Structural transformation in Africa: Static gains, dynamic losses

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Nairobi 5-6 December 2013
Structural change, narrowly defined here as the reallocation of labor across sectors, featured prominently in earlier analyses of economic growth (e.g. Kuznets, 1966; Chenery et al. 1986)

It is receiving renewed attention:
- More recent studies show structural change is growth-enhancing in Africa since 2000 (McMillan, Rodrik, Verduzco-Gallo, 2013)

This paper:
- Presents the Africa Sector Database. Funded by ESRC/DFID and part of the project “Structural Change and Productivity Growth in Africa”
- Uses the dataset to put recent African growth in historical and international perspective
Africa Sector Database
Decomposition labor productivity growth

Sub-Saharan Africa

- **2000-2010**: 2.6%
- **1990-2000**: 1.1%
- **1975-1990**: -0.1%
- **1960-1975**: 2.9%

- **Within**
- **Between - static**
- **Between - dynamic**

Average annual labor productivity growth
Decomposition GDP per capita growth

Sub Saharan Africa

Average annual GDP per capita growth

- 1960-1975
  - Δ GDP per worker
  - Δ Persons engaged as a share in working age population
  - Δ Working age population as a share in total population

- 1975-1990
  - Δ GDP per worker
  - Δ Persons engaged as a share in working age population
  - Δ Working age population as a share in total population

- 1990-2010
  - Δ GDP per worker
  - Δ Persons engaged as a share in working age population
  - Δ Working age population as a share in total population

Summary:
- 2.6% growth from 1990-2010
- 0.4% growth from 1975-1990
- 2.1% growth from 1960-1975
Content Africa sector database

- 11 Sub-Saharan African countries: Botswana, Ethiopia, Ghana, Kenya, Malawi, Mauritius, Nigeria, Senegal, South Africa, Tanzania, and Zambia

- Value added in real and nominal prices. Employment (split by gender)
- 1960 to 2010
- PPPs for international level comparisons at the sector level for the year 2005 (Inklaar and Timmer, 2013)

10 broad sectors of the total economy (ISIC revision 3.1).

1. Agriculture, hunting, forestry and fishing (AtB);
2. Mining and quarrying (C);
3. Manufacturing (D);
4. Electricity, gas and water supply (E);
5. Construction (F);
6. Wholesale and retail trade, hotels and restaurants (GtH);
7. Transport, storage, and communication (I);
8. Finance, insurance, real estate and business services (JtK);
9. Government services (LtN);
10. Community, social and personal services (OtP).

Grouping:
- Agriculture
- Other industries
- Manufacturing
- Other industries
- Other industries
- Market services
- Market services
- Market services
- Non-market services
- Non-market services
Sources and methods

• Take estimates of value added by sector from the latest revision and back cast this data using sector growth rates from historical statistics.

• International consistency of the cross-country sector data is ensured by the application of the SNA framework for the measurement of Gross Domestic Product (Gollin et al., 2012)

• We use a consistent employment concept of persons engaged across countries.
  ▪ This includes informal sector workers (excluded in Rodrik, 2013)
  ▪ Relies heavily on population censuses

• Full documentation and data online. Public and free at: www.ggdc.net/asd

Aim is to ensure maximum transparency in the construction of the African Sector Database and stimulate further research
ASD is fully documented in ‘Africa Sector Database: Contents, Sources, and Methods’
Overview of employment benchmark years and interpolation method used

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</tbody>
</table>

**Legend**

- **Benchmark level estimates**
- **Trend from Establishment Survey**
- **Trend from average labour productivity growth**
Stylized fact 1:
Manufacturing expanded between 1960 and 1975. After 1990 market services activities expanded

<table>
<thead>
<tr>
<th>Employment shares</th>
<th>1960</th>
<th>1975</th>
<th>1990</th>
<th>2010</th>
</tr>
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<tr>
<td>Agriculture</td>
<td>72.7</td>
<td>66.0</td>
<td>61.6</td>
<td>49.8</td>
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<tr>
<td>Manufacturing</td>
<td>4.7</td>
<td>7.8</td>
<td>8.9</td>
<td>8.3</td>
</tr>
<tr>
<td>Other industries</td>
<td>4.6</td>
<td>5.2</td>
<td>5.3</td>
<td>5.1</td>
</tr>
<tr>
<td>Market services</td>
<td>8.8</td>
<td>10.3</td>
<td>12.9</td>
<td>23.5</td>
</tr>
<tr>
<td>Non-market services</td>
<td>9.2</td>
<td>10.6</td>
<td>11.2</td>
<td>13.3</td>
</tr>
<tr>
<td>All sectors</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Notes: Figures are unweighted averages across eleven African countries. Numbers may not sum due to rounding.
Stylized fact 2:
The marginal productivity of additional workers in the expanding sectors differs for the periods 1960-1975 and 1990-2010

Relative productivity levels

<table>
<thead>
<tr>
<th></th>
<th>1960</th>
<th>1975</th>
<th>1990</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>0.5</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
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<tr>
<td>Manufacturing</td>
<td>2.5</td>
<td>2.8</td>
<td>2.4</td>
<td>1.6</td>
</tr>
<tr>
<td>Market services</td>
<td>4.5</td>
<td>3.4</td>
<td>3.0</td>
<td>1.8</td>
</tr>
<tr>
<td>Non-market services</td>
<td>1.8</td>
<td>1.7</td>
<td>1.8</td>
<td>1.3</td>
</tr>
<tr>
<td>All sectors</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Notes: Figures are unweighted averages across eleven African countries.
Increase in manufacturing employment share in Botswana and Tanzania post-1990

In Ghana, the share of workers in market services expanded from 20.5 percent in 1990 to 30.2 percent in 2010. In Zambia, market services almost doubled from 6.8 percent to 13.2 percent of the labor force.

For all countries in the Africa Sector Database, the market services employment share increased after 1990.
Productivity trend in manufacturing (USA is 100)
Productivity trend in market services (USA is 100)
• Shift-share decomposition method to measure the contribution to growth from the reallocation of workers across sectors

• Method decomposes the aggregate change in labor productivity into within and between effects

\[ \Delta P = \Sigma_i \text{ within effects} + \Sigma_i \text{ between effects} \]

• Four main variants
Decomposition methods

1. McMillan and Rodrik (2011):

\[ \Delta P = \sum_i (P_i^T - P_i^0) S_i^0 + \sum_i (S_i^T - S_i^0) P_i^T \]

2. Opposite base and end years:

\[ \Delta P = \sum_i (P_i^T - P_i^0) S_i^T + \sum_i (S_i^T - S_i^0) P_i^0 \]

3. Period averages:

\[ \Delta P = \sum_i (P_i^T - P_i^0) \bar{S}_i + \sum_i (S_i^T - S_i^0) \bar{P}_i \]

4. If growth and levels are not correlated, a more appropriate decomposition is:

\[ \Delta P = \sum_i (P_i^T - P_i^0) S_i^0 + \sum_i (S_i^T - S_i^0) P_i^0 + \sum_i (P_i^T - P_i^0) \times (S_i^T - S_i^0) \]
# Decomposition results, 1960-2010

## Decomposition equation used:

<table>
<thead>
<tr>
<th>Labour productivity growth</th>
<th>Component due to:</th>
<th>Within</th>
<th>Between</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Static</td>
<td>Dynamic</td>
</tr>
<tr>
<td>(1)</td>
<td>1.4</td>
<td>0.8</td>
<td>0.6</td>
</tr>
<tr>
<td>(2)</td>
<td>1.4</td>
<td>-0.1</td>
<td>1.5</td>
</tr>
<tr>
<td>(3)</td>
<td>1.4</td>
<td>0.3</td>
<td>1.1</td>
</tr>
<tr>
<td>(4)</td>
<td>1.4</td>
<td>0.8</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Notes: Figures are unweighted averages across eleven African countries. Numbers may not sum due to rounding.
Decomposition results by period

Sub-Saharan Africa

1960-1975

1975-1990

1990-2010

average annual labour productivity growth

-2.0% -1.0% 0.0% 1.0% 2.0% 3.0% 4.0%

-0.1%

1.8%

2.9%

Within
Between - static
Between - dynamic
Decomposition results by period:

- **1960-1975**
  - Average annual labour productivity growth: 4.4%

- **1975-1990**
  - Average annual labour productivity growth: 3.3%

- **1990-2010**
  - Average annual labour productivity growth: 3.1%

**Legend:**
- Blue: Within
- Red: Between - static
- Green: Between - dynamic
Decomposition results by period:

- **1960-1975**:
  - Within: 2.4%
  - Between - static: -0.9%
  - Between - dynamic: 0.5%

- **1975-1990**:
  - Within: -0.9%
  - Between - static: 0.9%
  - Between - dynamic: 0.9%

- **1990-2010**:
  - Within: 0.9%
  - Between - static: -0.9%
  - Between - dynamic: 2.4%

*average annual labour productivity growth*
What has been the role of sectors in explaining these aggregate patterns?

Requires adjusting the decomposition method

In current decomposition methods, all expanding sectors contribute positively to changes in aggregate productivity even when they have below-average productivity levels or growth rates.
The decomposition in equation (4) is modified as follows

\[
\Delta P = \sum_i^I (P_i^T - P_i^0)S_i^0 + \sum_j^J (S_j^T - S_j^0)(P_j^0 - P_j^{0*}) + \sum_j^J \left( (P_j^T - P_j^0) - (P_j^{T*} - P_j^{0*}) \right) (S_j^T - S_j^0)
\]

where J is the set of expanding sectors, and K is the set of shrinking sectors, and average labour productivity of shrinking sectors at time T and 0 is given by

\[
P_0^{0*} = \frac{\sum^K (S_k^T - S_k^0)P_k^0}{\sum^K (S_k^T - S_k^0)}
\]

\[
P_T^{T*} = \frac{\sum^K (S_k^T - S_k^0)P_k^T}{\sum^K (S_k^T - S_k^0)}
\]
## Decomposition results, 1990-2010

<table>
<thead>
<tr>
<th>Labor productivity growth</th>
<th>Component due to:</th>
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<tbody>
<tr>
<td></td>
<td>Between</td>
</tr>
<tr>
<td></td>
<td>Within</td>
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<table>
<thead>
<tr>
<th>Industry</th>
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<tbody>
<tr>
<td>Agriculture</td>
<td>0.7%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>0.2%</td>
<td>0.1%</td>
<td>-0.1%</td>
</tr>
<tr>
<td>Other industries</td>
<td>0.6%</td>
<td>0.5%</td>
<td>-0.4%</td>
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<tr>
<td>Market services</td>
<td>0.1%</td>
<td>1.1%</td>
<td>-1.1%</td>
</tr>
<tr>
<td>Non-market services</td>
<td>0.2%</td>
<td>0.1%</td>
<td>-0.2%</td>
</tr>
<tr>
<td>All sectors</td>
<td>1.9%</td>
<td>1.8%</td>
<td>1.8%</td>
</tr>
</tbody>
</table>

Notes: Figures are unweighted averages across eleven African countries. Numbers may not sum due to rounding.
Quality of the database (Jerven, 2013), a case in point is the pending revision of Nigeria’s national accounts.

We do not directly observe marginal productivity of reallocating workers.

A full understanding of the driving forces in recent high GDP growth in Africa requires working with a decomposition of GDP per capita.

Thanks for your attention.
appendices
Decomposition of productivity growth in MR and ASD database, 1990-2005

<table>
<thead>
<tr>
<th></th>
<th>Labour productivity growth</th>
<th>Component due to:</th>
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<tbody>
<tr>
<td></td>
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<tr>
<td>MR (2011)</td>
<td>0.86</td>
<td>2.13</td>
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<tr>
<td>Ours</td>
<td>1.55</td>
<td>1.04</td>
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</table>

Difference in reallocation effect due to data:
- Zambia: female workers under covered in the 1990 numbers used by MR
- Senegal: EMP for 1991 set equal to 1990, VA for 2004 set equal to 2005
## Decomposition results, 1960-1975

<table>
<thead>
<tr>
<th>Industry</th>
<th>Labor productivity growth</th>
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<tr>
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<td>Within</td>
<td>Static</td>
<td>Dynamic</td>
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</tr>
<tr>
<td>Agriculture</td>
<td>0.5%</td>
<td>-0.1%</td>
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<td>-0.1%</td>
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<tr>
<td>Other industries</td>
<td>0.4%</td>
<td>0.7%</td>
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<tr>
<td>Market services</td>
<td>0.2%</td>
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<td>-0.3%</td>
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<tr>
<td>Non-market services</td>
<td>0.3%</td>
<td>0.3%</td>
<td>-0.1%</td>
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<tr>
<td>All sectors</td>
<td>2.9%</td>
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<td>1.9%</td>
<td>-0.7%</td>
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*Notes:* Figures are unweighted averages across eleven African countries.
<table>
<thead>
<tr>
<th>Country</th>
<th>First estimate of GDP (in current prices)</th>
<th>Start of time series</th>
<th>Error margin (1970)*</th>
<th>Statistical capacity level (2010)**</th>
<th>Latest revision of the base year</th>
<th>SNA currently used</th>
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<td>1964</td>
<td>1974</td>
<td>17%</td>
<td>57</td>
<td>2006</td>
<td>SNA93</td>
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<td>Ethiopia</td>
<td>1961</td>
<td>1961</td>
<td></td>
<td>77</td>
<td>2011</td>
<td>SNA93</td>
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<td>1965</td>
<td></td>
<td>66</td>
<td>2006</td>
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<td>1947</td>
<td>15%</td>
<td>62</td>
<td>2001</td>
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<tr>
<td>Malawi</td>
<td>1955</td>
<td>1955</td>
<td>22%</td>
<td>79</td>
<td>2007</td>
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<tr>
<td>Mauritius</td>
<td>1950</td>
<td>1950</td>
<td></td>
<td>77</td>
<td>2006</td>
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<td>Nigeria</td>
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<td>59</td>
<td>1994</td>
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* Error margin is the mid-point estimate presented in Blades (1980). This number (= per cent) gives the 95 per cent confidence interval of the GDP estimate.

** Figures taken from The World Bank’s Bulletin Board on Statistical Capacity.