

Why is Agriculture so Unproductive in the United States?

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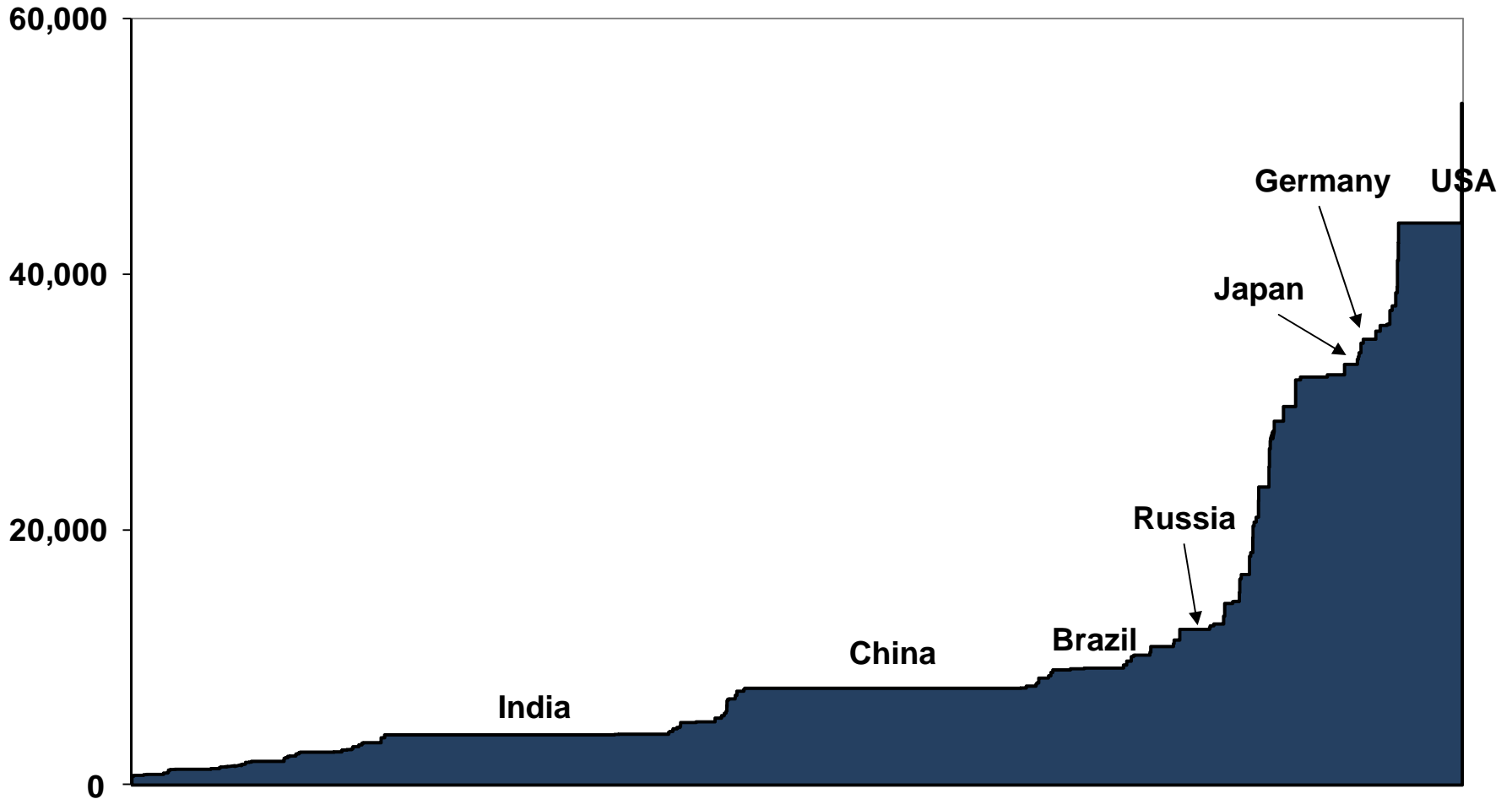
MOTIVATION

My Research Program

- **Broad area is “Growth and Development”**
- **Key Fact in Growth and Development**
 - **HUGE cross-country differences in output per worker**
 - **Gap between USA & poorest countries: ~ factor 50-100**
 - **Illustrating figure on next slide**
- **Key Question in Growth and Development**
 - **What causes such large gaps in output per worker?**

World Output Distribution 2007

Output pw (ppp adjusted \$)



Population

Source: Maddison⁴

What Causes Such Large Gaps in Output pw?

- **Development Accounting**

- Impose aggregate Cobb-Douglas production function

$$Y = A \cdot K^{1/3} \cdot H^{2/3}$$

- Feed in cross-country differences in physical and human capital
- Obtain contributions to output per worker gap
 - ~ 1/2 from total factor productivity (TFP) gap
 - ~ 1/3 from physical capital gap
 - ~ 1/6 from human capital gap

- **Key question becomes**

- What is the reason for gaps in TFP?
- Why are poor countries less efficient in using their production factors than rich countries?

Part of the Answer: Identify the Problem Sectors

- **Sectors which are particularly unproductive**
 - Sectoral gaps larger than aggregate gaps
 - Either for TFP or labor productivity
(former harder, latter easier to measure)
- **Knowing problem sectors provides valuable info**
 - Helps distinguish between different theories
 - Helps develop policy recommendations
- **Result from literature:**

Agriculture is the problem sector in poor countries

 - Caselli (Handbook)
 - Restuccia et al (JME,08)
 - Herrendorf-Valentinyi (JEEA,11)

Problem Sector Agriculture

- **In poor countries**
 - value added pw in ag ~10 times lower than in nonag
 - ~ 2/3 of worker force in agriculture
 - most people work in sector with lowest productivity
- **Why don't people**
 - leave agriculture and move to nonagriculture
 - produce tradable goods and import food from abroad?

Why Don't People Leave Agriculture?

- **Typical answer**

Poor countries must have large

- **barriers (e.g., transportation costs)**
- **distortions (e.g., only nonag sector pays taxes)**
- **institutional problems (e.g, property rights)**

- **Underlying logic**

- **Without barriers, distortions, and institutional problems, labor productivity should be equalized between ag and nonag**
- **However, little hard evidence in favor of this logic**
- **Usual problem is data from poor countries is poor too**

What We Do in This Paper

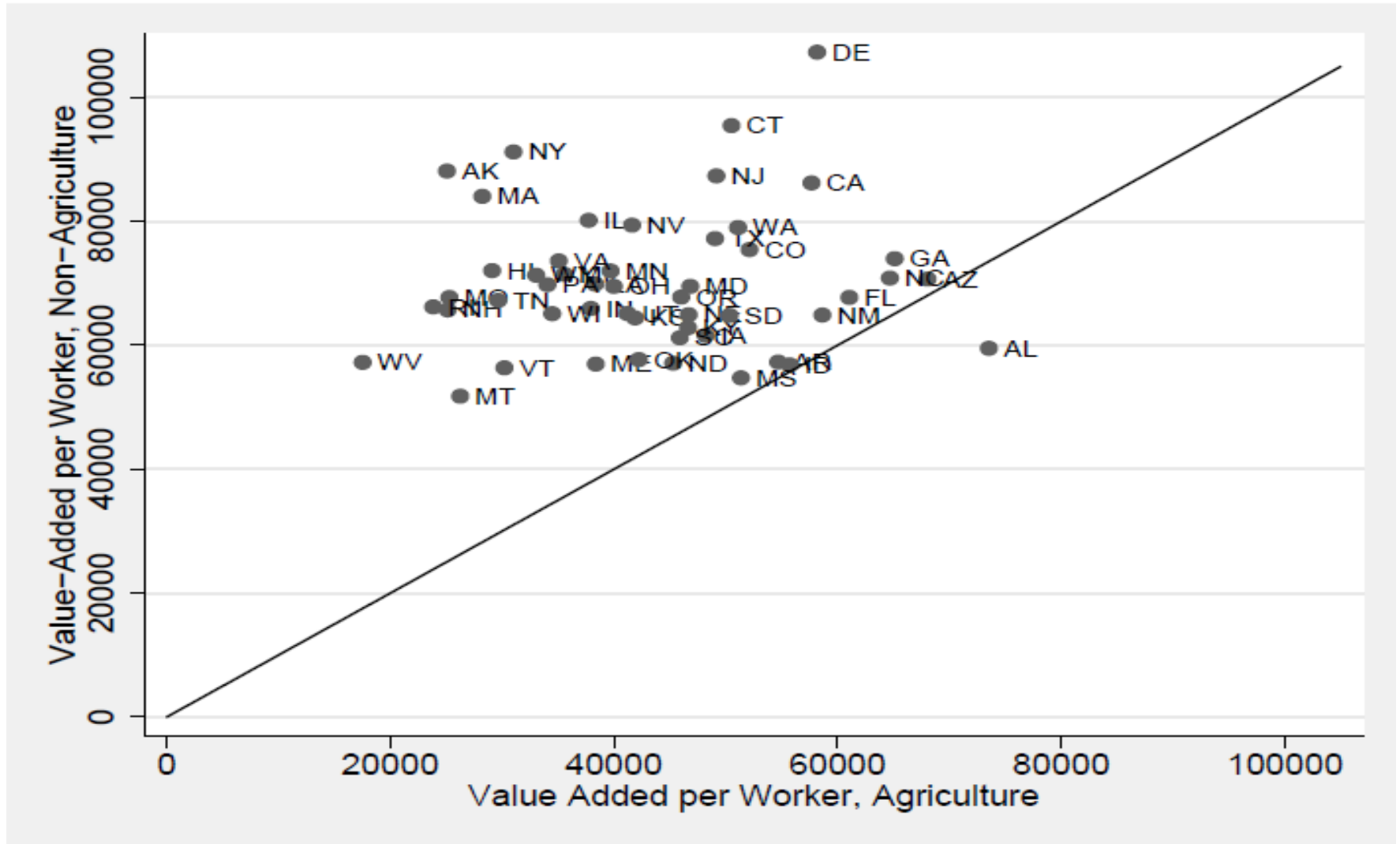
- **We study**
 - US agriculture at the state level
 - Compared to poor countries
 - very good data
 - small barriers, distortions, institutional problems
(we often calibrate undistorted benchmarks to USA)
- **We find**
 - in most US states ag less productive than nonag
 - productivity gaps are large
 - differences in human capital and measurement problems cause part of the gaps
- **We conclude**
 - large productivity gaps do NOT necessarily point to, large barriers, distortions, or institutional problems

**EVIDENCE ON
LABOR PRODUCTIVITY GAPS
FOR US STATES**

Data Concepts

- **Use most standard definitions and sources**
- **Agriculture**
 - **FAO definition: ag is farm sector**
 - **Farm sector**
 - **Includes animal and crop production**
 - **Excludes forestry, fishing, horticulture etc**
- **Sector value added (VA)**
 - **Ag: farm output – intermediates (in current \$)**
 - **Nonag: State GDP – VA in ag**
 - **From BEA's regional accounts**
- **Sector employment**
 - **Sectoral workers**
 - **From Population Census**

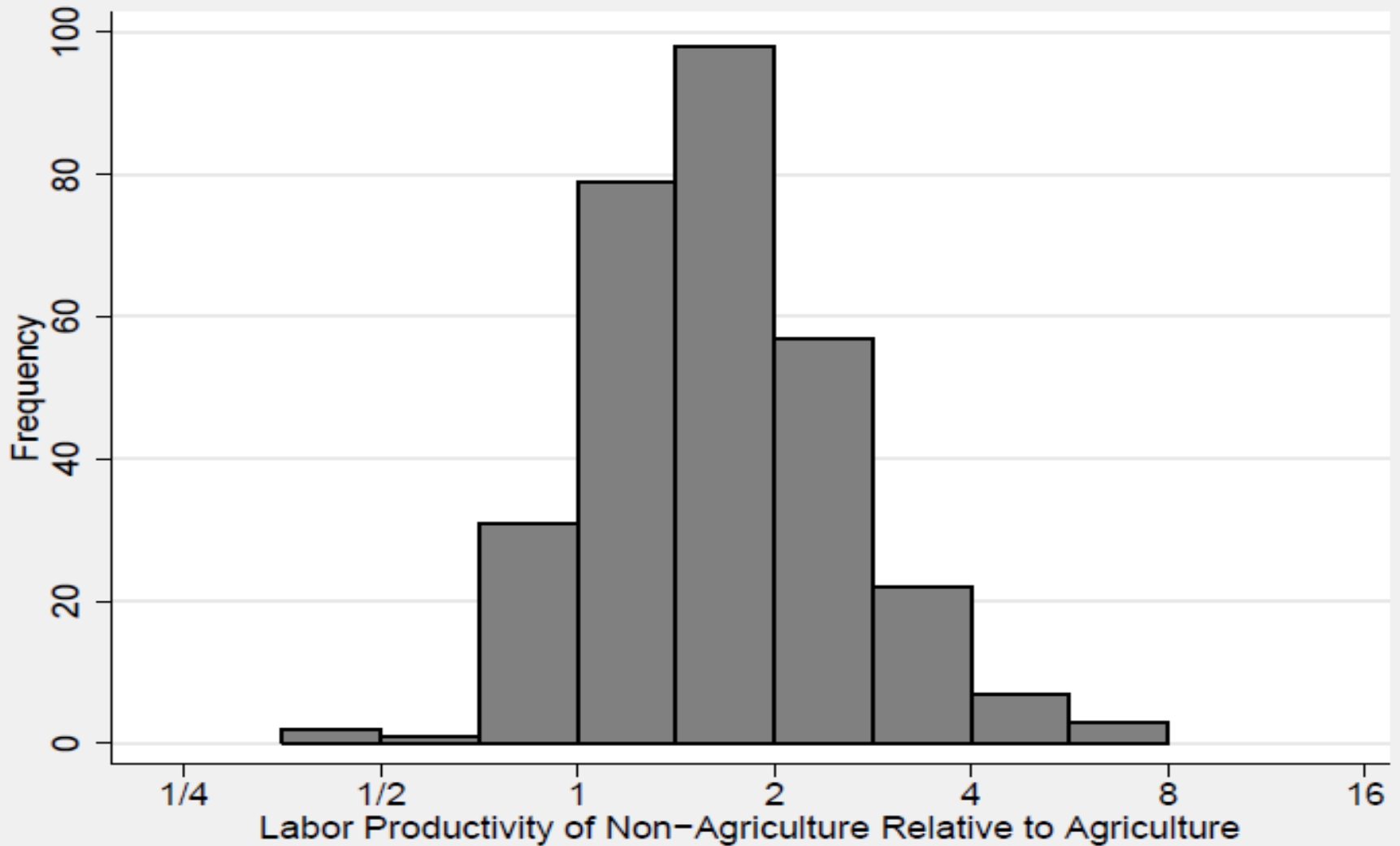
Labor Productivity Gaps in US States – A First Look at the Data in 2000



Possible Concerns with Previous Figure

- **BEA value added**
 - Does not include all income generated on farms (BEA concept: income earned by farmers)
 - Does not include subsidies
 - We use data from USDA to address these issues
- **Census employment**
 - Census taken in March
 - Census only counts first jobs
 - Census does not provide hours
 - We use data from CPS/ATUS to address these issues
- **Was 2000 special?**
 - 2000 could have been a bad year for agriculture
 - We calculate yearly gaps 1978-2007 to address this

Labor Productivity Gaps Nonag-Ag (50 US States, 1978-2007)



Summary Statistics – Labor Productivity Gaps (50 US States, 1978-2007)

Median	1.6
90th Percentile	2.9
Maximum	6.4

Possible Explanations for Gaps – Some Basic Theory

- Many states, each with two production locations

$$Y_{ai} = A_{ai}(K_{ai})^{\theta_{ai}}(L_{ai})^{1-\theta_{ai}},$$

$$Y_{ni} = A_{ni}(K_{ni})^{\theta_{ni}}(L_{ni})^{1-\theta_{ni}}.$$

- Workers mobile across locations

$$\frac{W_{ai}}{P_{ai}} = \frac{W_{ni}}{P_{ni}}.$$

- Perfect competition and profit maximization

$$W_{ji} = (1 + \tau_{ji})(1 - \theta_{ji})\frac{Q_{ji}Y_{ji}}{L_{ji}}.$$

Some Basic Theory – continued

- **Labor in efficiency units**

$$L_{ji} = \sum_{l \in \mathcal{L}_{ji}} h_l z_l = \frac{\sum_{l \in \mathcal{L}_{ji}} h_l z_l}{N_{ji}} N_{ji}$$

- **Key insight**

Proposition 1 If labor is freely mobile across the two locations of each state and there is perfect competition in each sector, then

$$\frac{(1 + \tau_{ai})(1 - \theta_{ai}) Q_{ai} Y_{ai}}{P_{ai}(L_{ai}/N_{ai})} \frac{Q_{ai} Y_{ai}}{N_{ai}} = \frac{(1 + \tau_{ni})(1 - \theta_{ni}) Q_{ni} Y_{ni}}{P_{ni}(L_{ni}/L_{ni})} \frac{Q_{ni} Y_{ni}}{N_{ni}}. \quad (6)$$

Possible Explanations for the Gaps – Four Candidates

$$\frac{(1 + \tau_{ai})(1 - \theta_{ai}) Q_{ai} Y_{ai}}{P_{ai}(L_{ai}/N_{ai})} \frac{Q_{ai} Y_{ai}}{N_{ai}} = \frac{(1 + \tau_{ni})(1 - \theta_{ni}) Q_{ni} Y_{ni}}{P_{ni}(L_{ni}/L_{ni})} \frac{Q_{ni} Y_{ni}}{N_{ni}}$$

1. **Subsidies**
2. **Capital shares**
3. **Cost of living**
4. **Efficiency units (“human capital”)**

Possible Explanations – continued

1. Subsidies

- Agriculture more subsidized?
- Included in our value added calculation
- Does not help because states with unproductive agriculture pay more taxes than they get subsidies

2. Capital shares

- Agriculture less capital intensive?
- Typically agriculture more capital intensive (land!)
- Does not help

3. Cost of living

- Cheaper to live on farms than in cities?
- Yes but hard to gauge magnitude because CPI covers metropolitan areas only
- Additional data work: calculate urban-rural cost of living
- Right direction but small quantitatively

Possible Explanations – continued

- 1. Subsidies**
- 2. Capital shares**
- 3. Cost of living**
- 4. Efficiency units (“human capital”)**
 - **Farmers less educated? Yes!**
 - **In addition, Mincer return on education much lower in agriculture than in nonagriculture**
 - **These two facts imply that standard measures of human capital much lower in agriculture than in nonagriculture**
 - **This goes in the right direction and matters quantitatively**

Summary Statistics – Labor Productivity Gaps After 1.-4. (50 US States, 1978-2007)

	Raw	1-4
Median	1.6	1.1
90th Percentile	2.9	1.6
Maximum	6.4	2.9

Conclusions

- **We found labor productivity gaps nonag-ag**
 - US states 1978-2007
 - Sizeable even with best possible measurement
 - Same order of magnitude as for poor countries
- **What accounts for these gaps?**
 - Distortions, barriers, institutions most likely don't
 - Human capital accounts for part of gaps
 - Remaining part unaccounted for
 - Measurement error? In particular, missing VA in agriculture ...