Why do cities exist?

Dr. Hans Koster
Assistant professor
Why do cities exist?

1. Practicalities
2. Introduction
3. Stylised facts
4. The existence of cities
5. Summary

1. Practicalities

- Hans Koster
  - Department of spatial economics
  - VU University Amsterdam
  - Urban economics, environmental economics, economic geography
    - [URBANECONOMICS.NL](http://www.urbaneconomics.nl)

- Details
  - h.koster@vu.nl
  - Available until September 19
  - 18 hours of lectures

- Key elements in lectures; study at home!
  - See [www.urbaneconomics.nl/coursematerial](http://www.urbaneconomics.nl/coursematerial) for lecture sheets and links to papers
1. Practicalities

- Interactive; input during lectures requested

- Do not hesitate to ask questions during class!
  - No such thing as a stupid question

- A small remark on notation in the slides
  \( \mathbb{Q} = \text{question} \)
  \( \mathbb{E} = \text{exercise} \)
  \( \mathbb{A} = \text{application} \)

- This lecture: test exam micro-economics
  - Appendix of O’Sullivan
  - Answers will be published on [www.urbaneconomics.nl/coursematerial](http://www.urbaneconomics.nl/coursematerial)
Observation 1:

The world is *urban*, ever more...

![Graph showing urban and rural population percentages over time](http://esa.un.org/unup/p2k0data.asp)
Observation 1

- The world is *urban*, ever more...
  - About 15% of population in Sri Lanka is urban

*Source: World Bank*
Observation 1

- People move to cities

Observation 1

- Cities grow big ...

Number of Cities With 1 Million or More Residents, 1975, 1995, and 2015

- Less developed countries
- More developed countries

<table>
<thead>
<tr>
<th>Year</th>
<th>Less developed countries</th>
<th>More developed countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>1975</td>
<td>110</td>
<td>85</td>
</tr>
<tr>
<td>1995</td>
<td>250</td>
<td>114</td>
</tr>
<tr>
<td>2015</td>
<td>426</td>
<td>138</td>
</tr>
</tbody>
</table>

Observation 1

- And even bigger.

<table>
<thead>
<tr>
<th>1970</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Tokyo, Japan</td>
<td>1. Tokyo, Japan</td>
</tr>
<tr>
<td>2. New York, United States</td>
<td>2. Jakarta, Indonesia</td>
</tr>
<tr>
<td>3. Shanghai, China</td>
<td>3. Seoul, South Korea</td>
</tr>
<tr>
<td>4. Osaka, Japan</td>
<td>4. Delhi, India</td>
</tr>
<tr>
<td>5. Mexico City, Mexico</td>
<td>5. Shanghai, China</td>
</tr>
<tr>
<td>8. Buenos Aires, Argentina</td>
<td>8. New York, United States</td>
</tr>
<tr>
<td>9. Los Angeles, United States</td>
<td>9. Sao Paulo, Brazil</td>
</tr>
<tr>
<td>10. Beijing, China</td>
<td>10. Mexico City, Mexico</td>
</tr>
</tbody>
</table>

What is remarkable here?
Observation 1

- A city is:
Observation 1

- A city is:
  
  ... high population density
  
  ... people and firms wanting to reduce distance
Observation 2

- The world is flat
Observation 2

- The world is flat

Until 1850: 7km/h  
2000: 1000km/h  
2015: ∞ km/h
Observation 2

- The world is flat

- The products we consume originate from all over the world
  - Transport costs of goods are very low
  - → Outsourcing
2. Introduction

Paradox!

People and firms want to reduce distance by locating in cities

\[ \iff \]

Decreasing effective distance makes the world flat

- What do some stylised facts tell us about this paradox?
Stylised fact 1: urbanised countries are richer

Does this figure conclusively show that cities make you richer?

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3. Stylised facts

Stylised fact 2: cities cluster
Why do cities exist?

3. Stylised facts

Stylised fact 3: firms cluster

In the Netherlands:

- Metal and Electronic Industry
- ICT Industry
- Culture, Other Services
Stylised fact 4: people cluster

Boston:

MAP 8–1 Income Segregation: Boston

Per-Capita Income

- 8,774–21,866
- 21,867–30,366
- 30,367–37,862
- 37,863–51,152
- 51,153–117,316
Stylised fact 4: people cluster

Sri Lanka:

Source: Amasinghe et al. (2005)
Stylised fact 5: the largest cities are in developing countries

Source: Data from United Nations Population Division, March 2002.
Why do cities exist?

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3. Stylised facts

Stylised fact 6: Some cities grow faster than others

Municipal population growth

- 6 to 7.2 (25)
- 5 to 6 (112)
- 4 to 5 (193)
- 3 to 4 (129)
- 0 to 3 (39)
**Stylised fact 7: Zipf’s law**

<table>
<thead>
<tr>
<th>City</th>
<th>Rank</th>
<th>Size (population)</th>
</tr>
</thead>
<tbody>
<tr>
<td>City A</td>
<td>1</td>
<td>100</td>
</tr>
<tr>
<td>City B</td>
<td>2</td>
<td>$\frac{1}{2} \times 100$</td>
</tr>
<tr>
<td>City C</td>
<td>3</td>
<td>$\frac{1}{3} \times 100$</td>
</tr>
<tr>
<td>City D</td>
<td>4</td>
<td>$\frac{1}{4} \times 100$</td>
</tr>
<tr>
<td>City E</td>
<td>5</td>
<td>$\frac{1}{5} \times 100$</td>
</tr>
<tr>
<td>City N</td>
<td>n</td>
<td>$\frac{1}{n} \times 100$</td>
</tr>
</tbody>
</table>
Stylised fact 7: Zipf’s law

Zipf’s Law for Sri Lanka

\[ \log(\text{rank}_i) = 15.32 - 1.1491 \times \log(\text{pop}_i) \]

Graph showing the relationship between rank and population, with a linear equation indicating Zipf's law for Sri Lanka.
Why do cities exist?

3. Stylised facts

Stylised fact 8: Prices/m² differ over space

FIGURE 6–9 Panel A: Bid Rent of the Office Sector

FIGURE 6–9 Panel B: Bid Rent of the Manufacturing Sector
Stylised fact 9: Larger cities have higher crime rates

![Graph showing the relationship between crime and city population](image)

**Fig. 1.**—Crime and city population: relationship between crime and city population taken from the 1982 Uniform Crime Reports and the 1980 census. $t$-statistic is 9.44.
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3. Stylised facts

Stylised fact 10: Energy use per capita is higher for countries with more urbanisation

Energy use (kg of oil equivalent per capita)

Urban Population (as % of total Population)

$R^2 = 0.4563$
3. Stylised facts

Stylised fact 11: Some buildings are taller than others
Stylised fact 12: Larger cities are more congested
3. Stylised facts

- In this course we will try to explain most of these stylised facts

- Economic theories
  - Profit-maximising firms and utility maximising households
  - Externalities
  - Restrictions

- We will use data to provide evidence for these theories
  - Regression models
  - Assess statistical significance
  - Make a distinction between correlation and causal effects (Q What is the difference?)

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</table>
Why do cities exist?

4. The existence of cities

- Why are people willing to live in dirty, noisy, crowded cities?
  - Individuals are not self-sufficient
  - Specialisation in specific tasks

- Recall definition of a city:
  - An area with ‘high’ population density
  - Firms and people wanting to reduce distance

- Recall paradox:
  - Growing cities vs. ‘death of distance’
Why do cities exist?

4. The existence of cities

- **Existence of a city requires:**
  - Agricultural surplus
  - Urban production
  - Transportation for exchange

**Q** Can you think of non-economic reasons why cities may arise or decline?
Why do cities exist?

4. The existence of cities

- Three assumptions that make city formation unattractive

  1. Equal productivity of all land and all workers
  2. Constant returns to scale in transport and exchange
  3. Constant returns to scale in production

Q What is ‘constant returns to scale’
4. The existence of cities

- These assumptions imply:

1. Equal productivity of all land and all workers
   - Everybody would be self-sufficient

2. Constant returns to scale in transport and exchange
   - Exchange would only cause transport costs, no benefits

3. Constant returns to scale in production
   - No benefits of clustering of production in factories

- Note that clustering in space would drive up land prices (cost) without generating benefits
Why do cities exist?

4. The existence of cities

- Relax assumption 1
  - Unequal productivity benefits = comparative advantage

Q Please provide an example of a comparative advantage

<table>
<thead>
<tr>
<th></th>
<th>North</th>
<th></th>
<th>South</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bread</td>
<td>Shirts</td>
<td>Bread</td>
</tr>
<tr>
<td>Output / hr</td>
<td>2</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Opportunity cost</td>
<td>3 shirts</td>
<td>1/3 loaf</td>
<td>1 shirt</td>
</tr>
</tbody>
</table>

Q What is the best thing to do for ‘North’?
Why do cities exist?

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4. The existence of cities

- Relax assumption 1
  - Let’s assume that ‘South’ switches 2 hours from shirt to bread production

<table>
<thead>
<tr>
<th>TABLE 2–2</th>
<th>Specialization and Gains from Trade</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>North</td>
</tr>
<tr>
<td></td>
<td>Bread</td>
</tr>
<tr>
<td>Change in production from specialization</td>
<td>−2</td>
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Why do cities exist?

4. The existence of cities

- Relax assumption 1
  - Let’s assume that ‘South’ switches 2 hours from shirt to bread production

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<td>-------</td>
</tr>
<tr>
<td>-2</td>
</tr>
<tr>
<td>South</td>
</tr>
<tr>
<td>Bread</td>
</tr>
<tr>
<td>+2</td>
</tr>
</tbody>
</table>

- Trade in itself causes no cities; families could exchange among themselves
Why do cities exist?

4. The existence of cities

- Relax assumption 2
  - Economies of scale in exchange

- Trading cities
  - Result of combination of productivity differences and scale economies in transport
  - Long history (3000 BC)

- Examples
  - Cape Town, New York
  - Amsterdam
  - Colombo
Why do cities exist?

1. Practicalities
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4. The existence of cities

- Relax assumption 3
  - Economies of scale in production

- Sources of scale economies in production
  - Factor specialisation (Adam Smith)
  - Indivisibility of inputs (minimum efficient scale)

- If economies of scale in production exist
  - Concentration, in spite of high land rents
  - Emergence of a market area
4. The existence of cities

- Relax assumption 3
  - Economies of scale in production

- Households buy the product from the factory if:
  - Factory price $p_f + t \cdot d < p_h$
  - $t \cdot d$ are total transport costs
  - $p_h$ costs of home production
4. The existence of cities

- Relax assumption 3
  - Economies of scale in production

Q What happens when transport costs go down (e.g. due to innovations)
4. The existence of cities

- Relax assumption 3
  - Economies of scale in production

- Market area
  - Total volume of demand
  - Number of households for which the price of the product is less than $p_h$
  - Area in which supplier underprices its competitors
4. The existence of cities

- **Factory town**
  - Workers want to economise on commuting costs
  - Concentration of workers near factory
  - Substitution of (expensive) land for consumption of other goods
  - Higher population density
  ➜ Factory town

- **Simple model**
  - Economies of scale in production (due to fixed costs)
  - Economies of scale in transport
  - It explains cities that emerge during industrial revolution
To summarise:

- **Cities emerge when:**

  1. **Unequal productivity of land and workers**
     - Some locations are more attractive than others

  2. **Increasing returns to scale in transport and exchange**
     - Emergence of trading cities

  3. **Increasing returns to scale in production**
     - Benefits of clustering of production in factories
     - Emergence of factory towns
Remaining questions

- Why do modern cities grow beyond the size of one firm?
  - Agglomeration economies, city size, urban growth

- Where do cities emerge?
  - Location of cities is explained by economic forces
  - ... Location theory ➔ Wednesday
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Questions?

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Test exam

- Test exam micro-economics
  - Appendix of O’Sullivan
  - Basic econometrics

- Answers will be published on www.urbaneconomics.nl/coursematerial
  - Please e-mail name and grade to h.koster@vu.nl.
  - The grade will not count for the general grade, but gives for me the general level of micro and econometrics

- You may leave when you are ready