AGGREGATE DYNAMICS AND MICROECONOMIC HETEROGENEITY: THE ROLE OF VINTAGE TECHNOLOGY

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BACKGROUND/MOTIVATION

⬦ **After the Great Recession slow recovery of Southern European countries**

  – Prolonged slump in aggregate investment

  – Stagnant aggregate productivity

⬦ **Lack of investment often blamed for the poor performance of productivity**

  – Logic: technology adoption through investment

⬦ **Empirical evidence on vintage technology is scant**

◇ **We study the role of investment for productivity dynamics**

    – Microeconomic evidence on vintage effects

        ◦ Census of incorporated Italian firms

    – Macroeconomic implications: structural model

        ◦ Firm heterogeneity *à* la Khan and Thomas (ECMA, 2008)

        ◦ Technology adoption decision

THIS PAPER

◇ **Investment leads to TFP gains at the firm level**

– Firms with lower investment age have higher productivity
  investment age is the time elapsed since the last large investment episode

– Investment age/vintage effects account for $\sim 15\%$ of productivity
  heterogeneity across firms

◇ **Macroeconomic relevance of the link investment-productivity**

– Vintage technology amplifies dynamics following aggregate shocks

– Investment slowdown accounts for over $1/3$ of missing productivity
  growth in the Italian economy

EMPIRICAL ANALYSIS

MICROECONOMIC DATA

- ◇ **Census of incorporated Italian firms**

  – Balance-sheet data from 1986 to 2015 ($\sim$80% of total value-added)

- ◇ **Investment is a large and infrequent, or *lumpy*, episode**

  – In an average year, 18% of firms exhibits an investment rate over 20% (or spikes, 61% of total investment)

- ◇ **Empirics: Spikes as a signal of technology adoption**

VINTAGE EFFECTS IN THE DATA

EMPIRICAL SPECIFICATION

$$log(TFP_{f,t}) = \alpha + \sum_{j=1}^{7+} \beta_j Inv.Age_{j,f,t} + Controls_{f,t} + \epsilon_{f,t}$$

$\diamond$ $Inv.Age_{j,f,t}$: time elapsed since the last investment spike
($ik_{f,t} \geq 0.20$) computed using:

    $\circ$ All spikes in the sample

    $\circ$ Controlling for reverse causality: using only spikes predicted by
    Logit Model (Two-stage approach)

$\diamond$ **Controls:** firm-, industry-, year-effects, firm's age and size
dummies

INVESTMENT LEADS TO TFP GAINS

TFP GAP RELATIVE TO THE FRONTIER: ESTIMATED β_j'S
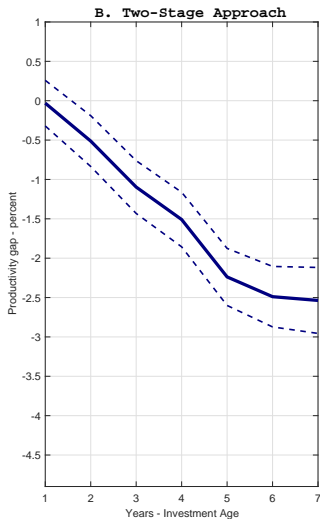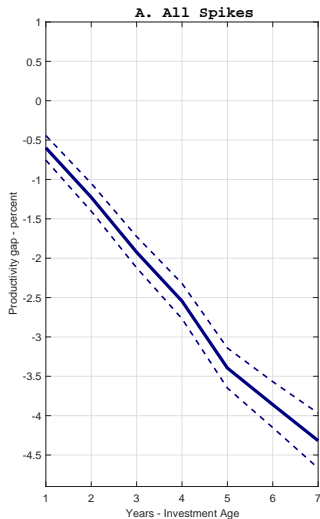
RBC WITH ENDOGENOUS TFP DISPERSION

◇ **Firms:**

— TFP has two components εz

  ○ ε exogenous temporary idiosyncratic shock

  ○ z permanent productivity vintage

— Adopting latest technology z is subject to a fixed cost

  ○ (S,s) technology adjustment rules - action/inaction region

  ○ Different TFP vintages coexist (distribution is non-degenerate)

  ○ Aggregate TFP is endogenous to firms' adoption decision

— The model disciplined by microeconomic data on capital accumulation

◇ **Standard Representative household**

APPLICATION TO ITALY: MODEL VS DATA

SHOCKS THAT DEPRESS INVESTMENT LEAD TO STAGNANT TFP

Financial Shock - TFP Response

	TFP DATA	TFP VINTAGE	TFP RBC
2012	-1.27%	-0.42%	0.00%
2013	-1.08%	-0.57%	0.00%
2014	-1.15%	-0.31%	0.00%
2015	-0.89%	-0.26%	0.00%

Notes: TFP responses following an increase in the price of investment goods. Each entry is in percent relative from trend values.