Scenarios for long-term economic city growth –
Models and results for selected CORFU case studies

Friso Schlitte
Hamburg Institute of International Economics
HWWI

ICFR, 5-7 September 2013, Exeter
Contents

• Introduction
• Drivers of regional growth
• Methodology
• Application examples
  – The case of Hamburg, Germany
  – The case of Dhaka, Bangladesh
Introduction

Why are economic scenarios relevant for flood issues in urban areas?

• Demand for land and type of land use
  – Settlement structure
  – Type and location of industries
  – Physical infrastructure

• Monetary issues
  – Public budgets and private wealth
  – Monetary value of physical capital (potential damages)

• Strategies dealing with flood issues should consider the socioeconomic development and its impact on the future state of the city
Introduction

Aim:

• Developing quantitativ long-term (2050) scenarios for population, income and employment growth on the regional level

Challenges:

• Common methodology for very heterogeneous case study cities
  – Highly developed cities with high level of wealth, low dynamics, ...
  – Rapidly growing cities in developing/emerging countries with low income levels, weak institutions and high social inequalities

• Generating results with a minimum of data input
  – Availability of regional level data is generally poor (also in developed countries)
  – Quality and availability is much worse in developing/emerging countries
Drivers for regional growth

- Regional growth is determined by many observable and unobservable factors
  - Global and national development
  - Demographic development
  - Qualification structure / level
  - R&D / Innovation
  - Sector structure / sectoral shifts
  - Variety of other idiosyncratic location factors
    - Accessibility, infrastructure, institutions, ...
    - soft location factors (quality of housing, education facilities, consumption amenities,...)

- Persistence of regional growth trends
  - circular, cumulative causation
  - When and why may a region leave an adopted growth path?
  - Scenarios should be considered as plausible description of the future, not as prediction
Methodology

General procedure:

• Taking national growth and disaggregate to regional level
• Estimate regional deviations from national growth and extrapolate past relationship
• Step-wise approach:

  1. Ex-post analysis (estimating drivers and trends)
     • Panel data estimation
     • Identifying regional trends (as deviation from the national development)
     • Identifying specific drivers (e.g. skill level, knowledge intensity of production)
     • Industry-wise analysis

  2. Projections (applying ex post results and socio economic scenarios)
     • National economic and demographic projections
     • Regional demographic projections (if available)
Methodology

Population growth:

\[ [1] \quad \text{grPOP}_{rit}^{15-64} = \gamma_0 + \gamma_1 \text{grPOP}_{it}^{15-64} + \tau_t + \kappa_r + u_{rt} \]

Employment growth (in each industry separately):

\[ [2] \quad \text{grEMP}_{rit} = \alpha_0 + \alpha_1 \text{grEMP}_{it} + \sum \alpha_n \text{Controls}_{rt} + \tau_{ti} + \kappa_{ri} + u_{rit} \]

Productivity (in each industry separately):

\[ [3] \quad \ln \frac{\text{GDP}_{rit}}{\text{EMP}_{rit}} = \beta_0 + \beta_1 \ln \frac{\text{GDP}_{it}}{\text{EMP}_{it}} + \sum \beta_n \text{Controls}_{rt} + \kappa_{ri} + \tau_{ti} \ast \kappa_{ri} + u_{rit} \]

Production (in each industry separately):

\[ [4] \quad \text{GDP}_{rit} = [3] \ast \text{EMP}_{ri(t-1)} (1 + [2]) \]

where r=region, i=industry, t=year
Application – The case of Hamburg

Model input:
– Information on 97 German regions, 1996 to 2008
– Industry wise GDP and Employment
  • Agriculture, forestry and fishing
  • Industry (excluding construction)
  • Construction
  • Trade
  • Financial & business services
  • Non-market services
– Projections
  • National Working age population until 2050 (Statistical Office of Germany)
  • National economic projections (Oxford Global Economic Model)
Application – The case of Hamburg

National level scenarios for Germany

<table>
<thead>
<tr>
<th></th>
<th>low growth</th>
<th>medium growth</th>
<th>high growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>GVA(billion Euro, 2005 prices)</td>
<td>2958 32%</td>
<td>3496 56%</td>
<td>4036 80%</td>
</tr>
<tr>
<td>Employment (total, tsd.)</td>
<td>29510 -29%</td>
<td>33012 -20%</td>
<td>36047 -13%</td>
</tr>
<tr>
<td>Population (aged 15-64, tsd.)</td>
<td>37577 -30%</td>
<td>40193 -25%</td>
<td>43395 -19%</td>
</tr>
<tr>
<td>Population (total, tsd.)</td>
<td>67411 -17%</td>
<td>71510 -12%</td>
<td>76703 -6%</td>
</tr>
</tbody>
</table>

Application – The case of Hamburg

Scenario results:

Working age population (in 1000)  Total employment (in 1000)  Total GVA (mio. €, 2005 prices)
Application – The case of Hamburg

Structural changes in Hamburg (sectoral GVA/total GVA)

<table>
<thead>
<tr>
<th>Sector</th>
<th>low growth</th>
<th>medium growth</th>
<th>high growth</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2050</td>
<td>2008 to 2050</td>
<td>2050</td>
</tr>
<tr>
<td>Agriculture, forestry and fishing</td>
<td>0.2%</td>
<td>0.0%</td>
<td>0.2%</td>
</tr>
<tr>
<td>Industry (excl. Construction)</td>
<td>13.1%</td>
<td>-2.2%</td>
<td>13.4%</td>
</tr>
<tr>
<td>Construction</td>
<td>2.4%</td>
<td>-0.8%</td>
<td>2.3%</td>
</tr>
<tr>
<td>Secondary sector</td>
<td>15.5%</td>
<td>-3.0%</td>
<td>15.7%</td>
</tr>
<tr>
<td>Trade</td>
<td>23.3%</td>
<td>-2.3%</td>
<td>23.5%</td>
</tr>
<tr>
<td>Financial &amp; business services</td>
<td>46.3%</td>
<td>11.9%</td>
<td>45.9%</td>
</tr>
<tr>
<td>Non-market services</td>
<td>14.7%</td>
<td>-6.6%</td>
<td>14.6%</td>
</tr>
<tr>
<td>Tertiary sector</td>
<td>84.3%</td>
<td>3.0%</td>
<td>84.1%</td>
</tr>
</tbody>
</table>

Tertiary sector: 84.3% (3.0%), medium growth: 84.1% (2.8%), high growth: 85.1% (3.8%)
Application – The case of Dhaka

Model input:

– Information on 64 districts, 1996 to 2000
– Industry wise GDP (only)
  • Agriculture, forestry and fishing, Industry (excluding construction), Construction, Trade, Financial & business services, Non-market services
  • Estimating GDP growth in fashion of equation [2]
– Regional (total) population from censuses 1991 and 2011
– Projections
  • National working age population and total GDP until 2050 (IIASA 2012)
  • No existing scenarios for sectoral disaggregated GDP in Bangladesh
# Application – The case of Dhaka

## National level scenarios for Bangladesh

<table>
<thead>
<tr>
<th></th>
<th>SSP3 (=low growth)</th>
<th>SSP2 (=medium growth)</th>
<th>SSP1 (= high growth)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2050</td>
<td>2010 to 2050</td>
<td>2050</td>
</tr>
<tr>
<td>GDP (billion US-$, 2005 prices)</td>
<td>153</td>
<td>197%</td>
<td>366</td>
</tr>
<tr>
<td>Population (total, million)</td>
<td>214</td>
<td>44%</td>
<td>194</td>
</tr>
<tr>
<td>Population (aged 15-64, million)</td>
<td>142</td>
<td>49%</td>
<td>132</td>
</tr>
<tr>
<td>Share of population in urban areas</td>
<td>38%</td>
<td>36%</td>
<td>52%</td>
</tr>
</tbody>
</table>

Source: SSP-Database, IIASA 2012 (prepared for the 5th IPCC-Report).
Application – The case of Dhaka

Scenario results:

Working age population (in 1000)

Total GDP (mio. Taka, 1996 prices)
### Structural changes in Dhaka (sectoral GDP/total GDP)

<table>
<thead>
<tr>
<th></th>
<th>low growth</th>
<th>medium growth</th>
<th>high growth</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2050 to 2008</td>
<td>2050 to 2008</td>
<td>2050 to 2008</td>
</tr>
<tr>
<td>Agriculture, forestry and fishing</td>
<td>0.5%</td>
<td>-0.6%</td>
<td>0.3%</td>
</tr>
<tr>
<td>Industry (excl. Construction)</td>
<td>36.7%</td>
<td>-2.0%</td>
<td>35.9%</td>
</tr>
<tr>
<td>Construction</td>
<td>2.5%</td>
<td>-0.8%</td>
<td>1.9%</td>
</tr>
<tr>
<td><strong>Secondary sector</strong></td>
<td><strong>39.2%</strong></td>
<td><strong>-2.8%</strong></td>
<td><strong>37.7%</strong></td>
</tr>
<tr>
<td>Trade</td>
<td>21.3%</td>
<td>-10.8%</td>
<td>20.7%</td>
</tr>
<tr>
<td>Financial &amp; business services</td>
<td>31.3%</td>
<td>18.6%</td>
<td>34.9%</td>
</tr>
<tr>
<td>Non-market services</td>
<td>7.7%</td>
<td>-4.4%</td>
<td>6.4%</td>
</tr>
<tr>
<td><strong>Tertiary sector</strong></td>
<td><strong>60.3%</strong></td>
<td><strong>3.4%</strong></td>
<td><strong>62.0%</strong></td>
</tr>
</tbody>
</table>
Conclusions

- Common methodology for long term scenarios in very heterogeneous cities
- Methodology is adaptable to data availability
- Results are scenarios, not predictions
Thank you!

Friso Schlitte
Hamburg Institute of International Economics
HWWI
schlitte@hwwi.org
Scenarios for structural changes in Bangladesh (sectoral GDP/total GDP)

<table>
<thead>
<tr>
<th>Sector</th>
<th>SSP3 (low growth)</th>
<th>SSP2 (medium growth)</th>
<th>SSP1 (low growth)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2050 difference in</td>
<td>2050 difference in</td>
<td>2050 difference in</td>
</tr>
<tr>
<td></td>
<td>% points, 2010 to 2050</td>
<td>% points, 2010 to 2050</td>
<td>% points, 2010 to 2050</td>
</tr>
<tr>
<td>Agriculture, forestry and fishing</td>
<td>11.9% -8.3%</td>
<td>6.8% -13.4%</td>
<td>3.1% -17.0%</td>
</tr>
<tr>
<td>Industry (excl. Construction)</td>
<td>28.9% 8.1%</td>
<td>31.8% 10.8%</td>
<td>30.0% 9.1%</td>
</tr>
<tr>
<td>Construction</td>
<td>8.4% -0.8%</td>
<td>7.2% -2.0%</td>
<td>6.8% -2.4%</td>
</tr>
<tr>
<td>Trade</td>
<td>20.1% -5.5%</td>
<td>21.7% -3.9%</td>
<td>23.8% -1.9%</td>
</tr>
<tr>
<td>Financial &amp; business services</td>
<td>17.7% 8.3%</td>
<td>21.4% 12.0%</td>
<td>23.5% 14.0%</td>
</tr>
<tr>
<td>Non-market services</td>
<td>12.9% -1.7%</td>
<td>11.8% -2.9%</td>
<td>12.9% -1.8%</td>
</tr>
</tbody>
</table>

Regional cross-section: 64 districts of Bangladesh

Time-series: - 1990 – 2000

Data: - GDP, employment by several different economic sectors - Population by gender, age, activity rate - So far missing: employment data and regional population projections