Structural change, labor productivity and economic growth

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Outline

• Defining, measuring, documenting structural transformation
• Extensions and Robustness tests
• Explaining the results
  - Macro framework
  - Micro framework (example from Botswana)
• Research Agenda
  - Country studies
  - More than 200 household surveys
  - Data collection Africa
What do economists usually mean by structural transformation?
structural transformation → dual economy models → a la Arthur Lewis → agriculture to manufacturing → economic growth
Consider India in 1990
India fits the Lewis Model

Correlation Between Sectoral Productivity and Change in Employment Shares in India (1990-2005)

\[ \beta = 35.2372; \text{t-stat} = 2.97 \]

*Note: Size of circle represents employment share in 1990

**Note: \( \beta \) denotes coeff. of independent variable in regression equation:

\[ \ln(p/P) = \alpha + \beta \Delta \text{Emp. Share} \]

Source: Authors’ calculations with data from Timmer and de Vries (2009)
So does China

Correlation Between Sectoral Productivity and Change in Employment Shares in China (1997-2007)

\[ \beta = 14.0055; \text{t-stat} = 1.02 \]

*Note: Size of circle represents employment share in 1997

**Note: \( \beta \) denotes coeff. of independent variable in regression equation:

\[ \ln(p/P) = \alpha + \beta \Delta \text{Emp. Share} \]

Source: Authors’ calculations with data from China’s National Bureau of Statistics
So, what does the rest of the world look like?
Correlation Between Sectoral Productivity and Change in Employment Shares in Venezuela (1990-2005)

\[ \beta = -14.5675; \ t-stat = -3.44 \]

*Note: Size of circle represents employment share in 1990

**Note: \( \beta \) denotes coeff. of independent variable in regression equation:

\[ \ln(\text{p/P}) = \alpha + \beta \Delta \text{Emp. Share} \]

Source: Author’s calculations with data from Timmer and de Vries (2007)
Correlation Between Sectoral Productivity and Change in Employment Shares in Mexico (1990-2005)

\[ \beta = 4.9089; \text{ t-stat} = 0.70 \]

*Note: Size of circle represents employment share in 1990

**Note: \( \beta \) denotes coeff. of independent variable in regression equation:

\[ \ln(p/P) = \alpha + \beta \Delta \text{Emp. Share} \]

Source: Author's calculations with data from Timmer and de Vries (2007)
Nigeria

Correlation Between Sectoral Productivity and Change in Employment Shares in Nigeria (1990-2005)

\[ \beta = 9.8367; \text{t-stat} = -1.12 \]

*Note: Size of circle represents employment share in 1990

**Note: \( \beta \) denotes coeff. of independent variable in regression equation: 

\[ \ln(p/P) = \alpha + \beta \Delta \text{Emp. Share} \]

Source: Authors' calculations with data from Nigeria's National Bureau of Statistics and ILO's LABORSTA
Malawi

Correlation Between Sectoral Productivity and Change in Employment Shares in Malawi (1990-2005)

\[ \beta = 12.5284; \text{t-stat} = 0.39 \]

*Note: Size of circle represents employment share in 1990

**Note: \( \beta \) denotes coeff. of independent variable in regression equation:

\[ \ln(p/P) = \alpha + \beta \Delta \text{Emp. Share} \]

Source: Authors' calculations with data from Malawi's National Statistical Office, WDI 2010, and ILO's LABORSTA
Correlation Between Sectoral Productivity and Change in Employment Shares in Hong Kong (1990-2005)

\[ \beta = 2.8359; \text{ t-stat } = 2.51 \]

*Note: Size of circle represents employment share in 1990

**Note: \( \beta \) denotes coeff. of independent variable in regression equation:

\[ \ln(p/P) = \alpha + \beta \Delta \text{Emp. Share} \]

Source: Author's calculations with data from Timmer and de Vries (2007)
How important has structural change been as a determinant of labor productivity and to what extent does it explain regional patterns of growth?
Labor productivity growth decomposition

\[ \Delta Y_t = \sum_{i=n} \theta_{i,t-k} \Delta y_{i,t} + \sum_{i=n} y_{i,t} \Delta \theta_{i,t} \]

\( Y \) refers to aggregate labor productivity, \( y \) is sectoral labor productivity, \( \theta \) is employment share, \( \Delta \) is the first-difference operator, \( i \) indexes sectors, \( t-k \) and \( t \) stand for initial and final years.
Data

• Start from Groningen Growth and Development Center (GGDC) data base, which provides employment and real valued added statistics for 27 countries disaggregated into 10 sectors (Timmer and de Vries, 2007; 2009)
  – We converted local currency value added at 2000 prices to dollars using 2000 PPP exchange rates.

• Complement with data from national sources for 11 additional countries (China, Turkey, and several African countries)

• For the most part, VA comes from national income accounts, while level and structure of employment come from population censuses (and other household surveys)
  – Since employment data are not based on labor force or industrial surveys (save for extrapolation purposes), coverage of informal sector should be less problematic than otherwise
Decomposition of productivity growth, by region: 1990 - 2005

Decomposition of productivity growth by country group, 1990-2005
Extensions and Robustness Tests

- Including unemployment
- Marginal vs. average productivity of labor
- Measurement of productivity and structural change
- Checks on informal sector
- Extending the timeframe 1960-2010
Including Unemployment: South Africa

Correlation Between Sectoral Productivity and Change in Employment Shares in South Africa

Without Unemployment: 1990-2005

\[
\Delta \text{Emp. Share} = -0.2091; \text{t-stat} = -0.08
\]

With Unemployment: 1990-2005

\[
\Delta \text{Emp. Share} = -5.0946; \text{t-stat} = -1.63
\]
Marginal vs. Average Products

Malawi 2005

U.S. 2005
Measurement Issues

• Supplementing analysis using national accounts data with household data

• With household data, we should also be able to get at some of issues raised by Gollin et al including
  – quality of the workforce
  – hours worked
Adjusting for Informal Sector

Excluding Informal Labor (1990-2005)

Including Informal Labor (1990-2005)

*Note: Size of circle represents employment share in 1990
**Note: \( \Delta \) denotes coeff. of independent variable in regression equation: \( \ln(p/P) = \Delta + \Delta \text{Emp. Share} \)

Source: Authors’ calculations with data from Kenya National Bureau of Statistics, Central Bureau of Statistics, UN National Accounts Statistics and ILO’s KILM

\( \Delta = 17.0317; t\text{-stat} = 0.82 \)

\( \Delta = 0.0902; t\text{-stat} = 0.02 \)
Explaining the results: macro

- Some countries have more “surplus labor” in agriculture than others
- Role of comparative advantage: primary products versus manufactures
- Labor market rigidity: spatial or sectoral barriers to labor mobility
- Trade/industrial/currency policies
Examining the results: micro

Use country studies to examine the following outcomes as a function of the determinants of structural change:

• Sectoral shifts in employment
• Sectoral shifts in output
• Movements into and out of the informal sector
• Likelihood of unemployment controlling for individual characteristics

Correlation Between Sectoral Productivity and Change in Employment Shares in U.S.

1990-2005

\[ \Delta \text{Emp. Share} = -8.9330; \text{t-stat} = -1.44 \]

1997-2002

\[ \Delta \text{Emp. Share} = -24.0653; \text{t-stat} = -2.11 \]

\[ \beta = -19.7657; \text{ t-stat} = -2.03 \]

*Note: Size of circle represents employment share in 1997
**Note: $\beta$ denotes coeff. of independent variable in regression equation:
\[ \ln(p/P) = \alpha + \beta \Delta \text{Emp. Share} \]

Source: Author's calculations with data from Timmer and de Vries (2007)
U.S. Structural Change 1997-2009


\[ \beta = -13.4149; \text{t-stat} = -2.34 \]

*Note: Size of circle represents employment share in 1998

**Note: \( \beta \) denotes coeff. of independent variable in regression equation:

\[ \ln(p/P) = \alpha + \beta \Delta \text{Emp. Share} \]

Source: Authors' calculations with data from XXXXXXX
Example: Explaining Patterns in the U.S.

- Ebenstein, Harrison, McMillan and Phillips (2011) use data from current population surveys combined with data on trade and offshoring for the period 1982-2002 to show that:
  - Globalization is associated with a reallocation of workers across sectors and occupations
  - Reallocation across sectors is associated with a 2-4% decline in wages and if accompanied by a switch in occupation a 3-11% decline in wages
  - Effects are most pronounced for the period 1997 to 2002
Example: Explaining Patterns in the U.S.

Ebenstein and McMillan (2011) focus on the U.S. manufacturing sector for the period 1990 to 2005 and examine China’s impact on U.S. manufacturing sector:

– Offshoring to China
– Patterns in employment in U.S. and China
– Manufacturing in China and U.S. productivity
– Manufacturing in China and U.S. wage inequality
Offshore Employment by U.S. Firms in Developing Countries
Pattern is driven by China

Graphs by Country or area name
Employment Patterns: U.S. and China
### Table 4

US Labor Productivity and Unit Labor Costs (1990-2005)

<table>
<thead>
<tr>
<th></th>
<th>LHS: Industry Change in Labor Productivity (Output per US Worker)</th>
<th>LHS: Industry Change in Unit Cost of Labor (per US Worker)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Change in Industry’s Share of Chinese Employment</td>
<td>60.17</td>
<td>59.62**</td>
</tr>
<tr>
<td>Task Content Controls</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>29</td>
<td>29</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.39</td>
<td>0.59</td>
</tr>
</tbody>
</table>

* significant at 10% ** significant at 5%. *** significant at 1%.

**Source:** United States Public Use Microsample (1990 5% sample), China National Bureau of Statistics (1990 1% sample, 2005 0.2% sample), United States Bureau of Labor Statistics (1990, 2005)

**Notes:** Sample is restricted to manufacturing industries. Data on productivity are taken from the Bureau of Labor Statistics series on productivity and unit labor costs, transferred to a coding scheme consistent with US and China census classifications. BLS series data are equal to 100 in 2002. The independent variable in all regressions is the industry’s change in share of the Chinese employment between 1990 and 2005. The dependent variable is the log change in productivity (first two columns) or unit labor costs (second two columns) between 1990 and 2005. The task content controls are averages in task content for workers in the industry in the US in 1990, and are taken from Department of Transportation codes for required manual, routine, and abstract skills to perform a given occupation.
Example: United States

Ebenstein and McMillan (2011) combine micro data from the U.S. and China to show that:

– within manufacturing, sectors in which employment is expanding in China are declining in the US

– there is a strong positive correlation between productivity in US manufacturing and increased Chinese workers in that same industry

– there is a strong positive correlation between within sector employment expansion in China and within sector wage inequality in the U.S.
Next Steps

- More than 200 household surveys
- Data collection Africa : 1960-2010
- GGDC
- Country Studies : Botswana, Ethiopia, Ghana, Nigeria, Argentina, Brazil, Mexico, China, Vietnam, India, Poland, Turkey, Egypt, Tunisia
Conclusions

• For developing countries, the presence of large inter-sectoral productivity gaps ensures significant potential for rapid economic growth
• Optimistic message but fulfilling this potential requires an ongoing process of diversification and structural change
• China OEZ, Zambia, Pakistan, Egypt, Benin, Nigeria, Ethiopia, Russia, Vietnam, S. Korea, Cambodia, Thailand, Indonesia, Tanzania (Brautigam and Xiaoyang, 2011)
• Ambitious research agenda