Night lights as a proxy for economic growth?
an application to structural transformation

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Data challenges in medium and low income countries

- Large informal economy
- Unreliable domestic price index and PPP exchange rates
- Underfunded statistical agencies
  - Lack of GDP data and national account data
  - Short time series, no quarterly data, no regional disaggregation
  - Delays in data production
  - Large revision in GDP estimates over time (PWT)
- Difficulty to monitoring the economy
- Difficulty to measure the impact of new events/policies
Night time lights: what is it?
NTLs: main features I

Night time lights as a proxy for economic activity

- Henderson et al. (2012); Chen and Nordhaus (2011)
- Amount of light that can be observed from outer space
- Change in NTLs as a measure of income growth
- Part of remote sensing: data collected from above the earth’s surface (satellites)

DMSP : 1992-2013

- US Air Force Defense Meteorological Satellite Program
- Collect low-light imaging data to detect clouds at night
- Also identify lights from human settlements
- Observe every location on the planet at some instant
Visible Infrared Imaging Radiometer Suite

Available in NRT, better radiometric properties

Heavy data processing:

- Lunar lights, auroral activities, bio-mass burning, gas flare, cloud cover
- Satellite year dataset: average of valid nights observation
- Partly cleaned monthly dataset
- Measure of light at pixel level (around 1km2 at the equator)
- [https://eogdata.mines.edu/products/vnl/](https://eogdata.mines.edu/products/vnl/)
<table>
<thead>
<tr>
<th>Ref</th>
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<td>Henderson et al. (2012)</td>
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<td>1992-2013</td>
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<td>1992-2013</td>
<td>Decile &gt;2</td>
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<td>Hu and Yao (2019)</td>
<td>1992-2013</td>
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</table>
Light Employment elasticity?

Limitations:

▶ Captures services and manufacturing rather than agriculture (elasticity is lower)
▶ Population vs income
▶ Cloud free observation at high frequencies
▶ Still out perform other leading indicators (manufacturing production, imports)

Light-Employment elasticity:

▶ Light GDP elasticity + Okun’s law
▶ Light/employment elasticity
  ▶ National employment data from ILO
  ▶ Regional data: microdata repository
  ▶ Local data: census data
  ▶ Elasticity = 0.1 for 2d level AE in Africa
NTLs Applications

- GDP measures: World Bank, IMF
- **Covid-19**: India, Morocco
- **Climate change**: natural disasters
- **Conflicts**
- City growth and urbanization
- **Infrastructure**
- Regional growth and convergence
- Structural transformation in low income countries
- Spatial distribution of economic activity
- Importance of geographic variables
- **Regional inequalities**
- Nowcasting of employment
- Estimation of informal sector
- **Minimum wage reforms**
Ongoing Work

▶ Economic cost of conflicts in Africa (with S. Bridji)
  ▶ 1 conflict related death = 10 jobs lost

▶ Impact of Covid-19 in Asia:

▶ Convergence and structural transformation in Sub-Saharan Africa:
Convergence and structural transformation in sub-Saharan Africa

- Are poorer areas catching up with richer areas in sub-Saharan Africa?
- At the local level?
- Is it a homogenous or heterogenous process?
- What factors explains whether a given area is catching up
  - Sector specialization
  - Conflicts
  - Geographic characteristics: access to infrastructure, distance to main city
  - Natural characteristics: ruggedness, land suitability
Contribution to literature

- **Convergence literature:**
  - Use regional GDP per capita data
  - Africa under-represented for lack of regional data
  - Does not discuss importance of manufacturing

- **Structural transformation literature:**
  - Use aggregate data
  - Emphasizes sector specialization
  - No sub-national dimension
Light per employment as proxy for local labour productivity

Two innovative datasets
- Light intensity $\rightarrow$ income
- Census data $\rightarrow$ Employment
- Census data $\rightarrow$ Sector specialization

Growth in labour productivity and sector specialization
- 1136 administrative entities
- 10 sub-Saharan African countries
- 2000 $\rightarrow$ 2010
- Constraint is census data not nighttime lights
Maps of 1136 administrative entities
Main results

- Convergence at 2% annually: iron law of convergence
- But convergence heterogeneity: areas are left behind
- Importance of manufacturing employment ...
- As well as service employment
- Subsector specialization matters
- Distance to the main city, distance to conflicts, land suitability


