Schumpeterian Growth Theory

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Mathematics and growth

- Paul has given examples of how formal theory can either make verbal notions operational or show that they are flawed
  - price-taking
- He has also emphasized the importance of going back and forth between abstract models and concrete facts
- This is what we have tried to do over the past 25 years by building Schumpeterian growth theory while exploring rich micro data sets
- In particular, this has allowed us to better understand the role of firm and industry dynamics in the growth process

Schumpeterian growth: basic model

Main idea: growth results from vertical innovations which induce turnover and obsolescence (creative destruction)

Research labor	n
Frequency of innovation	λn
Size of innovation	γ
Value of innovation	$V_{t+1} = \frac{\pi_{t+1}}{r+\lambda n}$ (obsolescence-adjusted interest rate)
Research arbitrage	$w_t = \lambda V_{t+1}$
Growth rate	$g = \lambda n \ln \gamma = g(\lambda, \gamma, r)$

Industrial Organization (1)

Counterfactual: competition and entry foster growth, do not reduce it as predicted by the basic model....can we explain why?

To reconcile theory with evidence on competition and growth, allow for step-by-step innovation, which allows firms in some industries to be "neck-and-neck"

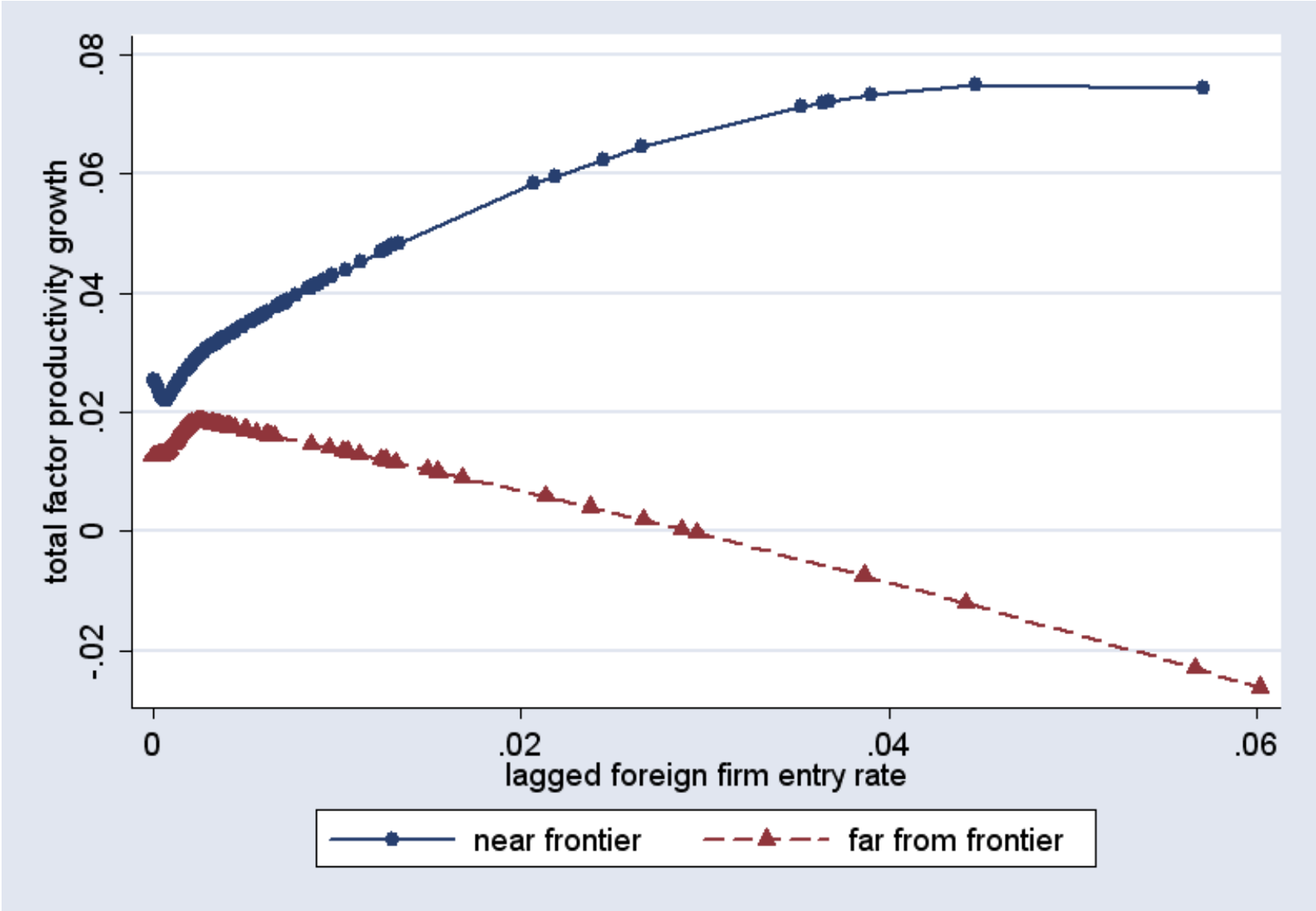
This introduces an "*escape-competition*" effect of competition on innovation

Aghion-Harris-Howitt-Vickers (2001),
Aghion-Bloom-Blundell-Griffith-Howitt (2005),
Acemoglu-Akcigit (2012), Aghion-Howitt-Prantl (2012)

Industrial Organization (2)

Three empirical implications:

1. Incumbent productivity growth stimulated by entry threat if near frontier, discouraged if far from frontier (Aghion-Blundell-Griffith-Howitt-Prantl)
2. Inverted-U relationship between competition and innovation/productivity growth (ABBGH)
3. Complementarity between patent protection and competition in fostering innovation (Aghion-Howitt-Prantl)


total factor productivity growth
-.02
0
.02
.04
.06
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0
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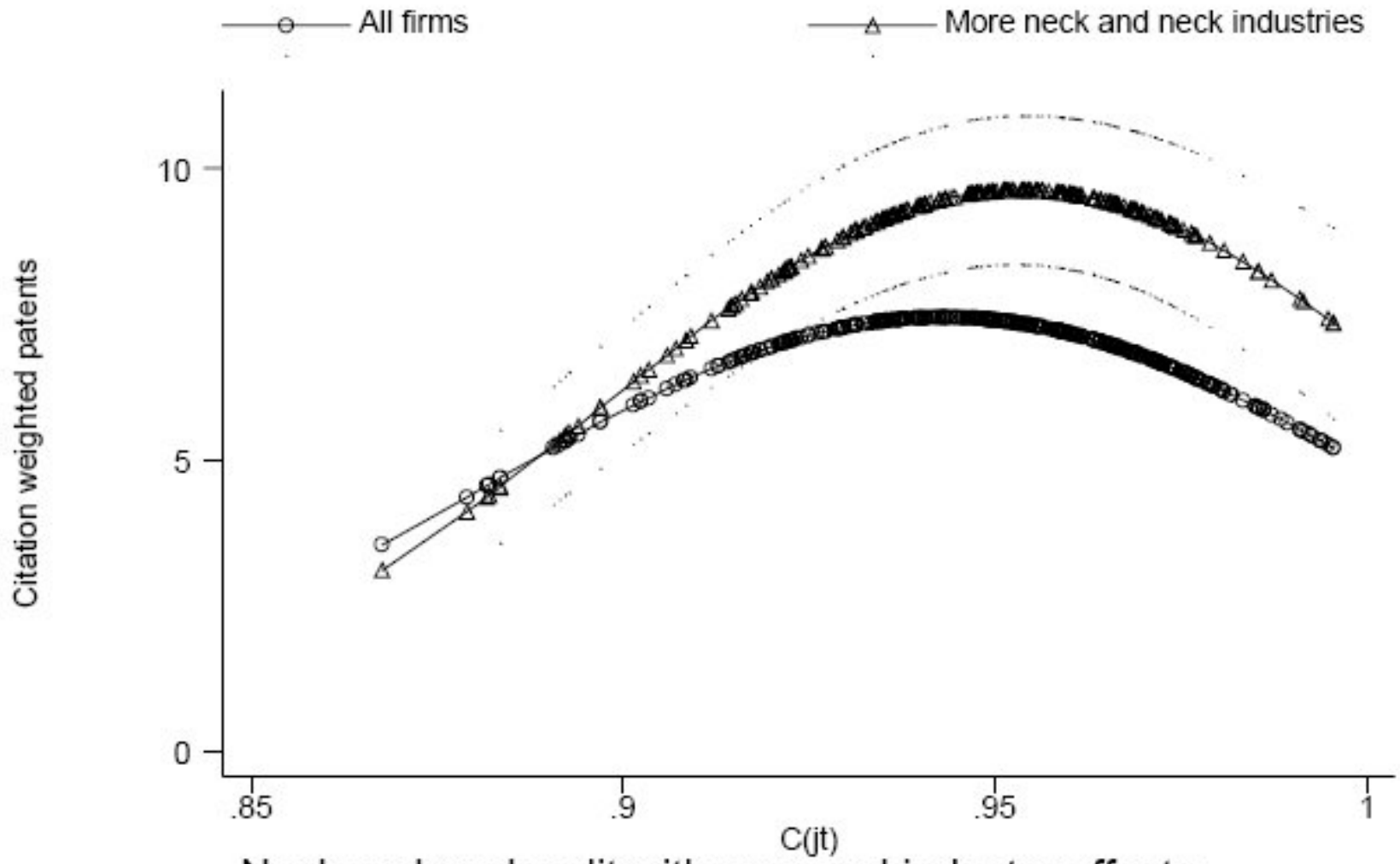
.06
lagged foreign firm entry rate
near frontier
far from frontier



Neck and neck split with year and industry effects

Firm dynamics (1)

Further extensions of the Schumpeterian framework to understand other facts, such as:

1. Small firms exit more frequently
2. Conditional on survival, small firms grow faster
3. Firm size and firm age are strongly positively correlated

Klette and Kortum (2004), Akcigit and Kerr (2010), Acemoglu, Akcigit, Bloom and Kerr (2012), Akcigit, Hanley and Serrano-Velarde (2012), Acemoglu, Akcigit, Hanley and Kerr (2012)

Firm dynamics (2)

Basic idea in Klette-Kortum:

1. firms are collections of product lines
2. each innovation involves quality improvement and therefore creative destruction on a line

Growth meets development (1)

Another fact to be dealt with:

Frontier innovation and catch-up growth do not seem to require the same policies

Acemoglu-Aghion-Zilibotti (2006)

Fig 11.2a: HIGH BARRIERS

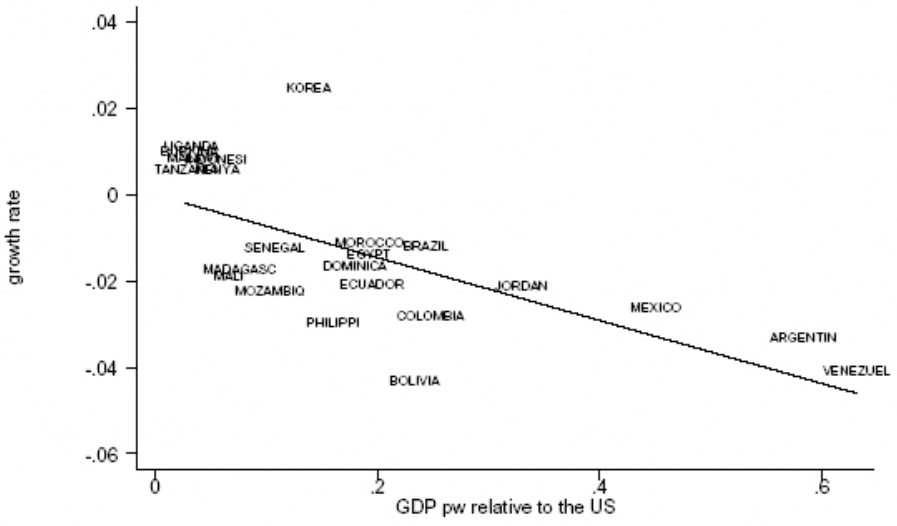


Fig 11.2b: LOW BARRIERS

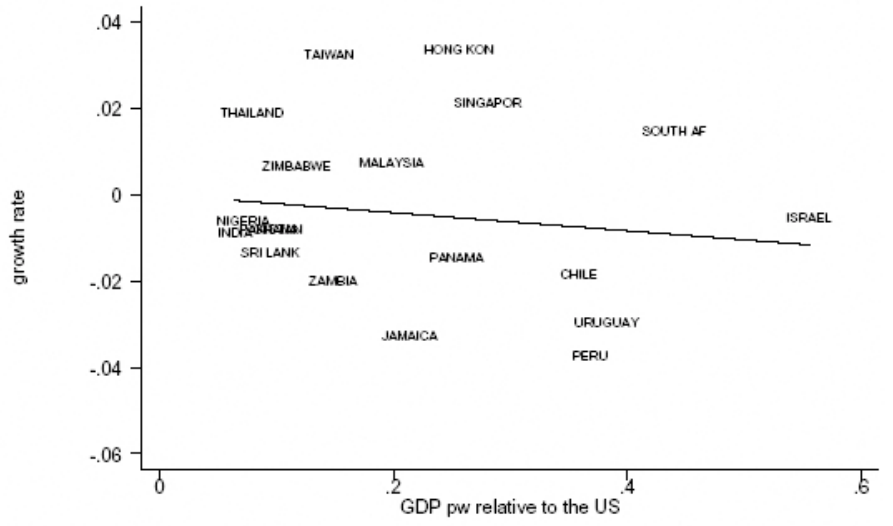


Fig 11.2c: HIGH BARRIERS (FE)

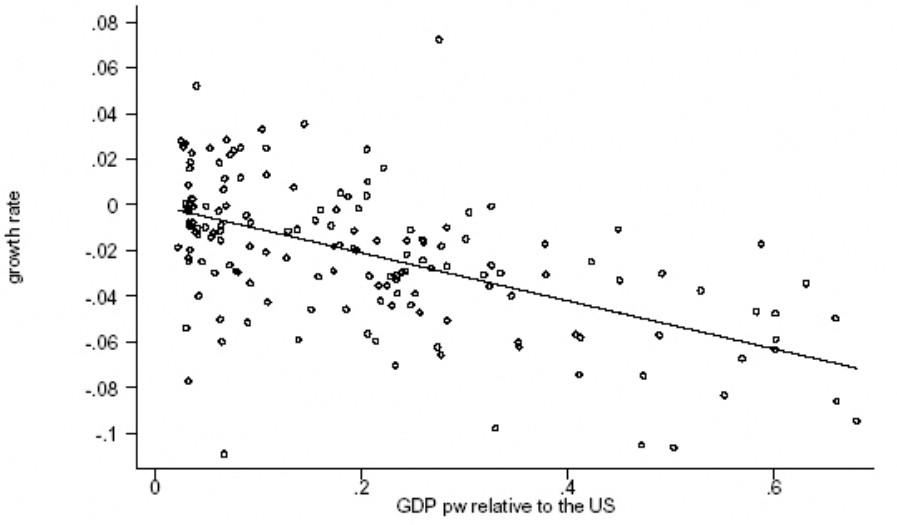
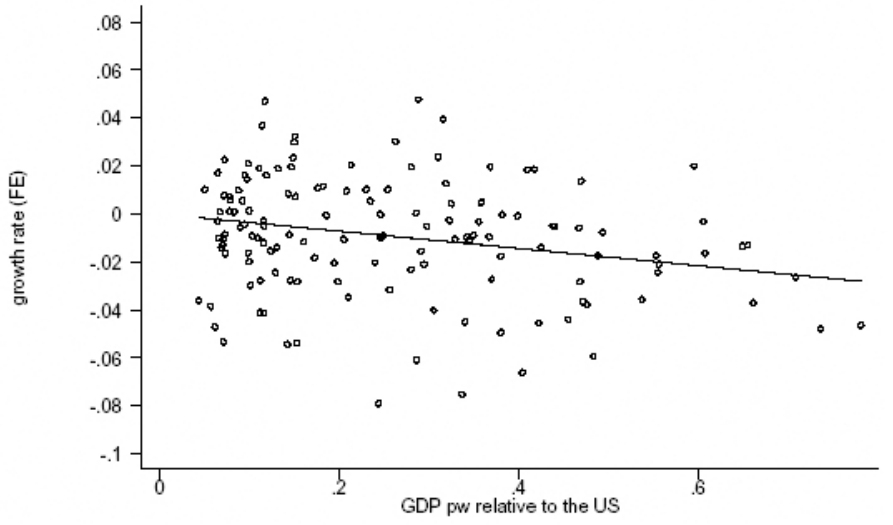


Fig 11.2d: LOW BARRIERS (FE)



Growth meets development (2)

Modifying the basic framework by adding imitation

If the fraction μ_n of sectors innovates and the fraction μ_m imitates:

$$A_{t+1} - A_t = \mu_n (\gamma - 1) A_t + \mu_m \left(\overline{A}_t - A_t\right)$$

So growth depends on "proximity" $a_t = A_t / \overline{A}_t$:

$$g_t = \frac{A_{t+1} - A_t}{A_t} = \mu_n (\gamma - 1) + \mu_m \left(a_t^{-1} - 1\right)$$

Growth meets development (3)

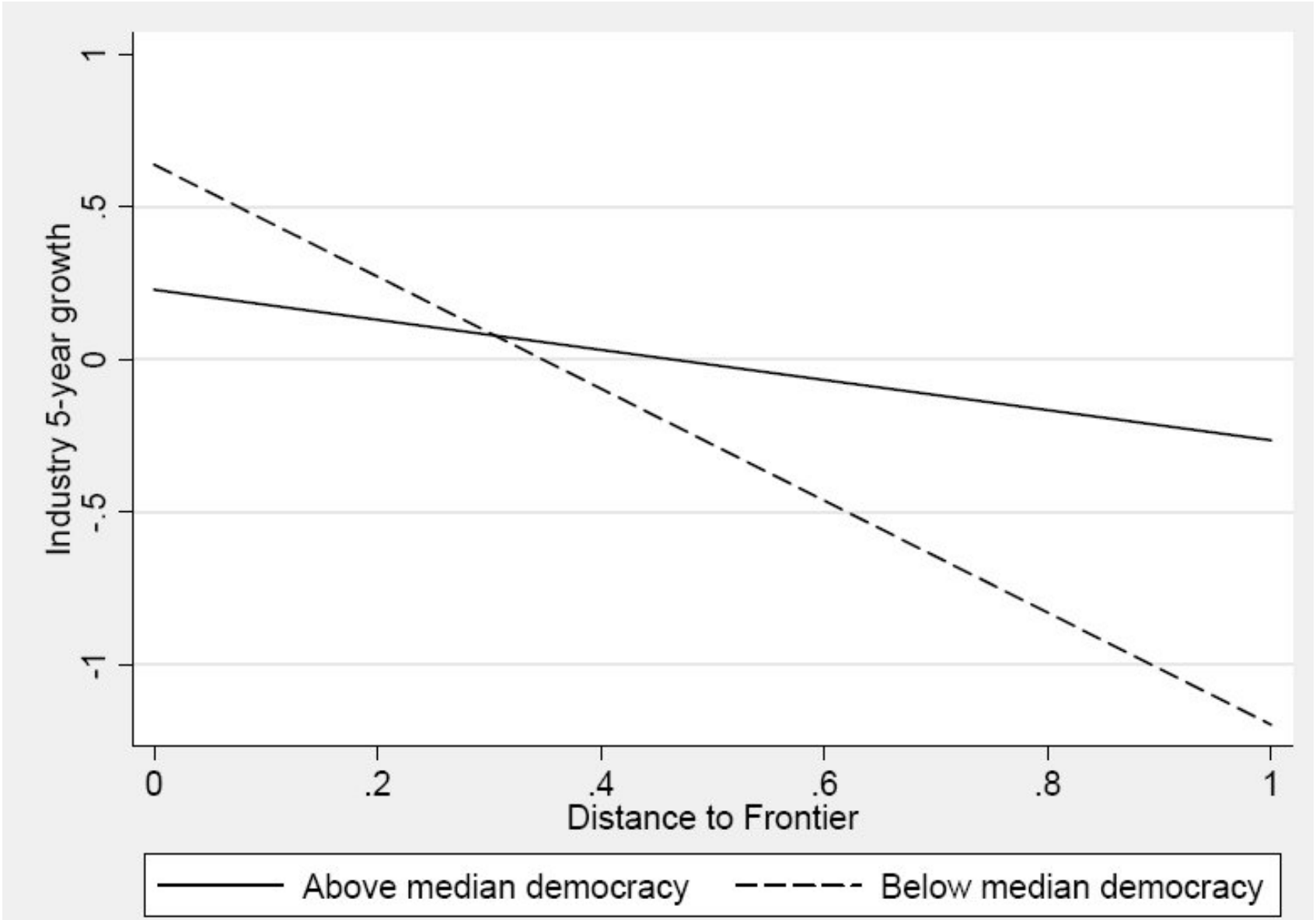
"Club convergence" through technology transfer

Appropriate growth policies and appropriate institutions

Aghion-Howitt (1998), Howitt (1999), Howitt-Mayer (2006), Acemoglu-Aghion-Zilibotti (2006), Aghion-Boustan-Hoxby-Vandenbussche (2007)

Political economy (1)

Democracy is more growth-enhancing closer to the frontier



Political economy (2)

Innovation-led growth involves a conflict between old and new

Democracy helps growth by reducing barriers to new entrants

Democracy is more growth-enhancing closer to the frontier, since
... frontier growth relies more on frontier innovation,
....which relies more on new entry

Krusell-Rios Rull (1996), Aghion-Howitt (1998, ch 10; 2009, ch 17), Acemoglu-Aghion-Zilibotti (2006), Aghion-Alesina-Trebbi (2010), Acemoglu-Robinson (2012)

Conclusion

The dialogue between Schumpeterian theory and micro data has enhanced our understanding of the growth process.

In particular, it has allowed us:

1. to put IO into growth,
2. to link growth with firm dynamics,
3. to reconcile growth with development and talk about appropriate institutions/growth policies, and
4. to link growth with politics.