# Structural Change, Misallocation, and Aggregate Productivity

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# Overview

(1) Large differences in income per capita across countries mostly accounted for by total factor productivity (TFP)

- What accounts for these productivity differences?

(2) Simple framework to discuss potential channels:

- technology
- selection
- misallocation

(3) What are the specific policies/institutions that generate misallocation?

(4) Broader consequences of misallocation via effects on selection and technology

# (1) TFP and Income Differences

- Cross-country income differences mostly accounted for by TFP (e.g. Klenow and Rodriguez-Clare 1997; Jones 2015)
  - Similar conclusion when accounting for human capital quality differences (e.g. Erosa et al 2010; Manuelli and Seshadri 2014)
- Sectoral labor productivity differences (levels and growth) account for cross-country and time-series patterns of structural change and aggregate outcomes (e.g. Gollin et al 2002; Restuccia et al 2008; Duarte and Restuccia 2010)
  - Productivity gaps largest in agriculture and services, smaller in industry

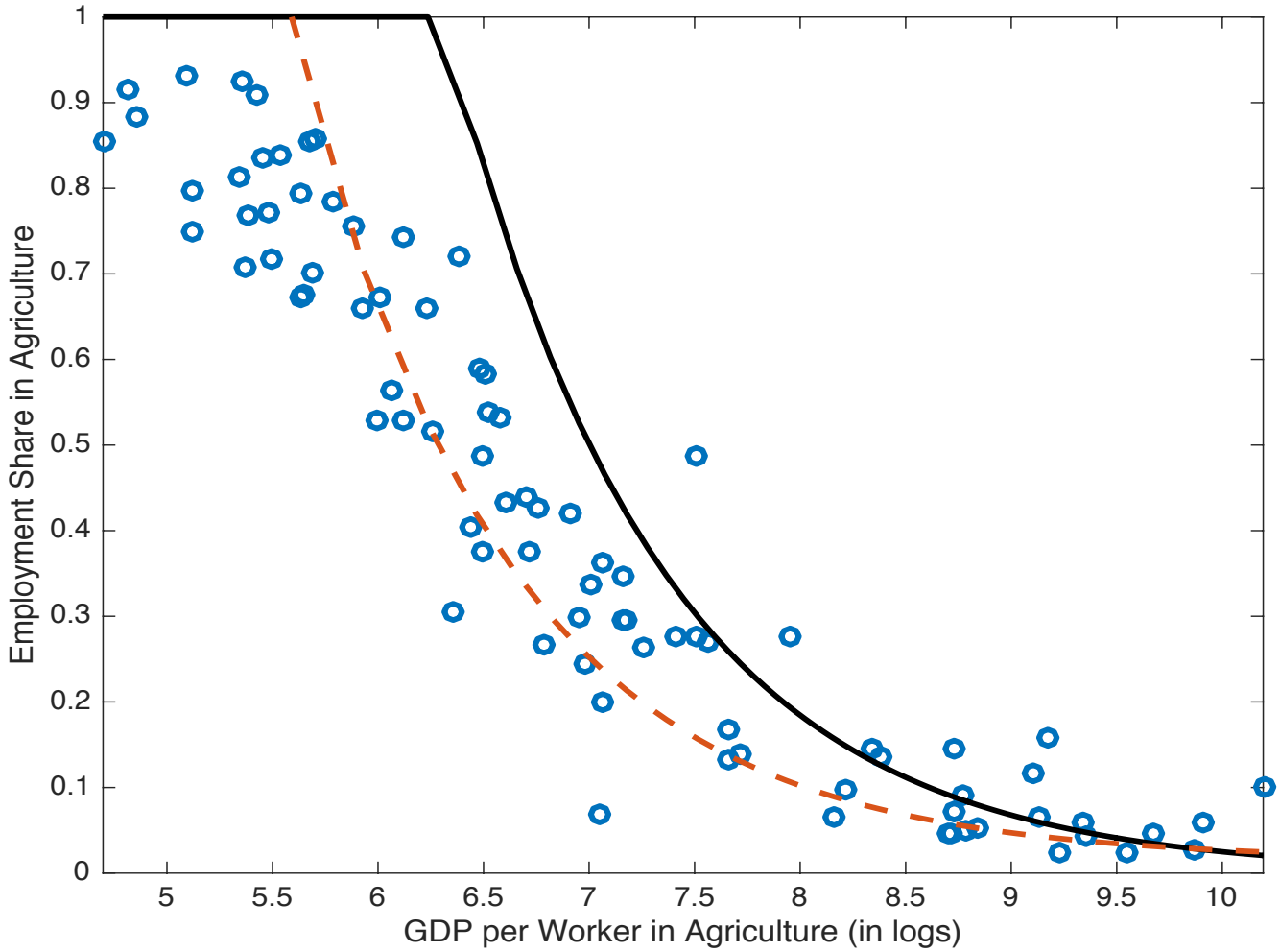
# (1) TFP and Income Differences

- Agriculture key in rich/poor aggregate productivity differences

| | Rich | Poor |
|---|---|---|
| Labor Productivity in Agriculture | 45 | 1 |
| Labor Productivity in Non-Ag | 4 | 1 |
| Aggregate Labor Productivity | 22 | 1 |
| Employment Share in Agriculture | 5% | 85% |

- Standard sectoral framework: $Y_a = AL_a = \bar{a}$ or $L_a = \frac{\bar{a}}{A}$ implies:
  - (a) over time, growth in productivity ($g_A$) allows reallocation of labor away from agriculture
  - (b) across countries, low A countries (poor) allocate more of their labor in agriculture

# Agriculture across Countries



# (2) Simple Framework of TFP Differences

- What accounts for productivity differences across sectors and countries?
- Restuccia and Rogerson (2016): Single good produced by $N$ potential heterogeneous production units indexed by $i$ according to

$$y_i = A_i \cdot f(k_i, h_i)$$

  where $A_i$ reflects differences in productivity across producers
- Fixed cost of operation $c$ in units of output
- Efficient allocation: Given aggregate capital $K$ and labor $H$, there is unique threshold $\bar{A}$ such that producers with $A_i > \bar{A}$ operate; and producers with higher $A_i$ are allocated greater amounts of capital and labor

# (2) Simple Framework of TFP Differences

- Consider economies with the same amount of aggregate resources: capital $K$, labor $H$, and number of potential production units $N$
- Three channels account for aggregate TFP differences across countries:
  - Distribution of $A_i$'s differ across countries (technology)
  - Countries choose different set of producers to operate (selection)
  - Countries allocate inputs of capital and/or labor differently across producers (misallocation)
- Key: specific policies/institutions generating misallocation can have larger effects on TFP by affecting technology/selection channels

# (3) Causes of Misallocation

- Indirect approach (e.g. Restuccia and Rogerson 2008; Hsieh and Klenow 2009): assess extent of misallocation without identifying underlying source, pointing to large TFP loses from misallocation
- Approach helps identify relevant patterns (within industry, across industry, across time and space, across occupations, etc.) but is silent about the specific sources of misallocation
- Identifying causes of misallocation key for policy analysis
- Direct approach: quantifies role of specific policies/institutions creating misallocation, e.g.
  - Regulation and discretionary provisions
  - Selective industrial policy
  - Financial frictions
  - Trade restrictions

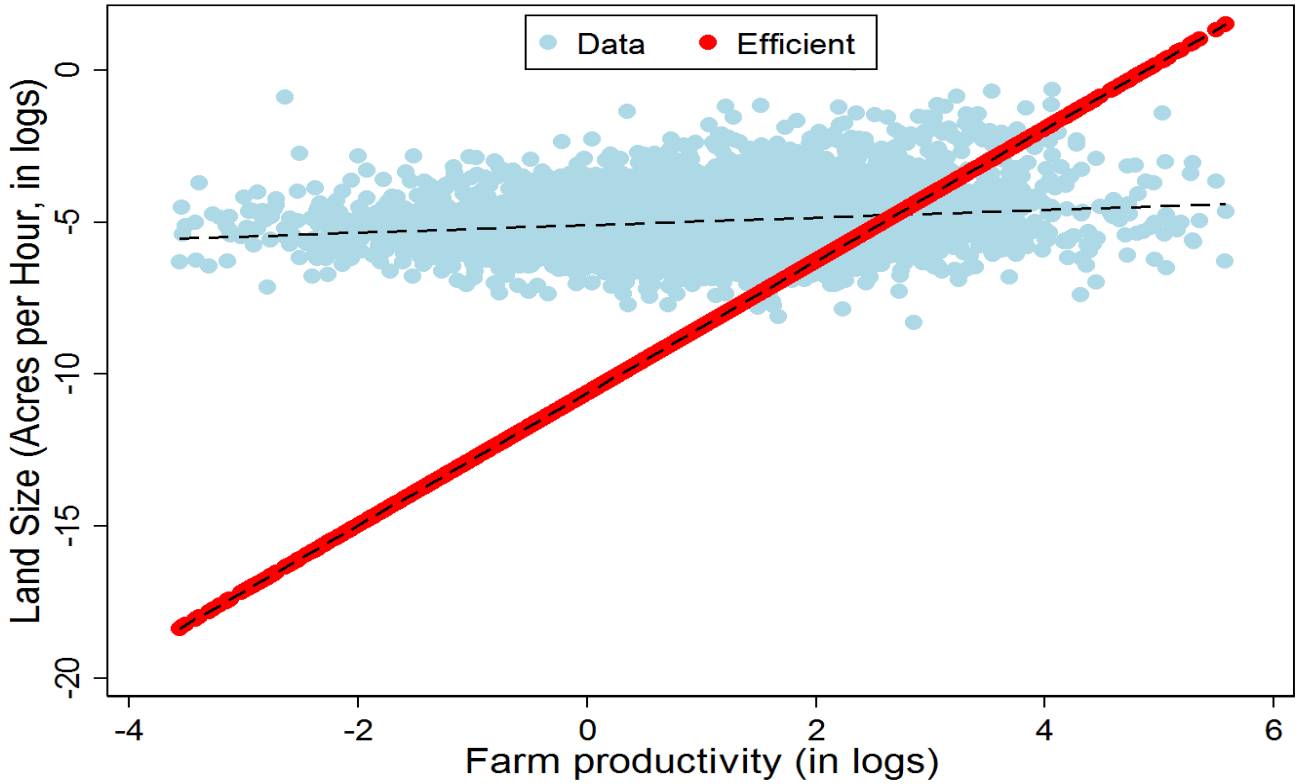
# (3) Causes of Misallocation

- Challenge of direct approach
  - There is not a single source generating the bulk of misallocation and productivity differences across countries
  - Role of misallocation from specific policies quantitatively limited
  - Many different policies/institutions needed to account for the data
- Some notable exceptions:
  - Land market institutions in agriculture (Adamopoulos and Restuccia 2014)
  - Changes in policy over time in specific contexts

# Land Market Institutions

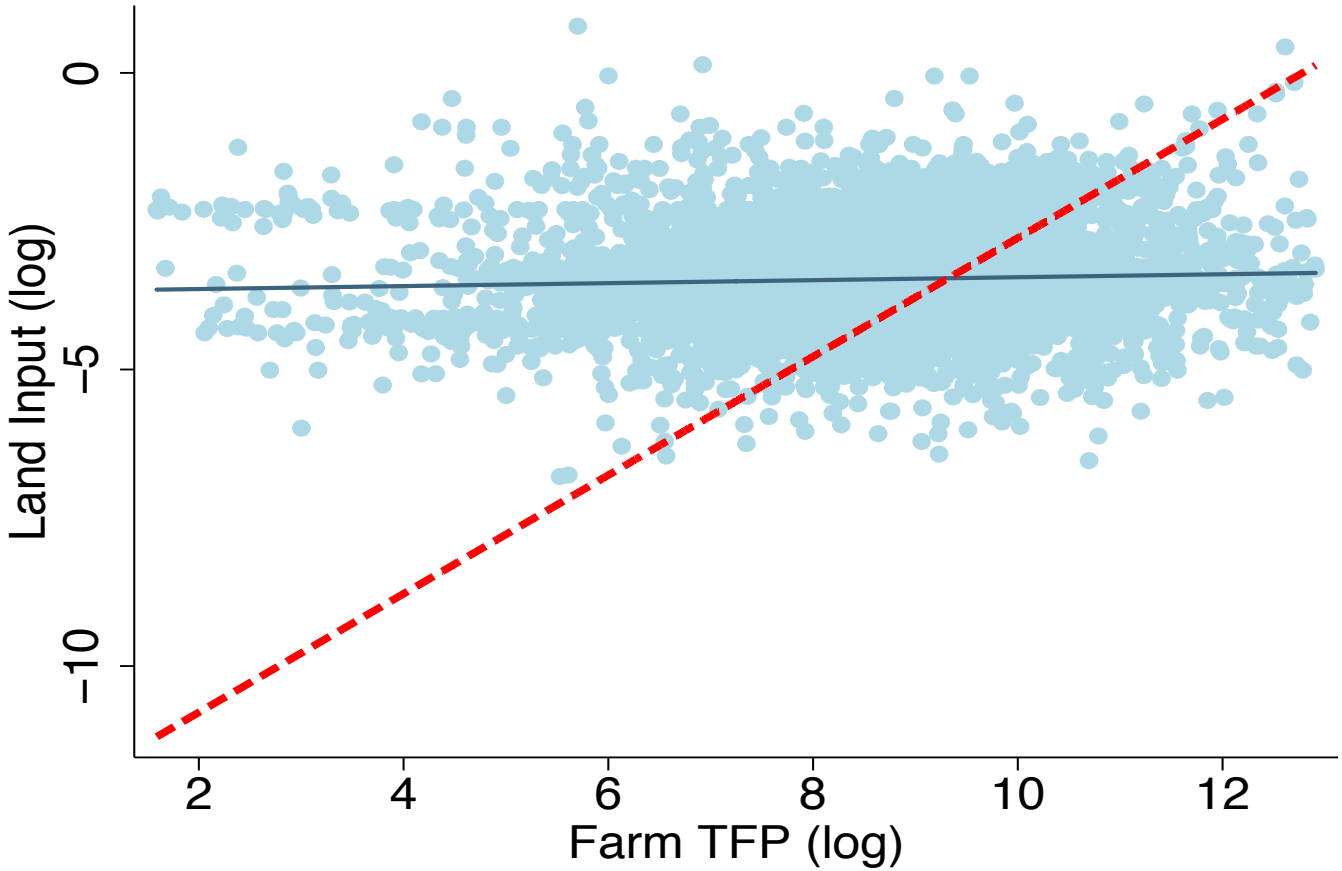
- Land institutions in poor countries characterized by:
  - Lack of well-defined property rights over land
  - Land use-rights are distributed in a fairly egalitarian basis...
  - ...coupled with difficulty of adjusting operational scales
- As a result, land is not allocated to best use, leading to small operational scales, preventing the adoption of best practices and investment in farm operations
- Evidence points to substantial land (and factor) misallocation in agriculture in poor and developing countries

# Land Misallocation in Malawi



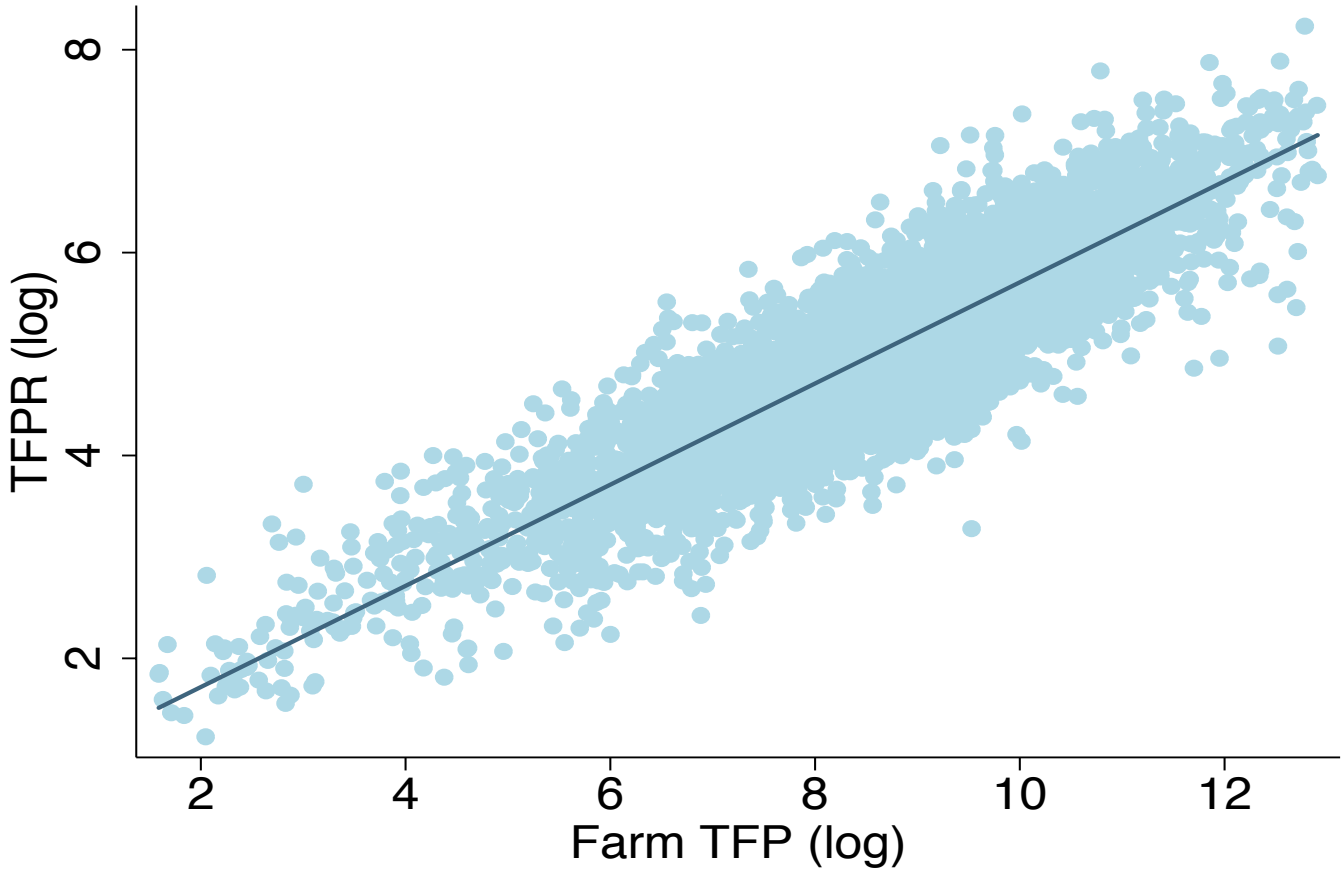

- Restuccia and Santaeulalia-Llopis (2015): Efficient factor reallocation increases aggregate agricultural productivity by 3.4-fold

# Land Misallocation in China




- Adamopoulos et al (2016): Factor misallocation in agriculture has not decreased in China (1993-2002)

# Implicit Agricultural Distortions in China




- Large implied distortions in agricultural sector $\sigma(\log(\text{TFPR}))=0.97$, $\rho(\log(\text{TFPR}),\log(\text{TFP}))=0.88$

# Aggregate Implications

- Aggregate impact of distortions:
  - Take US manufacturing distribution of $A_i$'s from Hsieh-Klenow
  - Apply US and China/India distortions in manufacturing from Hsieh-Klenow
  - Result: relative TFP gain 1.3-fold
  - Instead apply China distortions in agriculture
  - Result: relative TFP gain 4-fold
  - Take away: much larger distortions (misallocation) in agriculture
- Remark: heavier distortions to more productive units prevalent in poor countries, key for broader implications of misallocation

# Changes in Policy in Specific Contexts

(1) Land reform in Philippines (Adamopoulos and Restuccia 2015)

- Cap in farm size + gov. intervention in the land market (direct excess land to landless/smallholders, restrict reallocation)
- Reform reduces farm size (34%) and aggregate productivity (17%), gov intervention key as market reallocation of excess land generates only 1/3 of the negative effects

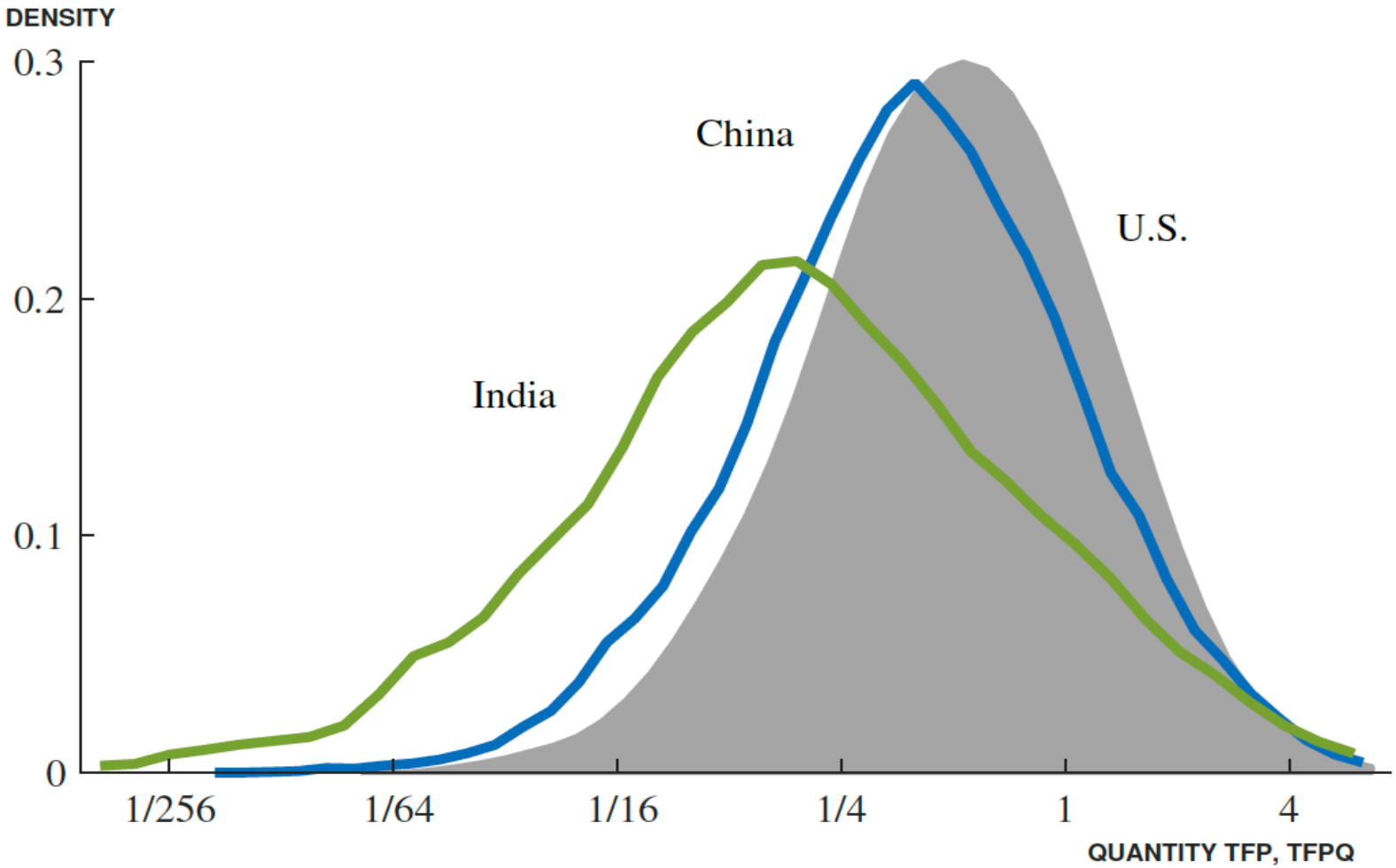
(2) Trade reform in Chile (Pavnick 2002)

- Liberalized trade reform on productivity using plant-level data, exploiting differential exposure to external competitive pressure
- Plants in import competing sectors grew 3-10% more than plants in the non-traded sector
- Reallocation of resources from less to more efficient plants and through plant exit contributed substantially to aggregate productivity growth during the period

# (4) Broader Consequences of Misallocation

- Early misallocation analysis: given a fixed productivity distribution common across countries, assess quantitative impact of factor misallocation (e.g. Restuccia and Rogerson, 2008)
- Recent work considers dynamic implications of misallocation
- Policies/institutions causing misallocation can generate larger effects on aggregate productivity by altering the productivity distribution via technology and selection channels
- This is important because:
  - Distribution of $A_i$'s differs across countries
  - A rough TFP decomposition in manufacturing reveals: misallocation (1/4) + selection (1/4) + technology (1/2)
  - Substantial shifts in the productivity distribution via technology required

Figure 35: The Distribution of TFPQ in 4-digit Manufacturing Industries




Note: This is the average distribution of TFPQ within 4-digit manufacturing industries for the U.S. in 1997, China in 2005, and India in 1994, computed as described in the text. The means across countries are not meaningful. Source: Hsieh and Klenow (2009); data provided by Chang Hsieh.

# (4) Broader Consequences of Misallocation

Some illustrative examples (misallocation + selection):

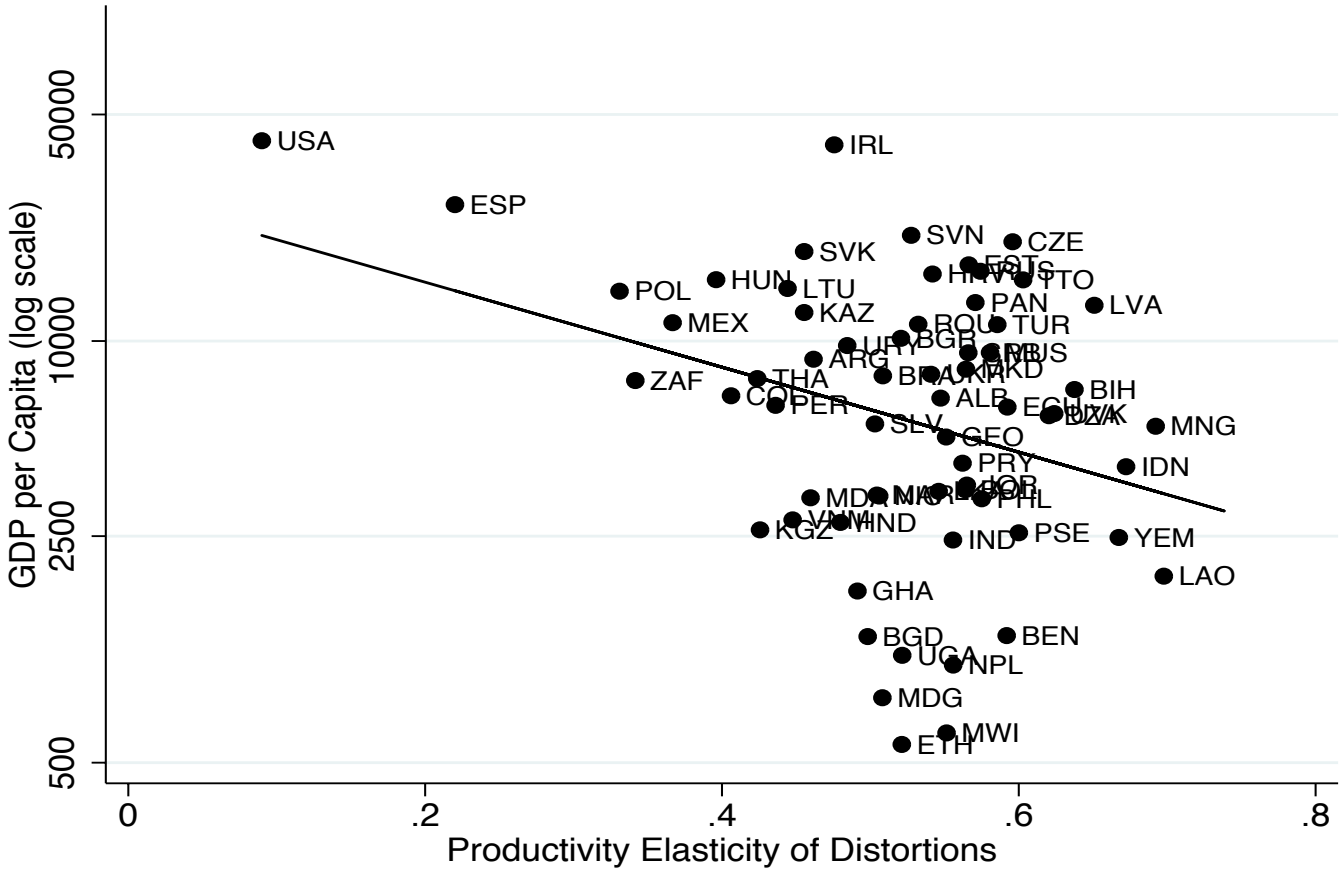
- Financial frictions (Buera et al 2011; Midrigan and Xu 2014)
  - Distorts entrepreneur-worker choices in addition to misallocation
  - Generates large negative effects on productivity
  - Can account for 40% of non-agricultural productivity differences across countries
- Imperfect land markets (Adamopoulos et al 2016)
  - Implicit distortions affect sector choice of highly productive farmers in addition to misallocation
  - In China a 1.8-fold TFP gain in agriculture from eliminating misallocation translates into a 15-fold gain when accounting for selection

# (4) Broader Consequences of Misallocation

Some illustrative examples (misallocation + technology):

- Idiosyncratic distortions and technology adoption (Ayerst 2016)
- Productivity investment and firm dynamics

# Productivity Elasticity of Distortions




- Source: Bento and Restuccia (2016)

# Productivity Investment and Firm Dynamics

- Bento and Restuccia (2016) Standard monopolistic competition framework extended to include: endogenous entry and entry-level and life-cycle productivity investment

| Prod. elasticity of distortions ($\gamma$): | 0.09 (US) | 0.50 (India) |
|---|---|---|
| Average Establishment Size | 22 | 3 |
| Entrant Productivity | 1.00 | 0.42 |
| Life-cycle growth (%) | 5.0 | 2.1 |
| Prod. investment share (%) | 13.5 | 5.4 |
| Decomposition of agg. output: | | |
| (a) Static misallocation | 1.00 | 0.63 |
| (c) Endogenous life-cycle growth | 1.00 | 0.70 |
| (d) Entrant investment | 1.00 | 0.47 |

# Conclusion

- Productivity at the core of cross-country differences in economic structures, structural change, and aggregate outcomes
- Misallocation quantitatively important in accounting for productivity differences but...
- ...there is not a single source of misallocation that can account for the bulk of differences
- Current work shows important link between misallocation and technology/selection channels in accounting for productivity differences