Convergence: Known and Unknown

■ What we know:

■ Last 30 years: Economic Convergence *between* countries (Patel, Subramanian, Sandefur 2021)

■ Poorer nations have caught-up with the more affluent nations

■ Sparse evidence on no convergence *within* countries (exceptions USA, UK)
Convergence: Known and Unknown

What we know:

- Last 30 years: Economic Convergence between countries (Patel, Subramanian, Sandefur 2021)
- Poorer nations have caught up with the more affluent nations
- Sparse evidence on no convergence within countries (exceptions USA, UK)

What we don’t know:

- Q1: What is the evolution of convergence within countries?
- Is economic growth concentrated in a few regions?
- Q2: What is the role of structural change?
This Paper

- **New dataset** on sub-national GDP & sectoral composition

- **Three Facts** on the Evolution of Convergence
  
  - #1: Within-Country convergence ↓ for the average country
  - #2: Role of structural change → services
  - #3: Services employment is spatially concentrated

- **Theory**: A spatial model of structural change
  
  - Consistent with the facts
  - Helps us understand the role of services
Contributions to the Literature

- Increase in spatial income disparities known for the U.S. 
  Gleaser and Gyourko (2006), Ganong and Shoag (2017), 
  Giannone (2017), Eckert, Ganapati and Walsh (2020)

  - Evidence for 34 countries across the world

- Data: GDP, education, & empl. at the subnat. level

- Structural Transformation and space 
  Caselli and Coleman (2001), Eeckert and Peters (2018), 
  Peters and Zilibotti (2022), Budí-Ors and Pijoan-Mas (2022)

  - Role of services for spatial inequality

- Feedback effect: Growth $\leftrightarrow$ Spatial Inequality
Data

- Sub-national GDP (in international $):
  - Sub-national units: States or Cities
  - At the State or Province level: 34 Countries
    - A balanced panel: 1980–2017
    - An unbalanced panel from 1960s
    - Years of schooling
    - GDP and Employment by Sector
- City-level data from The Economist
  - 200 Countries (inc. 19 African Countries), 2004–2019
  - GDP and Population
Constructing State Level Sub-national GDP

- Gennaioli et. al. (2012) have 80+ Countries
- This leaves us with 34 countries and 678 sub-national regions

<table>
<thead>
<tr>
<th>Region</th>
<th>World</th>
<th>Asia</th>
<th>Europe</th>
<th>N. Am</th>
<th>S. Am</th>
<th>Africa</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP</td>
<td>80%</td>
<td>75%</td>
<td>78%</td>
<td>100%</td>
<td>75%</td>
<td>24%</td>
</tr>
<tr>
<td>Population</td>
<td>65%</td>
<td>77%</td>
<td>62%</td>
<td>90%</td>
<td>77%</td>
<td>14%</td>
</tr>
<tr>
<td>N</td>
<td>34</td>
<td>6</td>
<td>16</td>
<td>3</td>
<td>5</td>
<td>3</td>
</tr>
</tbody>
</table>
Fact 1: A Stall in Within Country Convergence

- Evolution of Convergence between states within countries

- For each country $c$ at time $t_0$:

$$\text{Growth GDP}_{pc,s} = \alpha + \beta_c \log \text{GDP}_{pc,s} + \epsilon_s$$

- $s = \text{States, Provinces}$

- Avg. within-country convergence rate: $\overline{\beta_c} = \frac{\sum c \beta_c}{N}$

- Q1: Within-country convergence on average $\Rightarrow \overline{\beta_c} < 0$
Fact 1: A Stall in Within Country Convergence

Q1: Globally, is growth broad-based or concentrated?

Average within-country $\beta$ for 34 countries.

Blue: Unweighted Convergence Regressions
Fact 1: A Stall in Within Country Convergence

- **Q1:** Globally, is growth broad-based or concentrated?

![Chart showing average within-country β for 34 countries. Blue: Unweighted Convergence Regressions. Red: Population Weighted Convergence Regressions.](chart)

Average within-country $\beta$ for 34 countries.

**Blue:** Unweighted Convergence Regressions

**Red:** Population Weighted Convergence Regressions
Fact 1: A Stall in Within Country Convergence

- True for a large fraction of countries
- Compared to 1980s, 19/34 countries had a lower $\beta$ post-2007

\[ 1980 \beta < 2007 \beta \]

<table>
<thead>
<tr>
<th>Share of countries</th>
<th>56%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Share of GDP</td>
<td>77.1%</td>
</tr>
<tr>
<td>Share of population</td>
<td>69.0%</td>
</tr>
</tbody>
</table>
Fact 1: A Stall in Within Country Convergence

- Convergence b/w Cities within a country
- This figure includes Sub-Saharan Africa

Notes: This figure reports the average $\beta$ within-country for all the cities in our sample that include the majority of Sub-Saharan Africa as well.
Fact 1: A Stall in Within Country Convergence

- Conditional Convergence on Population Growth and Education

Notes: This figure reports the average $\beta$ within-country after conditioning for population growth (left) and education (right) for all the countries in our sample.
Robustness & Heterogeneity

- Robustness
  - Excluding India and China
  - Accounting for regional price differentials
  - Nightlights
  - Heterogeneity by OECD status and country size
Story of India or China catching up with the US

GDP per capita relative to US

China

India

0-14
What has happened within India and China?
What has happened within India and China?

**Employment Concentration in the Top 2 Decile Regions**

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td><strong>India</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Services</td>
<td>33.11</td>
<td>33.68</td>
<td>24.23</td>
<td>26.08</td>
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<tr>
<td>Prof., Business</td>
<td>39.35</td>
<td>46.98</td>
<td>24.17</td>
<td>32.30</td>
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<tr>
<td>Manufacturing</td>
<td>27.26</td>
<td>19.49</td>
<td>31.45</td>
<td>31.54</td>
</tr>
<tr>
<td><strong>China</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Beijing, Shanghai</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Tianjin, Jiangsu</td>
<td>Guizhou, Guangxi, Yunnan, Tibet</td>
</tr>
</tbody>
</table>
Fact 2: Structural Transformation & Convergence

Q2: What is the role of structural change towards services?

Notes: Population weighted beta vs services employment share (left) and log GDP per capita (right) for the unbalanced panel. Estimates are residualized off country fixed effects. The green line shows the evolution of the average country.
Fact 2: Structural Transformation & Convergence

Q2: What is the role of structural change towards services?

<table>
<thead>
<tr>
<th>Dependent Variable:</th>
<th>Within-country $\beta_{ct}$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
</tr>
<tr>
<td>log GDP pc</td>
<td>1.80</td>
</tr>
<tr>
<td></td>
<td>(0.40)***</td>
</tr>
<tr>
<td>Employment Shares</td>
<td></td>
</tr>
<tr>
<td>Agriculture</td>
<td></td>
</tr>
<tr>
<td>Manufacturing</td>
<td>-6.99</td>
</tr>
<tr>
<td></td>
<td>(3.80)*</td>
</tr>
<tr>
<td>Services</td>
<td>6.24</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Country FE</td>
<td>✓</td>
</tr>
<tr>
<td>N</td>
<td>980</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.30</td>
</tr>
</tbody>
</table>

Notes: Data from the unbalanced panel. Standard Errors clustered at country-level reported in parenthesis. *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$. 
A fall in Inequality with Structural Transformation

- Regional inequality has not ended

![Graph showing relationship between regional inequality and services share in employment.]
Fact 3: Regional Concentration of Services

- Suggestive evidence of "agglomeration" economies with services compared to manufacturing and agriculture
Beyond Services: Determinants of Regional Conv.

Cross-Country relationships

<table>
<thead>
<tr>
<th>Dependent Variable:</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service Employment</td>
<td>2.09</td>
<td>5.18</td>
<td>7.90</td>
<td>7.93</td>
<td>7.42</td>
</tr>
<tr>
<td>Share</td>
<td>(2.58)*</td>
<td>(2.58)*</td>
<td>(3.79)*</td>
<td>(3.62)**</td>
<td>(3.87)*</td>
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<tr>
<td>Growth Services</td>
<td>44.49</td>
<td>40.32</td>
<td>40.54</td>
<td>40.92</td>
<td>40.92</td>
</tr>
<tr>
<td>Productivity</td>
<td>(15.39)***</td>
<td>(15.42)***</td>
<td>(16.98)**</td>
<td>(17.26)***</td>
<td>(17.26)***</td>
</tr>
<tr>
<td>Road density</td>
<td>-43.23</td>
<td>-43.50</td>
<td>-51.59</td>
<td>-51.59</td>
<td>-51.59</td>
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<tr>
<td></td>
<td>(41.08)</td>
<td>(39.73)</td>
<td>(44.22)</td>
<td>(44.22)</td>
<td>(44.22)</td>
</tr>
<tr>
<td>Avg. FTAs</td>
<td>0.08</td>
<td>0.23</td>
<td>0.08</td>
<td>0.23</td>
<td>0.08</td>
</tr>
<tr>
<td></td>
<td>(1.30)</td>
<td>(1.54)</td>
<td>(1.30)</td>
<td>(1.54)</td>
<td>(1.54)</td>
</tr>
<tr>
<td>Years of Education</td>
<td>0.08</td>
<td>0.23</td>
<td>0.08</td>
<td>0.23</td>
<td>0.08</td>
</tr>
<tr>
<td></td>
<td>(0.26)</td>
<td>(0.26)</td>
<td>(0.26)</td>
<td>(0.26)</td>
<td>(0.26)</td>
</tr>
<tr>
<td>Polity IV Score</td>
<td>0.02</td>
<td>0.23</td>
<td>0.02</td>
<td>0.23</td>
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<tr>
<td></td>
<td>(0.07)</td>
<td>(0.07)</td>
<td>(0.07)</td>
<td>(0.07)</td>
<td>(0.07)</td>
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<tr>
<td>Year FE</td>
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<td>✓</td>
<td>✓</td>
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</tr>
<tr>
<td>N</td>
<td>314</td>
<td>314</td>
<td>299</td>
<td>299</td>
<td>299</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.17</td>
<td>0.21</td>
<td>0.23</td>
<td>0.23</td>
<td>0.34</td>
</tr>
</tbody>
</table>

Notes: Data from the unbalanced panel. Standard Errors clustered at country-level reported in parenthesis. *p < 0.1, **p < 0.05, ***p < 0.01.
A Model of Structural Transformation and Geography

- Structural Change (Canonical):
  - Three sectors $i$: agriculture $a$, manufacturing $m$ and services $s$
  - Subsistence level of agriculture: $\overline{c_a}$

- Spatial Equilibrium Model (Canonical):
  - Worker mobility across regions
  - Economy has $J$ regions

- Structural Change+Economic Geography:
  - Key: A higher agglomeration force $\delta$ in Services
Consumption

- Workers consume a bundle of the three sectors
  \[ C_j = C_s j C_{m,j}^{1-\gamma} (C_{a,j} - \bar{c}_a) \beta \]
- Workers have idiosyncratic taste shocks with shape parameter \( \nu \)
- Decide where to locate and consume
- Choose a location to maximize utility
  \[ U_{i,j} = \max_{j'} \max_C \log C_{j'} + \nu \mu_{i,j'} \]
A Model of Structural Transformation and Geography

- **Production**
  - Linear: \( Y_i = A_i N_i, \) \( N : \) Labor, \( i = a, m, s \)

- **Productivity Process:**
  - \( A_{ijt} = e^{g_i} A_{ijt-1}, \) for \( i = a, m \)
  - \( A_{sjt} = e^{g_s} A_{ijt-1} N_{sjt}^{\delta} \)
Calibration - Preliminary

- Calibrate for the average/representative country

- To build this representative country
  - Divide regions within each country into 3 groups by GDP per capita
  - Regions: Top, Middle, and Bottom
  - Cross-country average of GDP pc, Employment by sector for each group

- The representative country with 3 regions matches Fact 1
Calibration - Preliminary

- 8 Parameters:
  - Initial sectoral productivity and growth rate $A_i, g_i$
  - Agglomeration in Services $\delta$
  - Subsistence consumption level in Agriculture

- Target 21 moments
  - Regional Sectoral Employment Share (9)
  - National Sectoral Employment Share (2)
  - Change in National Sectoral Employment Share (3)
  - Convergence Rate $\beta$ for every 5th year (7)

- Sectoral consumption shares & $\nu$ set equal to literature
Model Matches Data on $\beta$ convergence
Key Insights of the Simulation

- Agglomeration Force: High, Low

- #1: Regional Convergence falls when agglomeration is high

- #2: Faster aggregate structural transformation towards services

<table>
<thead>
<tr>
<th></th>
<th>Baseline High</th>
<th>No agglomeration Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>%Δ β convergence 1980-2007</td>
<td>78</td>
<td>53</td>
</tr>
<tr>
<td>Variance of service share 2007</td>
<td>0.1</td>
<td>0.02</td>
</tr>
<tr>
<td>%Δ services share 1980-2007</td>
<td>29</td>
<td>26</td>
</tr>
</tbody>
</table>
Conclusions and Current Work

- **Q1:** Globally, is growth broad-based or concentrated?

  - Concentrated

  Corollary: Is India catching up with the U.S. or Mumbai with NYC? Mumbai with NYC

- **Q2:** What is the role of structural change towards services?

  - Stalling convergence in spatial inequality

  - **Feedback effect:** Growth ⇔ Spatial Inequality

- **On-going work:**

  - Improving dataset – regional prices, employment.
  - Improving model calibration.
Fact 1: A Stall in Within Country Convergence

Notes: This figure reports the average $\beta$ within-country Convergence for the 32 countries in our sample between 1980 and 2015 excluding India and China from the full sample.
Fact 1: A Stall in Within Country Convergence

(a) United States

(b) India

This figure reports the within-country $\beta$-convergence rates using Real GDP per capita.
Fact 1: A Stall in Within Country Convergence
Fact 1: A Stall in Within Country Convergence

(a) OECD Status

(b) Size (Population) of Countries