

# Digital Capital and Superstar Firms

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Discussion by:

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# Summary

An innovative measure of the quantity of firms' digital capital. Three steps:

- Proxy for firms' digital investment
- Measure the MV of firms' digital capital
- Separate P and Q of firms' digital capital

Several interesting findings:

- Rising Q but flat P of digital capital after 2001
- Digital capital is concentrated in a small group of “superstar” firms
- Digital capital helps improve firms' productivity

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## Promising to make a major contribution

Several explanations are proposed for rising superstar firms

- E.g., superstar firms possess more intangible capital

Intangible capital is a “catch-all” concept: It may reflect greater brand value (market power) or more advanced knowhow (technology)

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- John Van Reenen in 2020 Declining Dynamism Conference\*:

*“Measures we have are very crude. Better to use more firm-level measures, using admin data and specify types of intangibles.”*

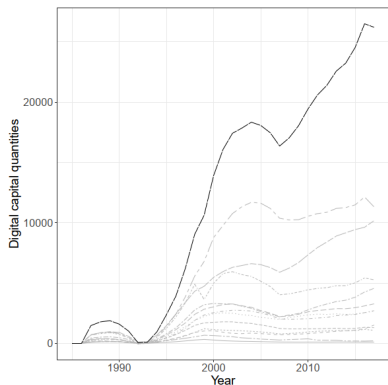
**This paper:** shed light on digital capital in superstar firms

\*<https://sites.bu.edu/tpri/news-and-events/technology-and-declining-economic-dynamism-conference/>

## Outline of my discussion

- Focus on the implications of digital capital for “superstar” firms
- Provide suggestions on empirical methodology
- Discuss an alternative LinkedIn data: BLS OEWS microdata

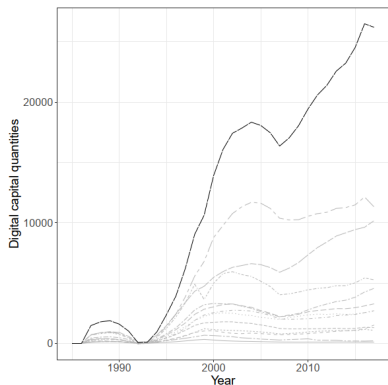
# Are superstar firms just getting bigger?



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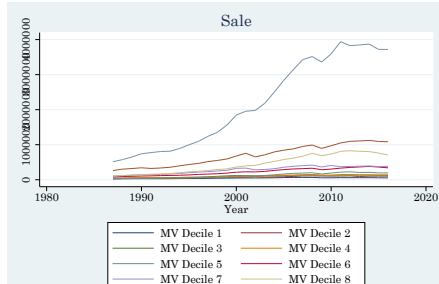
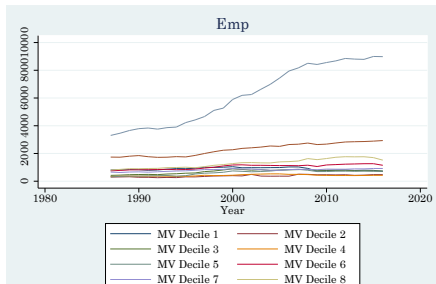
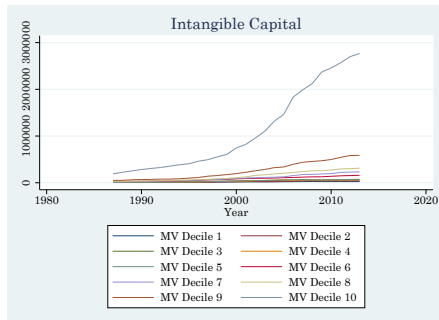
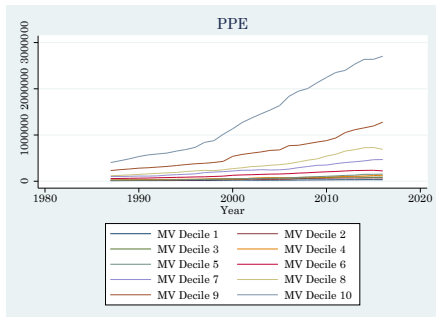
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- Black line indicates historical digital capital quantity for firms in the top decile by market value as of 2016
- Firm size distribution is skewed in Compustat sample
- Are top decile firms just many times larger in every aspect?

# Are superstar firms just getting bigger?

Superstar firms seem to be bigger in every metric, not just DC

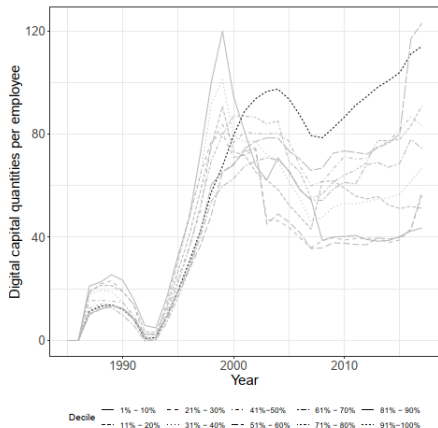


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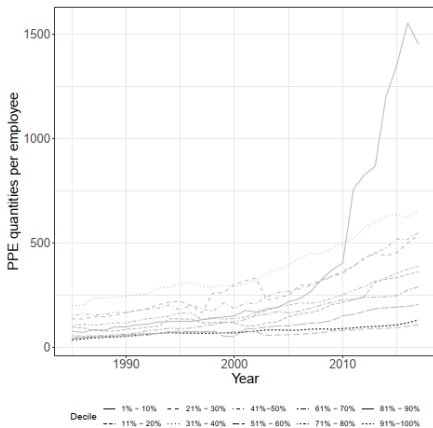
The graph can reflect a scale effect and a composition effect:

- Are superstar firms just X-times larger than small firms in average aspect?
- Are superstar firms **disproportionately** increasing digital capital more than other capital?

# A more informative graph: capital per employee



(a) Digital capital



(c) PPE

- Clearly superstar firms disproportionately accumulate more DC than PPE
- This finding has an important contribution—Superstar firms appear to possess a production technology more tilted towards digital capital than PPE and labor

# Measurement of market value for digital capital is ad-hoc

## Challenge:

- Hall (2001) use **total MV** to reveal the quantity of **total capital**
- This paper needs to single out the MV of a firm's **digital capital**

## Current procedure:

- Impute digital capital value from an OLS regression:

$$MV_{it} = \beta_{PPE} PPE_{it} + \beta_{OA} OA_{it} + \underbrace{\beta_{IT} IT_{it}}_{MV \text{ of } DC} + \epsilon_{it}$$

- This regression model can be theoretically supported because under assumptions in Hall (2001), a firm's market value can be decomposed linearly (Belo et al. (2021 JFE)):

$$V_{it} = q_{it}^{PPE} PPE_{it} + q_{it}^{OA} OA_{it} + q_{it}^{IT} IT_{it}$$

- However, the theoretical model requires the adjustment cost parameters ( $\theta$ s) to be time-invariant in order to identify Q and P
- The rolling window OLS regression does not discipline  $\theta_{PPE}$  or  $\theta_{OA}$  to be time-invariant.

Suggestion: Consider a structural approach to decompose  $V$  following Belo et al. (2021) rather than running regressions

## LinkedIn data

**Intuition:** Investment in digital capital is not just about purchasing equipment but also upgrading the firm's intangible side. The latter is usually many times more costly than the former

This paper showcases the power of using labor occupation data to measure firms' digital capital

An innovative and careful implementation of the LinkedIn resume data

- The ideal dataset is a year-firm-occupation level data with employment and wage
- The authors adjust occupation composition based on the OES public data because LinkedIn disproportionately covers more high-skill occupations
- The authors impute worker wages based on the OES public data because the LinkedIn does not provide wages

## Imputation and biased measurement

Imputations sometimes can introduce noise and attenuation effects, other times can introduce biases

For example, it is likely that the payroll to IT employees is a more direct proxy of firms' digital investment than the number of IT employees

If larger firms pay higher wages, the “firm size-wage premium,” the market value of digital capital can be underestimated for large firms and overestimated for small firms

Hence, correcting for this estimation bias may lead to even greater differences in digital capital quantity between small and large firms

# Introducing the BLS OES microdata

- A government administrative panel database since 1988
- Reporting employment and wages for all occupations within establishments, with over 800+ occupation categories
- Covering 1.2 million establishments; 62% of U.S. employment
- Matched to 3,857 Compustat firms per year (Zhang (2019 JF), Tuzel and Zhang (2021 JF))
- Can be a good complementary data to LinkedIn:
  - Stable coverage of firms over time
  - All occupations within an establishment is covered
  - Have wage data at establishment-occupation level



# Conclusion

- An innovative use of firm-occupation data to extract important economic quantity
- Promising findings to shed light on what is under the hood of superstar firms
- Massive upside potential