

Measuring Automation in Aggregate Data

Joseba Martinez¹ and Johan Moen-Vorum²

¹London Business School & CEPR

²London Business School

NBER SI 2020 IT and Digitization

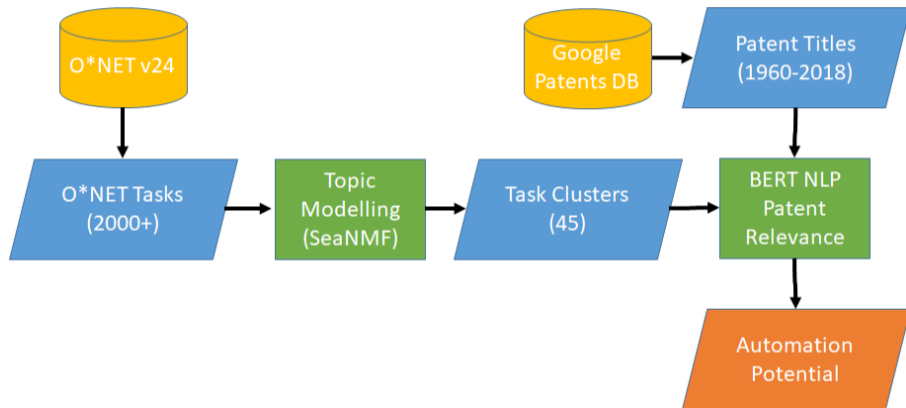
Introduction

- ▶ Measurement of tech development and adoption first-order concern
- ▶ Big knowledge gap in measurement of automation tech diffusion (some great recent work)
- ▶ Mental model for our approach:
 - ▶ Automation tech discovered, *Automation Potential* (AP) of work tasks accumulates
 - ▶ *Automation* is diffusion of this potential through investment
 - ▶ Measure diffusion through investment and/or task displacement

Introduction

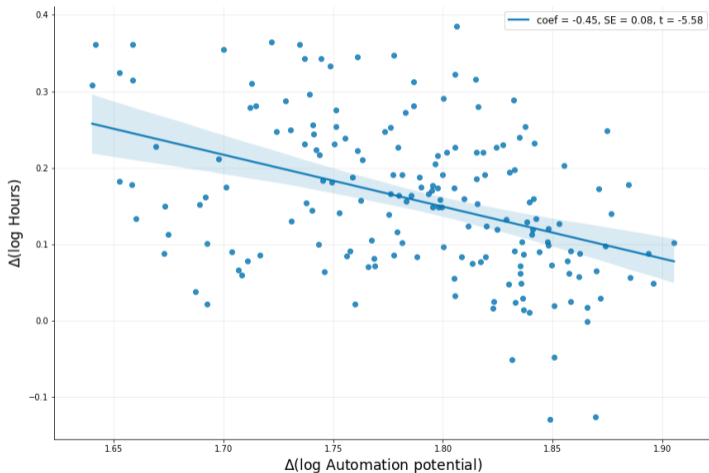
- ▶ What we do:
 - ▶ Define and measure *automation potential* (AP) of work tasks
 - ▶ Measure tech diffusion by linking AP to employment data
- ▶ Our approach:
 - ▶ Agnostic on which technologies enable automation
 - ▶ ... and on which tasks are automatable
 - ▶ Mostly hands-off: rely on NLP algorithms for classification
 - ▶ Data: O*NET tasks, Google Patents Public Dataset, Current Population Survey

Automation Potential



Result 1: Automation Potential/Cluster Hours Correlation

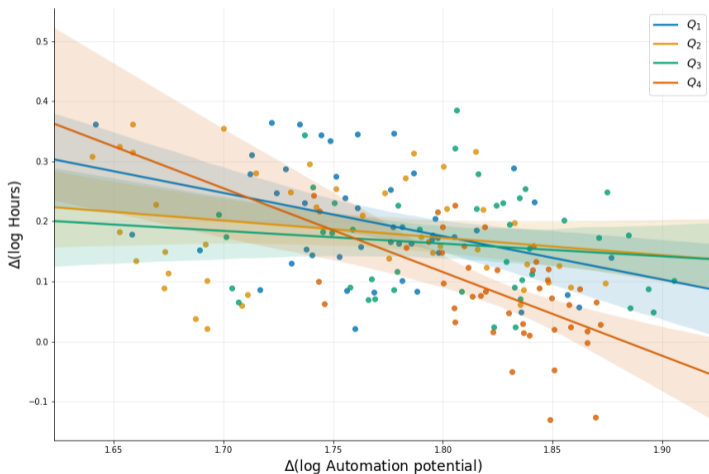
$$\Delta_{10} \log(Hours_{it}) = \gamma_t + \beta \Delta_{10} \log(AP_{it}) + e_{it}$$



Decadal Δ in Cluster Hours on Automation Potential

Result 2: AP/Cluster Hours: Quartiles of Manual-Routine

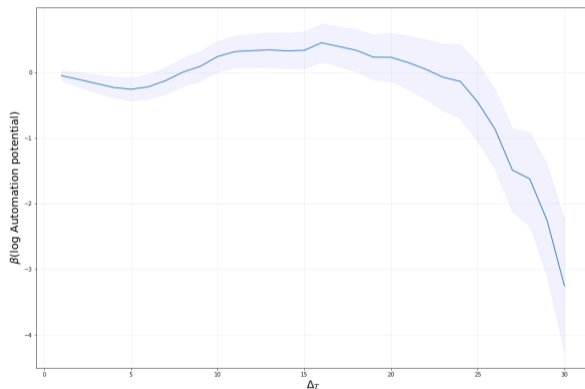
$$\Delta_{10} \log(Hours_{qit}) = \gamma_{qt} + \beta_q \Delta_{10} \log(AP_{qit}) + e_{qit}$$



Decadal Δ in Cluster Hours on AP by Quartiles of M-R

Result 3: Diffusion of Automation Potential

$$\Delta_k \log(\text{Hours}_{it}) = \gamma_t + \alpha_{it} + \beta_k \Delta_k \log(\text{AP}_{it}) + e_{it}$$

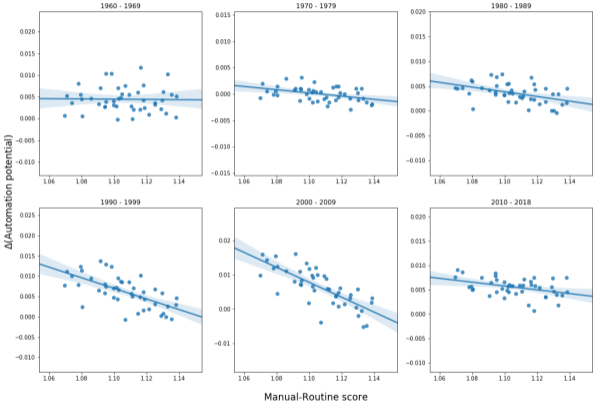


Stacked k period differences, adding cluster fixed effects

Conclusion

- ▶ We propose a measure of *Automation Potential*
- ▶ Measure diffusion of automation tech. by linking AP to employment outcomes
- ▶ Results:
 1. Δ task employment negatively correlated with Δ AP
 2. Correlation is driven by automation of Manual-Routine tasks
 3. Within task regression suggests average diffusion of automation potential is slow
 4. Over decades, patenting efforts have shifted decisively away from Manual-Routine automation

Result 4: Changing Emphasis of Automation Potential



Decadal Δ in Cluster Automation Potential on Manual-Routine Score