

# PUBLIC POLICY, INNOVATION, AND ECONOMIC GROWTH

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University of Chicago

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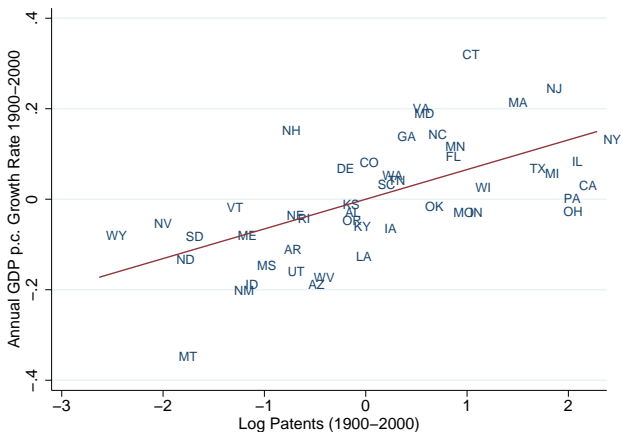
# Big Picture Question

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- ▶ Why do we care about **innovation**?

# Innovation and Growth

FIG 1. INNOVATION AND LONG-RUN ECONOMIC GROWTH  
(U.S. STATES, 1900-2000)

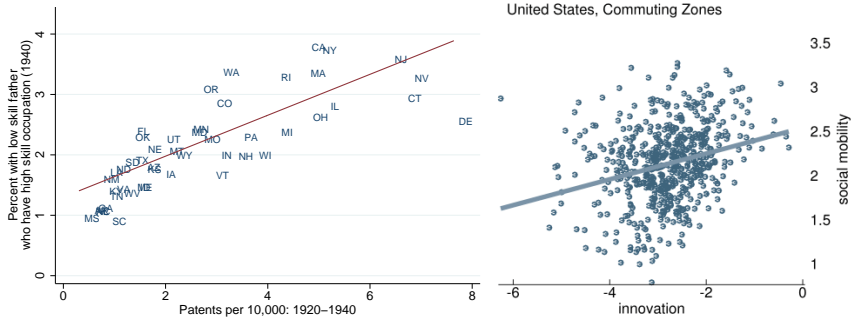


Source: Akcigit, Grigsby, and Nicholas (2016)

## 2. Innovation and Social Mobility

FIG 2. INNOVATION AND SOCIAL MOBILITY

United States, Commuting Zones



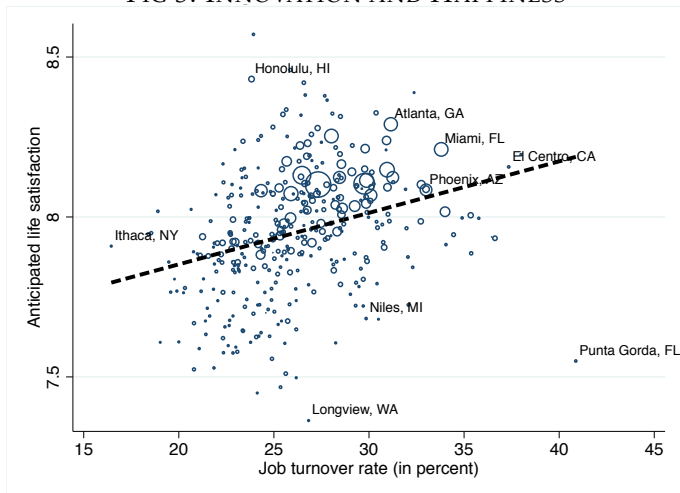
Sources:

Akcigit, Grigsby, and Nicholas (2016, Left figure)

Aghion, Akcigit, Bergeaud, Blundell, and Hémous (2018, Right figure)

# Innovation and Happiness

FIG 3. INNOVATION AND HAPPINESS



Source: Aghion, Akcigit, Deaton, and Roulet (2016)

# What Should We Do?

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- ▶ How can we foster innovation and technological progress?
- ▶ What are the optimal innovation policies?

# Public Policy Should Center Around:

## 1) Firms

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- ▶ respond to incentives, braindrain
- ▶ who gains from innovation?



# PART 1. FIRMS



## Firm's Innovation Choice & Public Policy

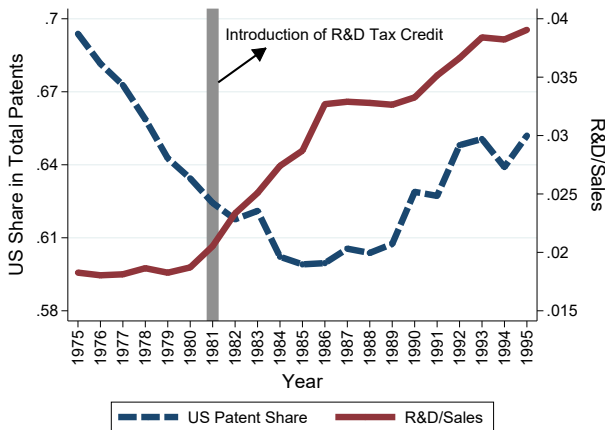
$$\max_{R\&D} \left\{ \begin{array}{l} \text{Innovation (R\&D)} \times \text{Profit} \\ - \\ \text{Cost(R\&D)} \end{array} \right\}$$

## Firm's Innovation Choice & Public Policy

$$\max_{R\&D} \left\{ \begin{array}{l} (1 - tax) \times Innovation(R\&D) \times Profit \\ - \\ (1 - subsidy) \times Cost(R\&D) \end{array} \right\}$$

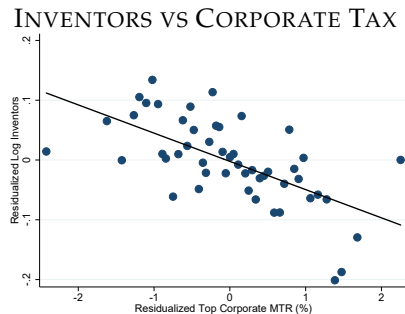
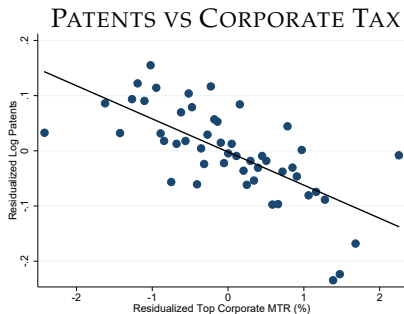
# U.S. R&D Tax Credit Program

## INTRODUCTION OF R&D TAX CREDIT, FIRM R&D SPENDING AND INNOVATION IN THE UNITED STATES



Source: Akcigit, Ates, and Impullitti (2018)

# Taxation and Innovation

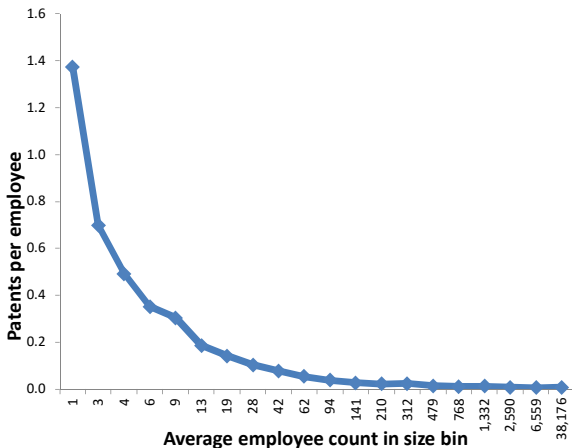


Source: Akcigit, Grigsby, Nicholas, and Stantcheva (2018)

- ▶ Should we subsidize firms?
- ▶ If yes, which firms?

# Innovation Intensity by Firm Size

FIG 4. INNOVATION INTENSITY BY FIRM SIZE



Source: Akcigit and Kerr (2017)

# Empirics (Akcigit and Kerr, 2017)

1. Firm size vs firm growth:

$$EmpGr_{f,t} = \eta_{i,t} - \underset{\text{(s.e. 0.0013)}}{0.0351} \cdot \ln(Emp_{f,t}) + \epsilon_{f,t}.$$



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$$Patent/Empl_{f,t} = \eta_{i,t} - \underset{\text{(s.e. 0.0058)}}{0.1816} \cdot \ln(Emp_{f,t}) + \epsilon_{f,t}.$$

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3. Firm size vs innovation quality:

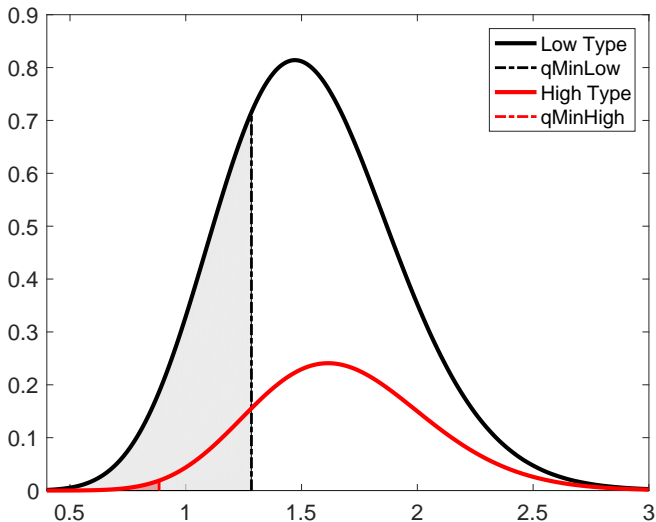
$$TopPatentShare_{f,t} = \eta_{i,t} - \underset{\text{(s.e. 0.0008)}}{0.0034} \cdot \ln(Emp_{f,t}) + \epsilon_{f,t}.$$

# Factor Reallocation and Composition

- ▶ Acemoglu, Akcigit, Bloom, and Kerr (2013):
  - ▶ Not every firm has the same ability/capacity.
  - ▶ Reallocation of factors from low types to high types is crucial.
  - ▶ Public policy should internalize its impact on the composition.
  - ▶ Bailing out or taxing troubled incumbents? Which firms could be troubled?

# Intuition of the Composition Effect

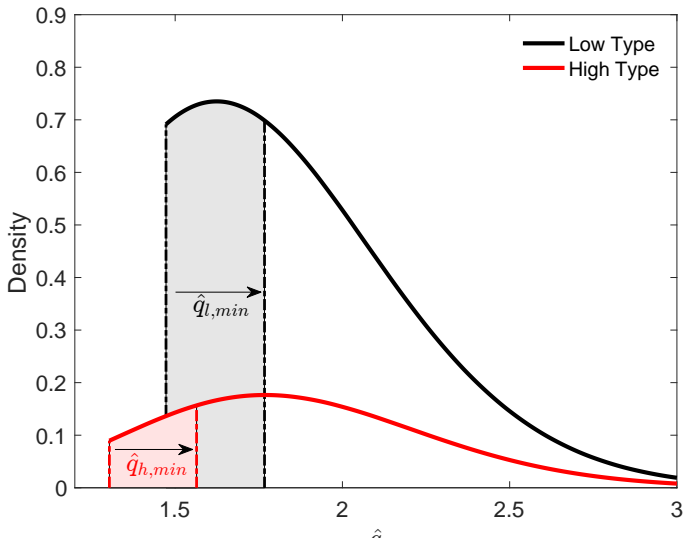
FIGURE: PRODUCTIVITY DISTRIBUTION



Source: Acemoglu, Akcigit, Bloom, and Kerr (2013)

# Intuition of the Composition Effect

FIGURE: EFFECT OF TAXING INCUMBENTS



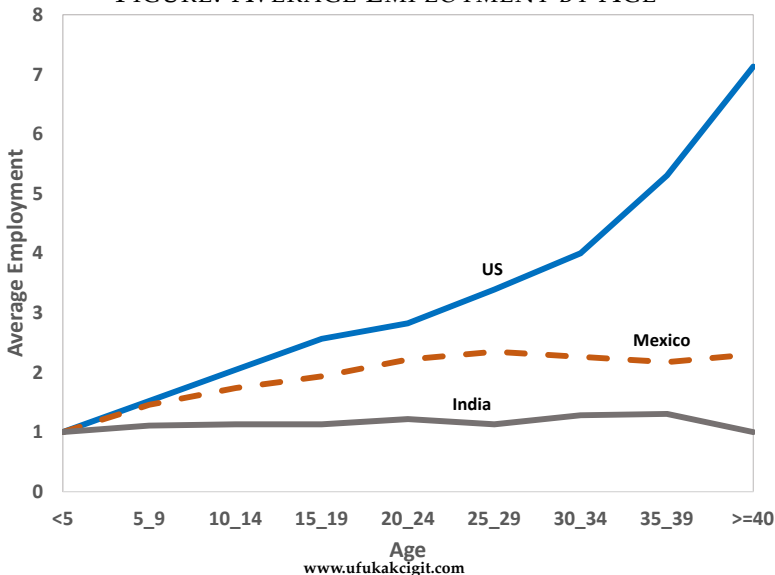
Source: Acemoglu, Akcigit, Bloom, and Kerr (2013)

# Firm Dynamics in Developing Countries

- ▶ How do firm dynamics differ across countries?

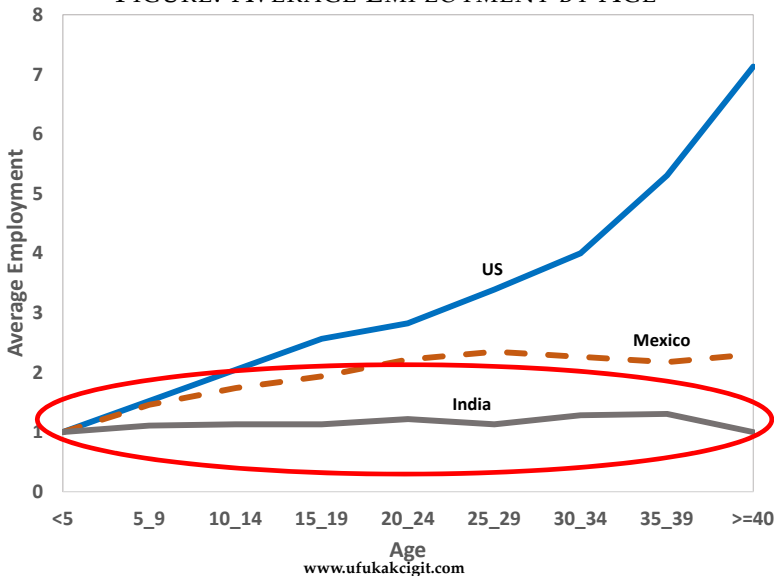
# Literature 1: Hsieh and Klenow on Firm Dynamics

FIGURE: AVERAGE EMPLOYMENT BY AGE



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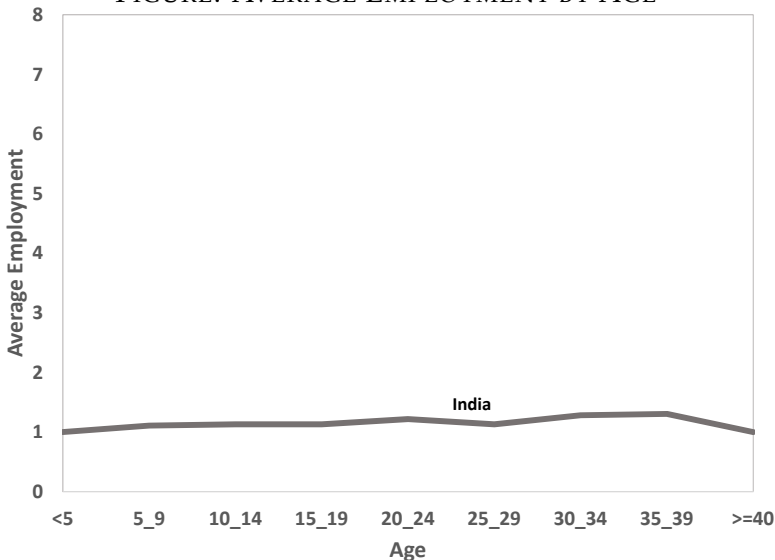
FIGURE: AVERAGE EMPLOYMENT BY AGE





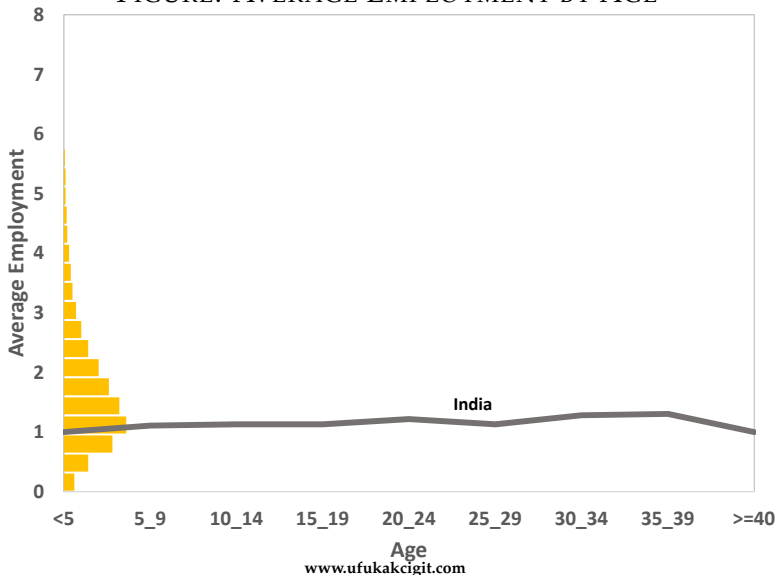
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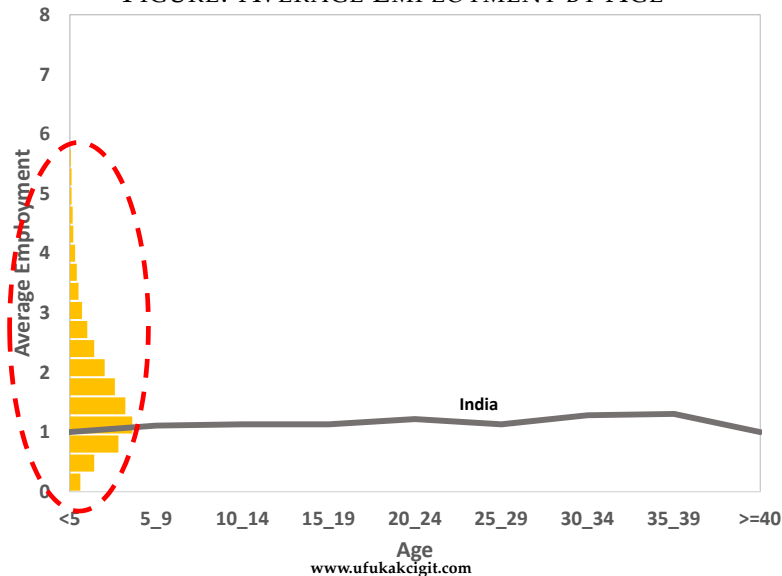
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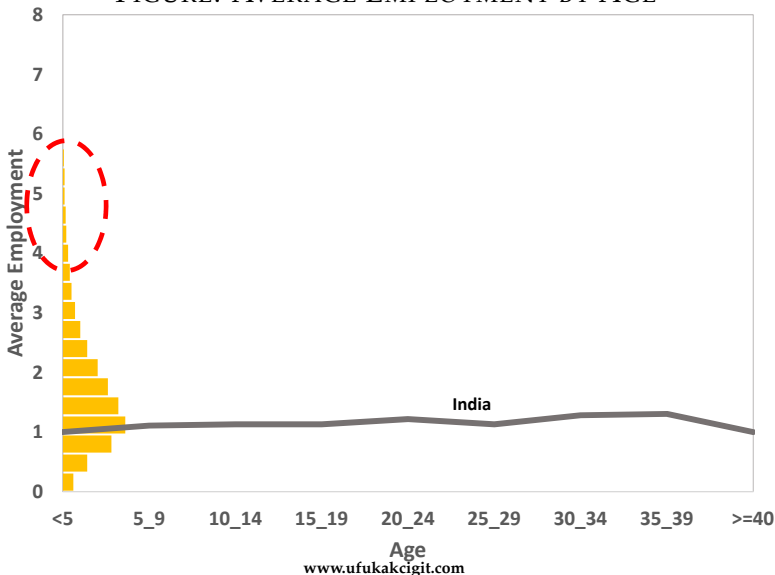
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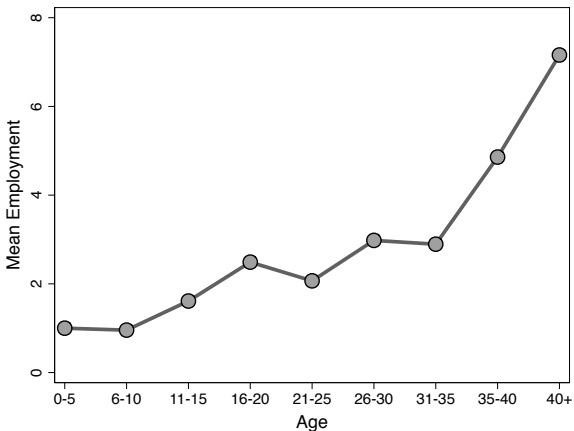
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# What About Developing Countries?

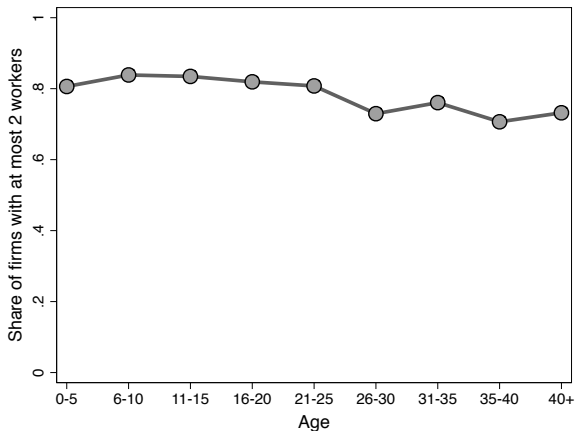
FIG 6. AVERAGE FIRM SIZE WITHIN TOP-5% BY AGE



Source: Akcigit, Alp, and Peters (2015)

# What About Developing Countries?

FIG 7. SHARE OF SMALL FIRMS BY AGE



Source: Akcigit, Alp, and Peters (2015)

# What About Developing Countries?

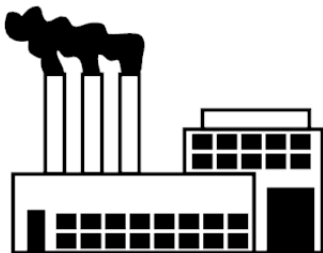
- ▶ Why do firms in developing countries not grow?

## What About Developing Countries?

- ▶ Why do firms in developing countries not grow?
- ▶ Interesting Fact: One of the best predictor of firm size in India is....



*vs.*





# Firm Dynamics in Developing Countries



**FAMILY SIZE!**

# Firm Dynamics in Developing Countries



MAJOR PROBLEM THAT INDIAN BUSINESS OWNERS FACE:  
**LACK OF TRUST & LACK OF DELEGATION**

# Indian Micro Data of Establishments

$$[\text{Manager}=0/1] = 3.941 \times \text{Firm\_Size} - 0.297 \times \text{Family\_Size} + 0.013 \times \text{Trust}$$

$(0.306)^{***} \qquad (0.120)^{**} \qquad (0.006)^{***}$

Firm size: Log Employment; Family Size: Log HH members; Trust: WVS

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$$\text{Firm\_Growth} = -0.096 \times \text{Firm\_Size} + 0.019 \times [\text{Firm\_Size} \times \text{Trust}]$$

$(0.003)^{***} \qquad (0.005)^{**}$

Firm size: Log Employment; Family Size: Log HH members; Trust: WVS

# Firm Dynamics in Developing Countries

Findings of Akcigit, Alp, and Peters (2015):

- ▶ The Indian economy suffers from a lack of firm selection, whereby a low rate of creative destruction allows subsistence producers with little growth potential to survive.
- ▶ The high delegation efficiency in the US is an important determinant of why US firms are large.
- ▶ While managerial delegation is inefficient in India, its effect on the lifecycle of Indian firms is muted due to important complementarities between the delegation efficiency and other factors affecting firm growth.
- ▶ Effective growth policies might have to consider the fact that even if one of its tires is fixed, a car cannot run when the rest of the tires remain broken.

# PART 2. INNOVATORS



# Becoming an Inventor

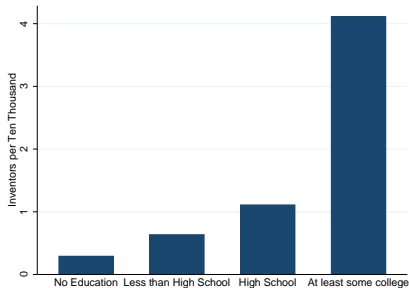
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- ▶ Who becomes an inventor?



# Becoming an Inventor in the U.S. (c. 1940)

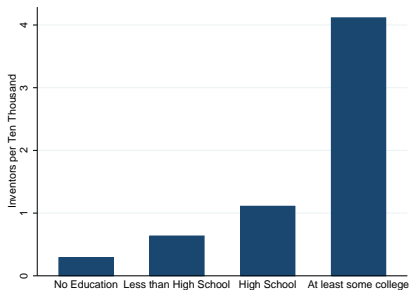
## Education



Source: Akcigit, Grigsby, and Nicholas  
(2016)

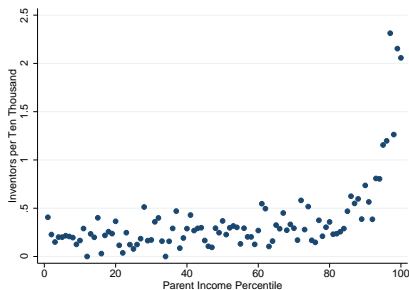
# Becoming an Inventor in the U.S. (c. 1940)

## Education



Source: Akcigit, Grigsby, and Nicholas (2016)

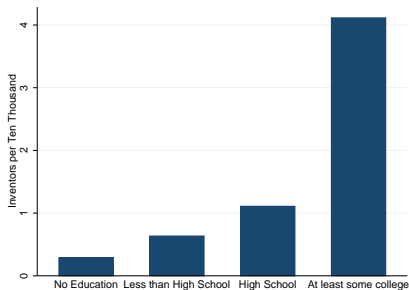
## Parental Income



Source: Akcigit, Grigsby, and Nicholas (2016)

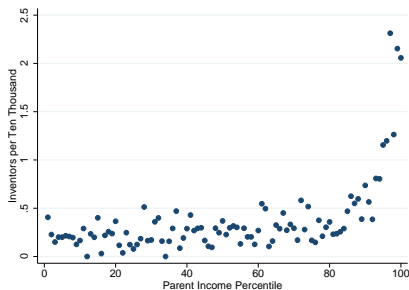
# Becoming an Inventor in the U.S. (c. 1940)

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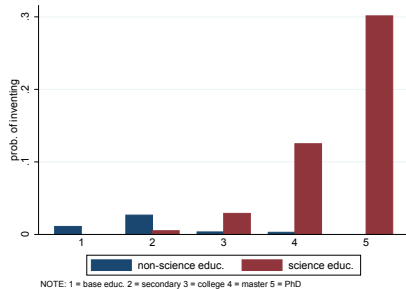
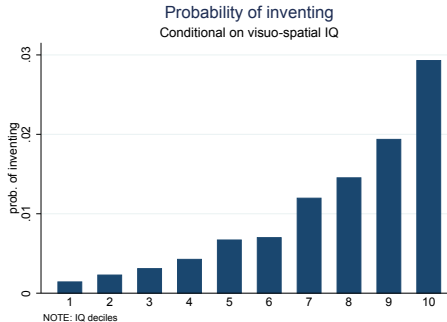
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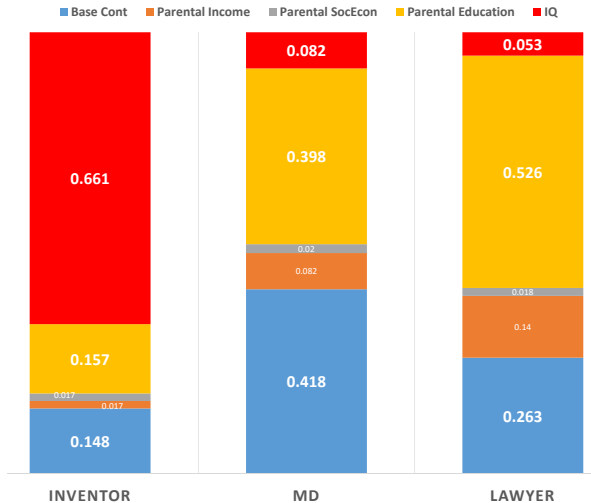
Source: Akcigit, Grigsby, and Nicholas (2016)

**Credit constraints seem to be an impediment to becoming an inventor.**

# Importance of IQ and Education in Finland



# Importance of IQ

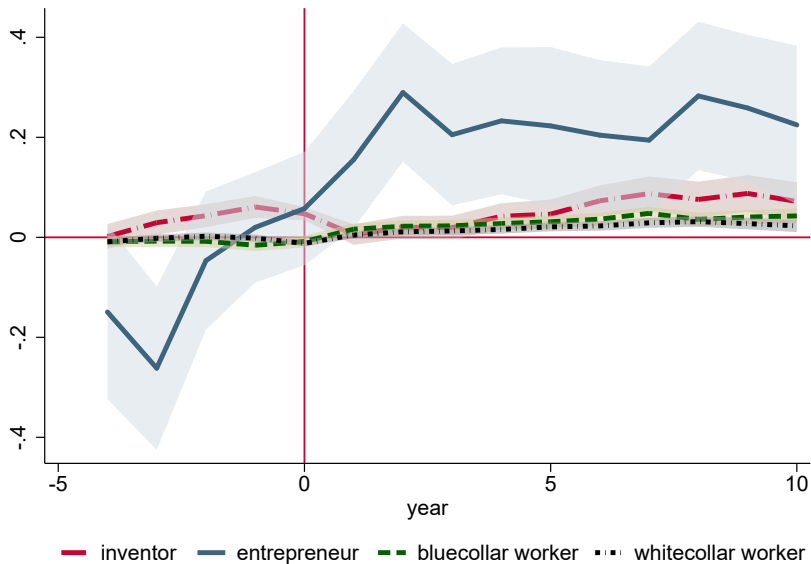


# Returns to Innovation

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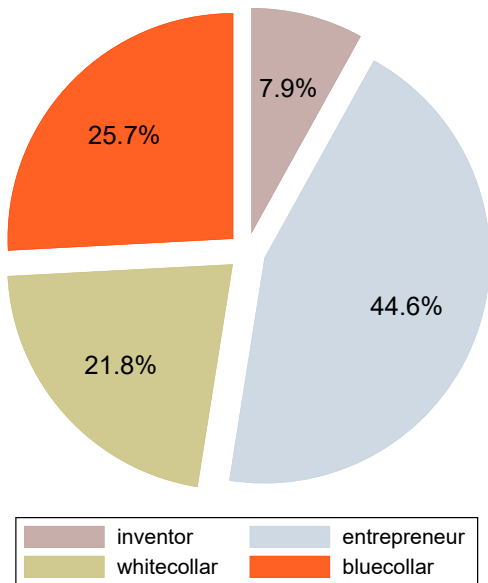
- ▶ Who gains from innovation?

# Returns to Innovation



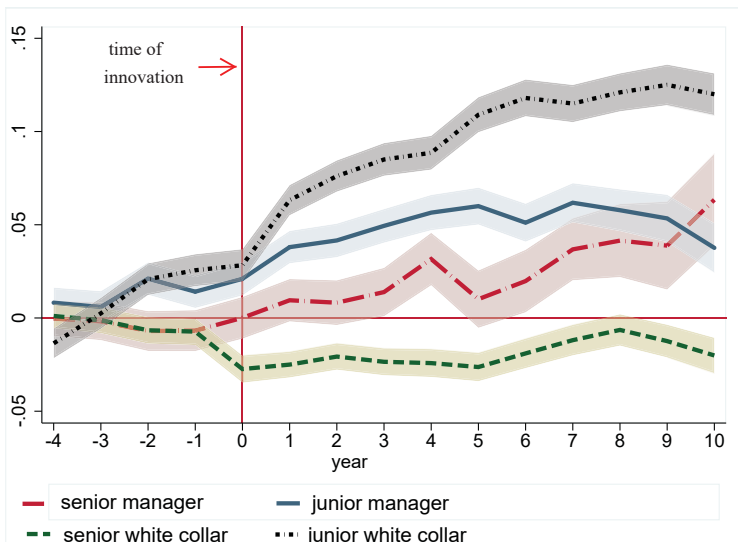
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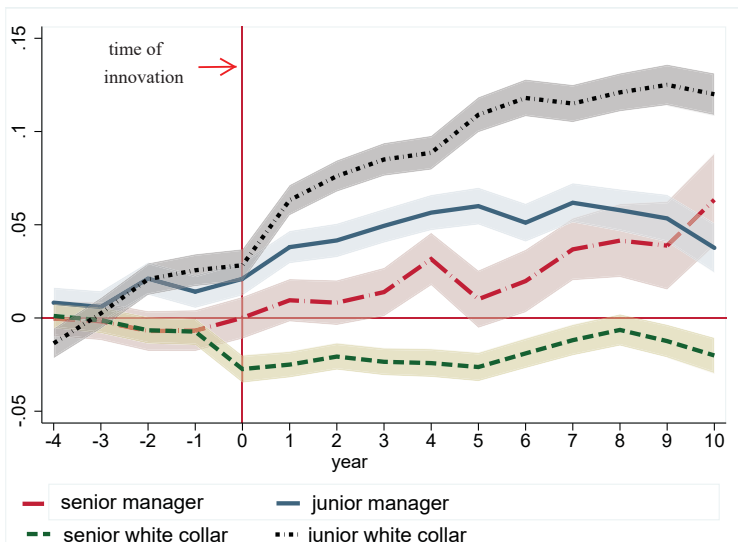




# Within-firm Income Dynamics Upon Innovation I/II



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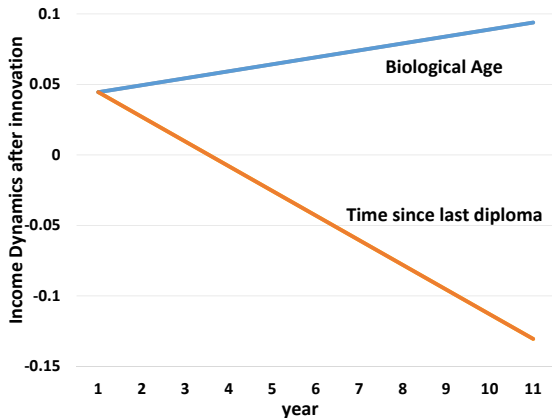


**Senior** white collars are hurt by innovation!

# Within-firm Income Dynamics Upon Innovation

## II/II

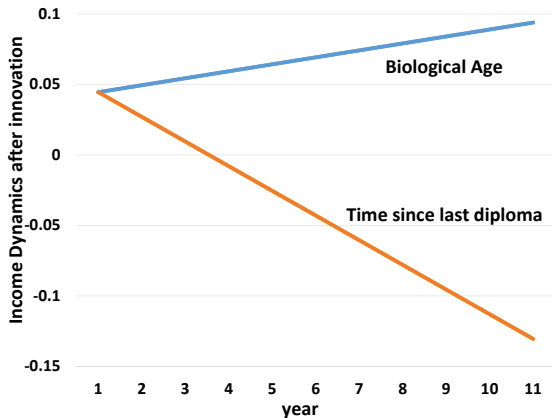
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# Within-firm Income Dynamics Upon Innovation

## II/II

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Negative impact comes from distance to frontier!  
Retraining programs could be helpful to make growth more  
"inclusive"!

# INNOVATION AND FIRM DYNAMICS IN TURKEY

# Innovation in Turkey

- ▶ How do the innovation dynamics look in Turkey?
- ▶ What are the appropriate industrial policies to boost innovation in Turkey? How effective are the current policies?
- ▶ What frictions do Turkish firms face?
- ▶ How does finance interact with firm performance?
- ▶ Who innovates and who gains from innovation in Turkey?
- ▶ What are the roles of universities in Turkish innovation systems?

## Innovation in Turkey - A New Project

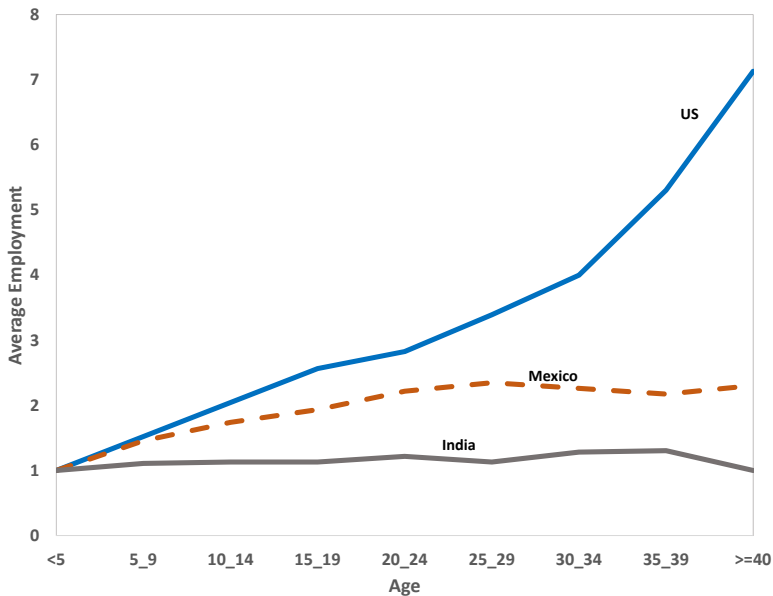
We recently launched a big-data project with a large group of mostly-PhD researchers at the Central Bank of the Republic of Turkey to inform policy using micro data.

The team has 4 sub-groups to specialize on

- ▶ cross-country analysis using COMPNET
- ▶ finance and innovation
- ▶ industrial policies and firm dynamics
- ▶ understanding individual inventors and entrepreneurs.

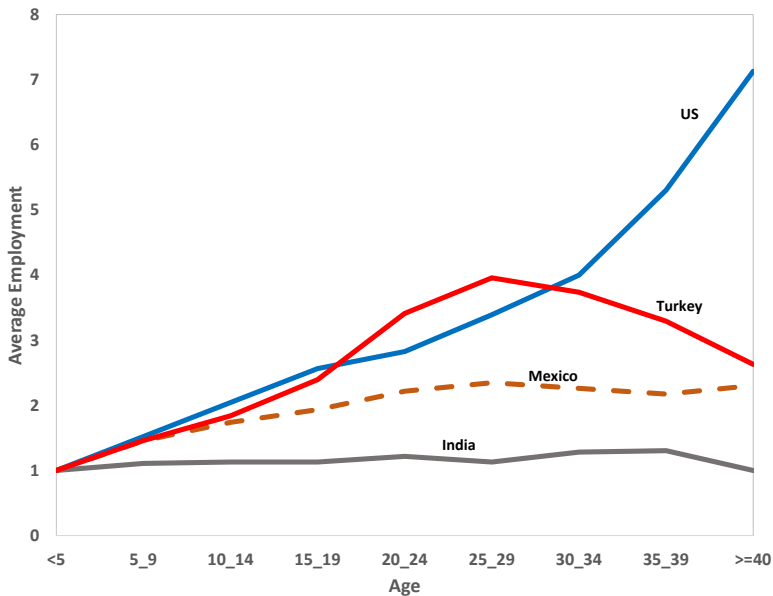
Our goal is to use/merge more than 15 sources of micro data to inform our analysis.

# Cross-country Comparison

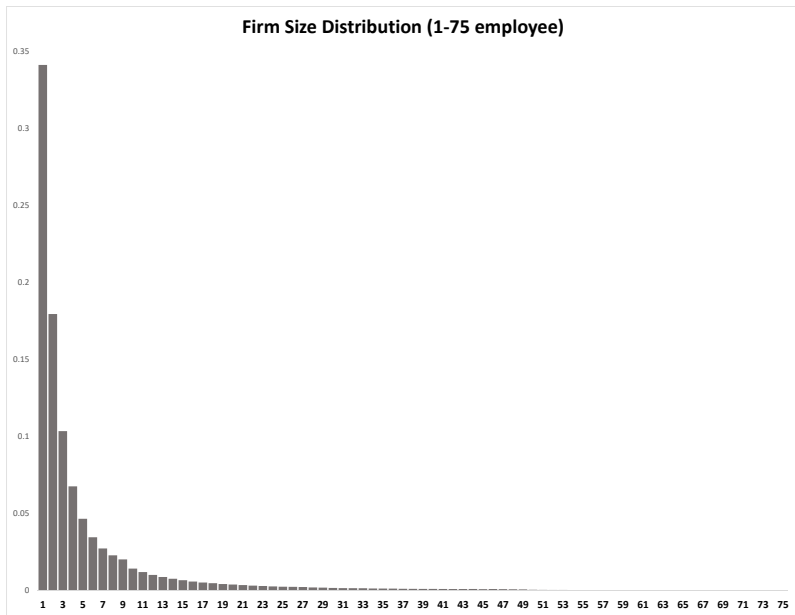




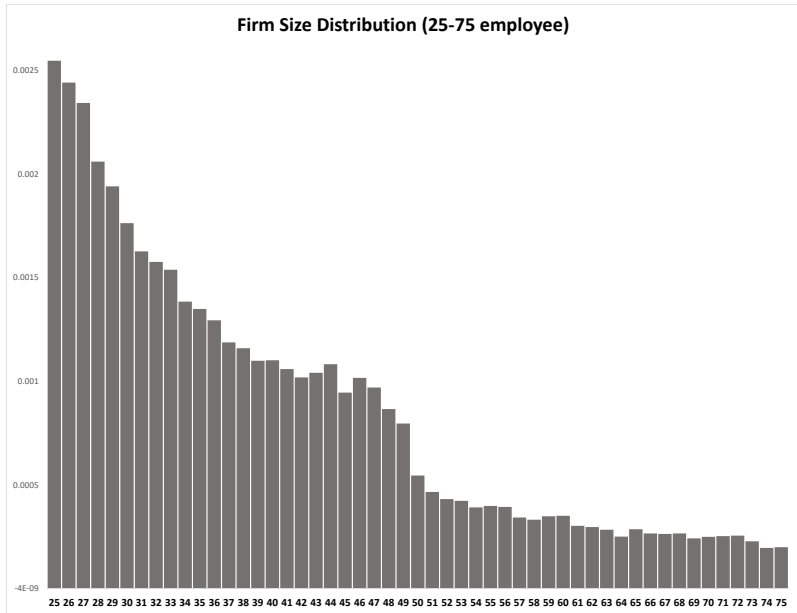
# Cross-country Comparison



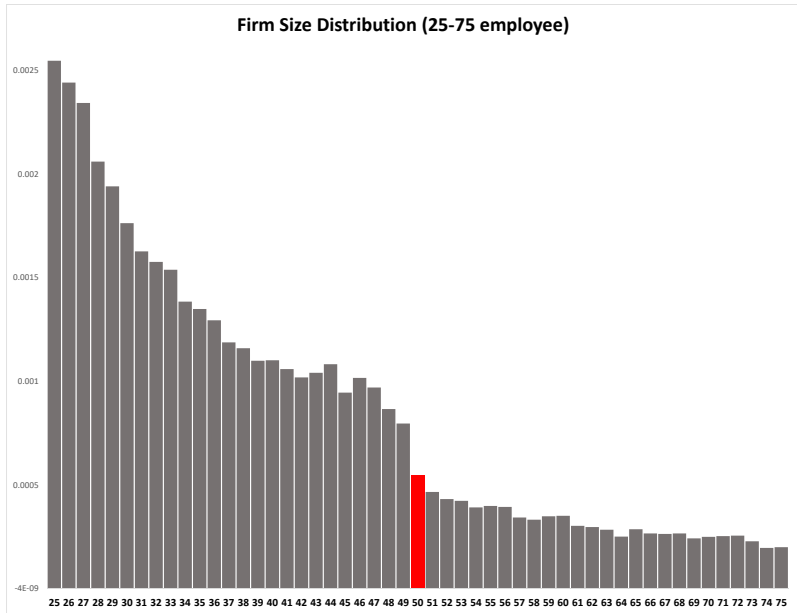
# Size-dependent Policies



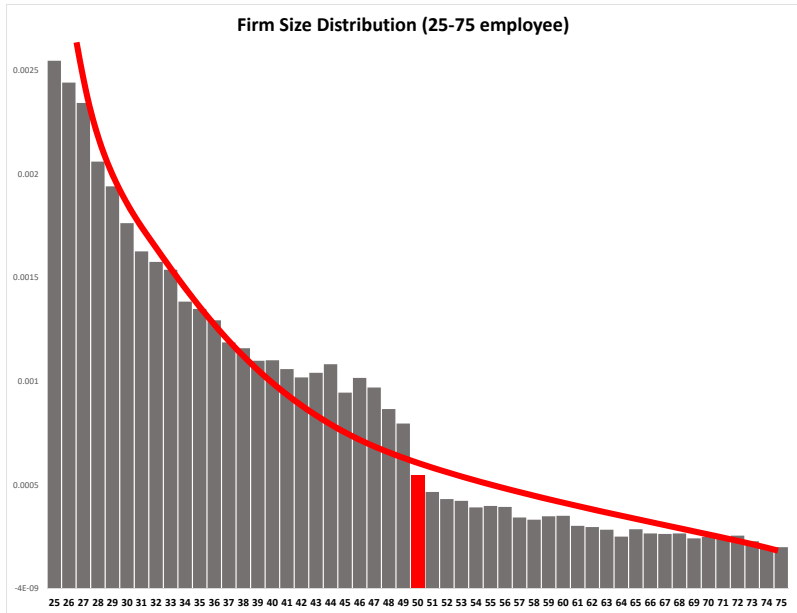
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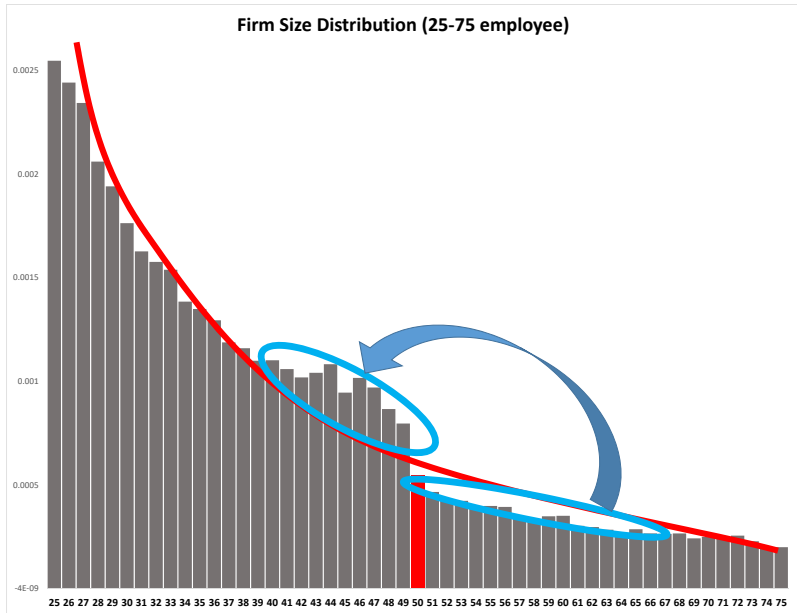
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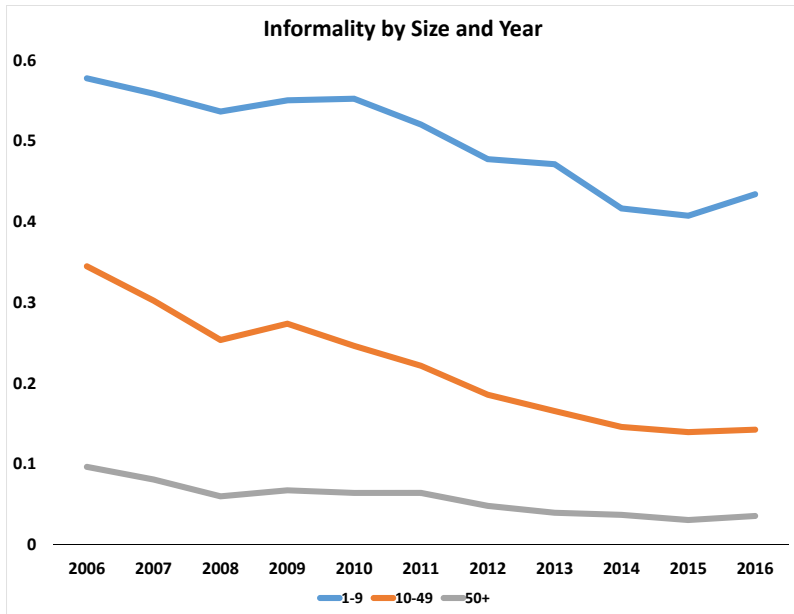
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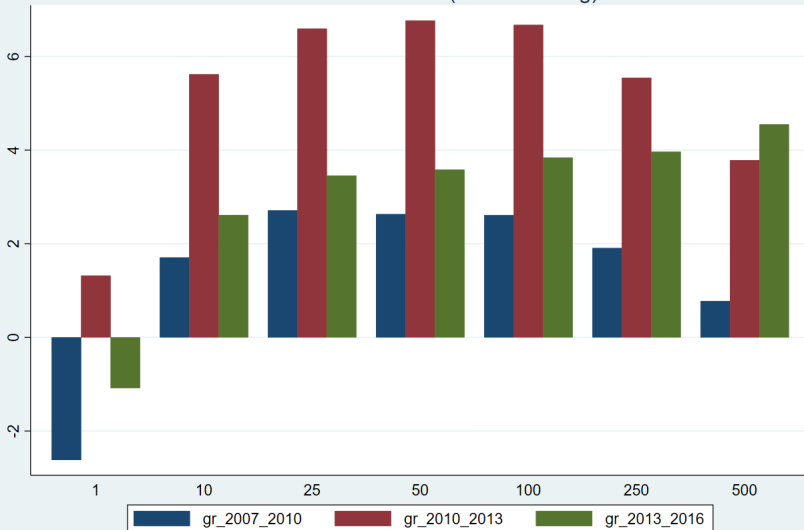


# Informality



# Within-Turkey Comparison

Sales Growth - Mean (Manufacturing)

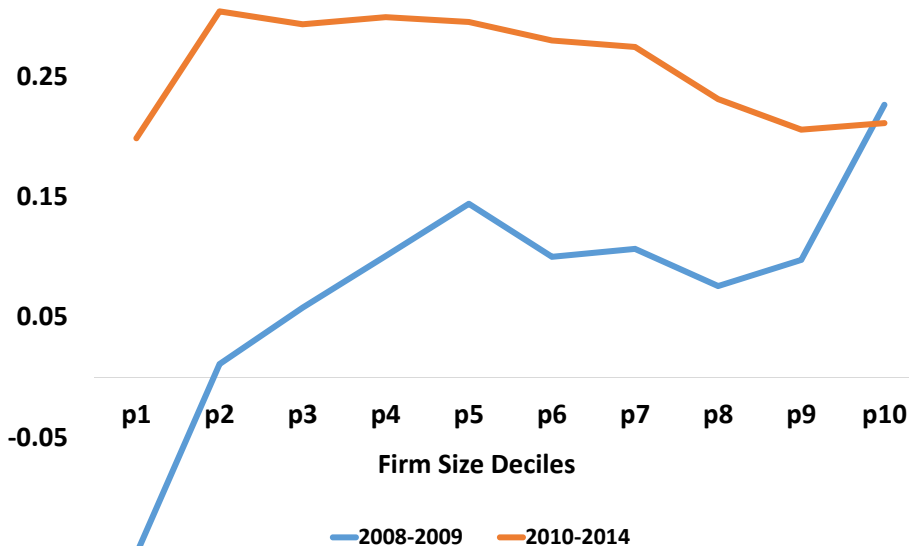


Sales are deflated with the GDP deflator. Growth rate is calculated as follows:  $100 * (\text{var} - L3.\text{var}) / ((\text{var} + L3.\text{var}) / 2)^3$



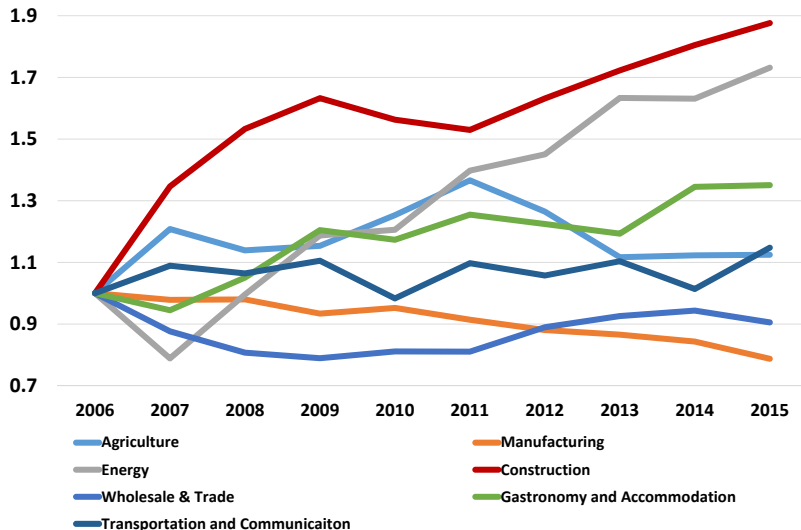
# Credit Growth

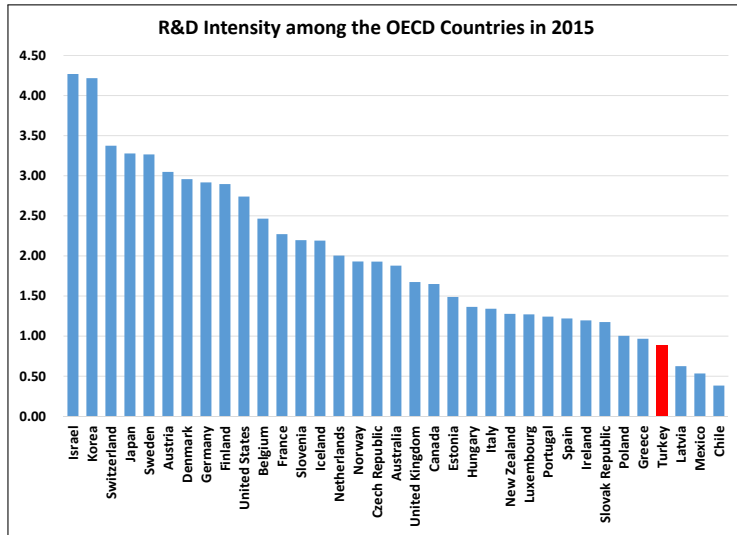
## Real Credit Growth by Firm Size Deciles



# Credit Growth

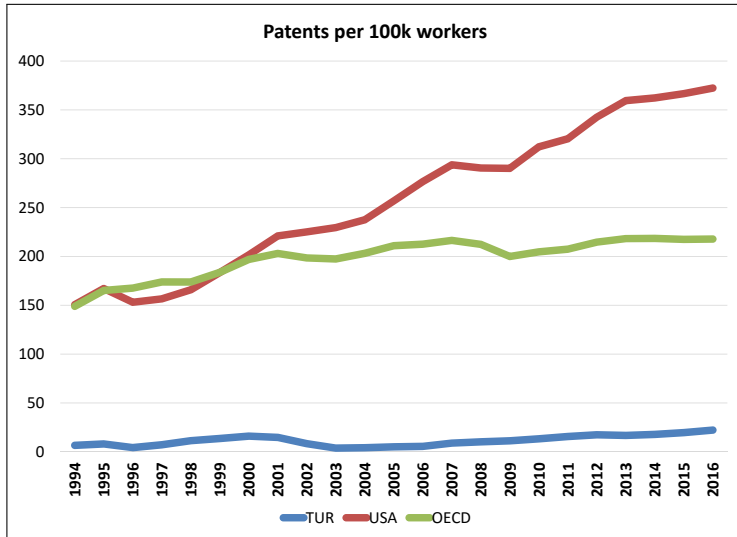
## Credit by Sector over Time (normalized)





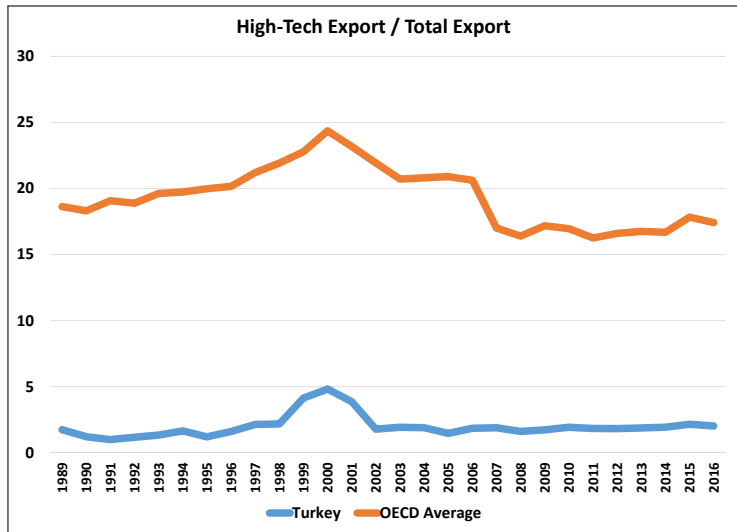
Source: OECD

# Patent Count / 100K Workers



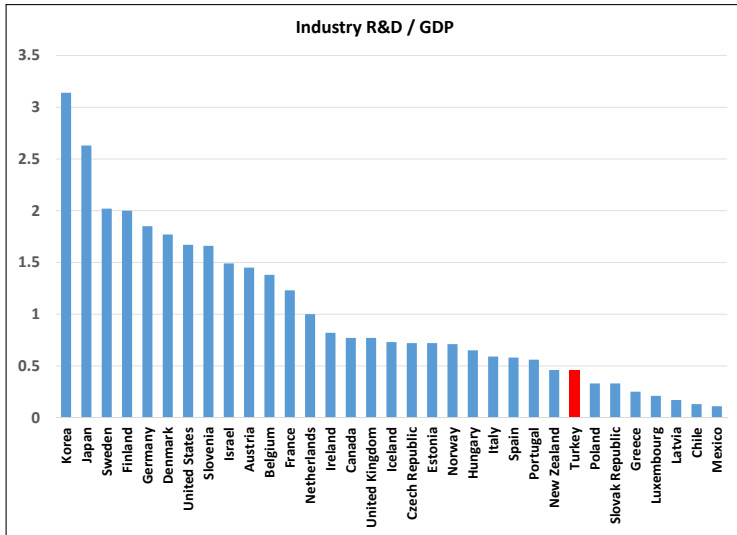
Source: World Bank

# High-tech Export Share...



Source: OECD

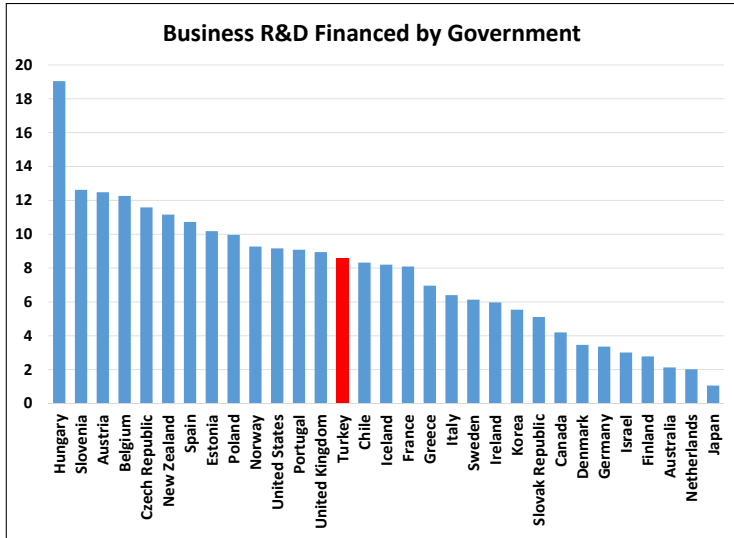
# Corporate R&D



Source: OECD

- ▶ Why is it lagging behind?
- ▶ Not enough government support?
- ▶ Firms suffer from other problems?

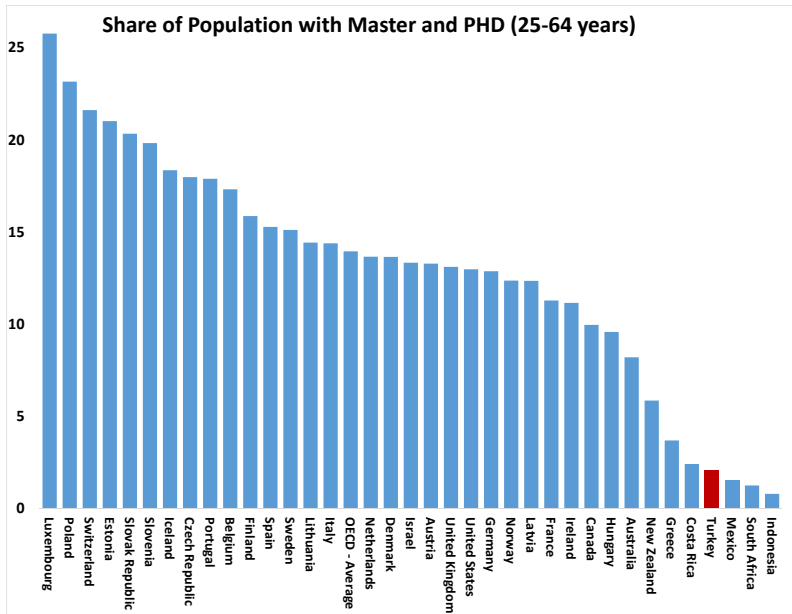
# Government Support for Private R&D



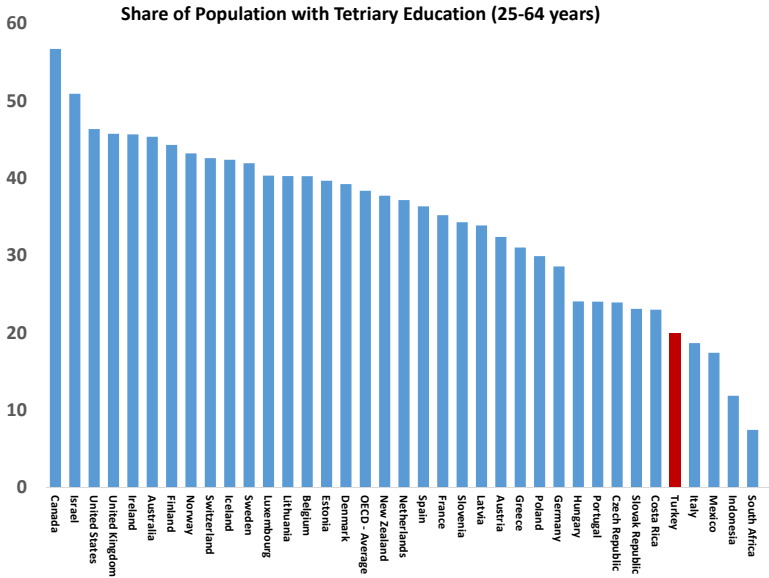
Source: OECD



# Human Capital for Innovation



# Human Capital for Innovation



## Conclusions (1/2)

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- ▶ Innovation is good for **growth** and **happiness**.
- ▶ Public policy should focus on: **firms, inventors, ideas**.
- ▶ Guided public policy: We need to target **spillover-generating** and **(high-type) more innovative firms**.
- ▶ **Universities** should not be left behind in funding!
- ▶ Factor reallocation among firms is key for growth.

## Conclusions (2/2)

- ▶ **Education policy** is key for becoming an inventor!
- ▶ This is also important to make the growth process more **inclusive**.
- ▶ Tax policy should not focus only on the incentives of inventors. **Financiers** and **managers** are also affected by such policies.
- ▶ **Tax policy** is key for superstar migration.
- ▶ **Secondary market for technologies** could be as important as creating new technologies.

Thank You...

## References:

- ABRAMS, D., U. AKCIGIT, AND G. OZ (2016): “Patent Trolls: Benign Middleman or Stick-Up Artist?,” University of Chicago Working Paper.
- ACEMOGLU, D., U. AKCIGIT, N. BLOOM, AND W. R. KERR (2013): “Innovation, Reallocation and Growth,” National Bureau of Economic Research WP # 18993.
- AGHION, P., U. AKCIGIT, A. BERGEAUD, R. BLUNDELL, AND D. HÉMOUS (2018): “Innovation and Top Income Inequality,” *Review of Economic Studies*, forthcoming.
- AGHION, P., U. AKCIGIT, A. DEATON, AND A. ROULET (2016): “Creative Destruction and Subjective Well-Being,” *American Economic Review*, 106(12), 3869–3897.
- AGHION, P., U. AKCIGIT, A. HYYTINEN, AND O. TOIVANEN (2017): “Social Origins and IQ of Inventors,” NBER Working Paper #24110.
- AKCIGIT, U., H. ALP, AND M. PETERS (2015): “Lack of Selection and Limits to Delegation: Firm Dynamics in Developing Countries,” National Bureau of Economic Research WP # 21905.

- AKCIGIT, U., S. ATES, AND G. IMPULLITTI (2018): "Innovation and Trade Policy in a Globalized World," NBER Working Paper #24543.
- AKCIGIT, U., S. BASLANDZE, AND S. STANTCHEVA (2016): "Taxation and the International Migration of Inventors," *American Economic Review*, 106(10), 2930–2981.
- AKCIGIT, U., M. A. CELIK, AND J. GREENWOOD (2016): "Buy, Keep or Sell: Economic Growth and the Market for Ideas," *Econometrica*, 84(3), 943–984.
- AKCIGIT, U., J. GRIGSBY, AND T. NICHOLAS (2016): "The Rise of American Ingenuity: Innovation and Inventors of the Golden Age," National Bureau of Economic Research Working Paper #23047.
- (2017): "Immigration and the rise of american ingenuity," *American Economic Review, Papers and Proceedings*, 107(5), 327–31.
- AKCIGIT, U., J. GRIGSBY, T. NICHOLAS, AND S. STANTCHEVA (2018): "Taxation and Innovation in the 20th Century," .
- AKCIGIT, U., AND W. R. KERR (2017): "Growth through Heterogeneous Innovations," *Journal of Political Economy*, forthcoming.