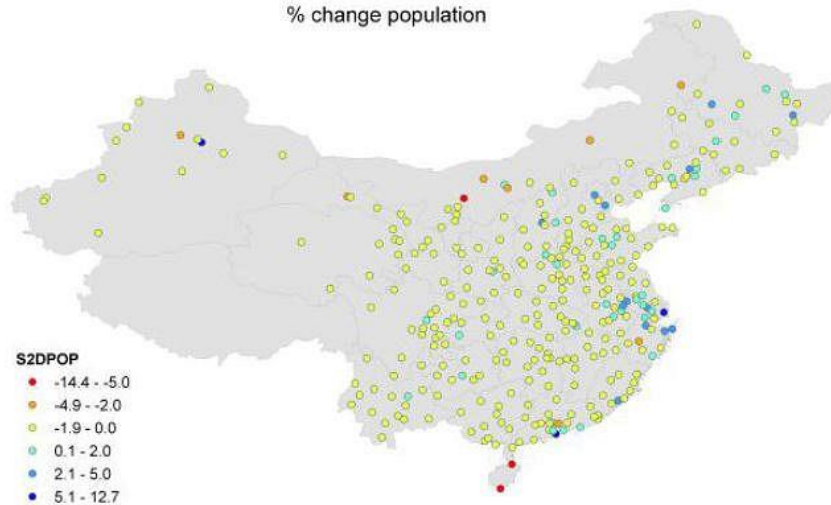
Scenario 4: no Hukou vs. Hukou, NEN

% change Y pw



Scenario 2: NEN vs. no NEN, RESTRICTED labor mobility

% change population



Scenario 4: no Hukou vs. Hukou, NEN

% change population



# Results

Aggregate impact of NEN under more realistic (short of abolishing Hukou) labor mobility not much different

Modest effect of the NEN on spatial reallocation

Ending Hukou completely would have far bigger effects

- Larger welfare gains

- More spatial inequality: Coastal cities in SE grow fastest (esp. in population but also reinforcing income inequality)

- Significant increase in urbanization

- Least urbanized prefectures urbanize faster (but largely due to rural out-migration rather than longer distance migration)

# Policy research priorities: Transport impacts

Interaction between transport policies with other policies  
(e.g., corridor development)

Rigid land and labor markets could prevent reorganization of the geography of production

When are transport investments in lagging regions:

- spatially blind “*institutions*” – mobility as a basic service that should be available to all (e.g., rural access)
- spatially connective “*infrastructure*” that integrate poor areas and let markets identify opportunities
- spatially targeted “*incentives*” (place-based policies) that might lead to inefficient reshuffling of economic activities?

# Conclusion: Battles won

Economic geography now a thriving sub-field of economics

Policy focus has shifted from preventing or managing the urbanization process to managing cities

Greater skepticism of place based policies

# Conclusion: Battles still to be won

“Institutions” (WDR09): how to provide basic services in (increasingly) sparsely populated lagging areas

Urban management: reducing congestion, promoting inclusion and making room for population growth

And doing so sustainably as both causes and consequences of pollution and climate change are increasingly concentrated in urban areas

Thank you