Advanced Technologies Adoption and Use by U.S. Firms: Evidence from the Annual Business Survey

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Motivation

Current measures of firm technology adoption and use is limited in

- Coverage
- Timeliness

Frontier moves fast: AI, cloud computing, robotics, etc.

Contribution = Firm-level data, key covariates, links to other data sets (e.g., ASM)

"Until this survey, we have had more papers on robots than we have had data points on robots." – Pascual Restrepo, discussion at AEA 2020

Findings

Adoption

- Digitization is widespread; cloud is a bit less, but adapted to many uses
- Advanced tech adoption is low and skewed
  - Size and age are key correlates
- Worker exposure to new technologies is higher

Technological Hierarchies

- Relationships between digitization, cloud computing, and applications (e.g., machine learning) look cumulative

Technology and Innovation

Annual Business Survey Overview

- First conducted in 2018
- Joint with the National Science Foundation's National Center for Science and Engineering Statistics
- Enterprise-level; mailed to 850,000 ***nationally representative*** employer businesses
  - Sampling stratified across 9 ownership groups within 20 two-digit NAICS industries
- Combines 3 pre-existing surveys
  - Survey of Business Owners (SBO), Annual Survey of Entrepreneurs (ASE), Business R&D and Innovation Survey for Microbusiness (BRDIS-M)

Modules

- New module planned each year
- 2018 ABS (Reference Year 2017) focuses on Digitization (Q1), Cloud Services (Q2) and new Business Technologies (Q3)
- 2019 ABS (Reference Year 2018) will focus on technology adoption and the workforce
- Rotate to create panel data

2018 Tech Statistics

Summary Statistics

	Observations	Mean Employment	Mean Age
Unweighted	573,000	89.32	16.33
Weighted	5,181,000	26.28	15.61

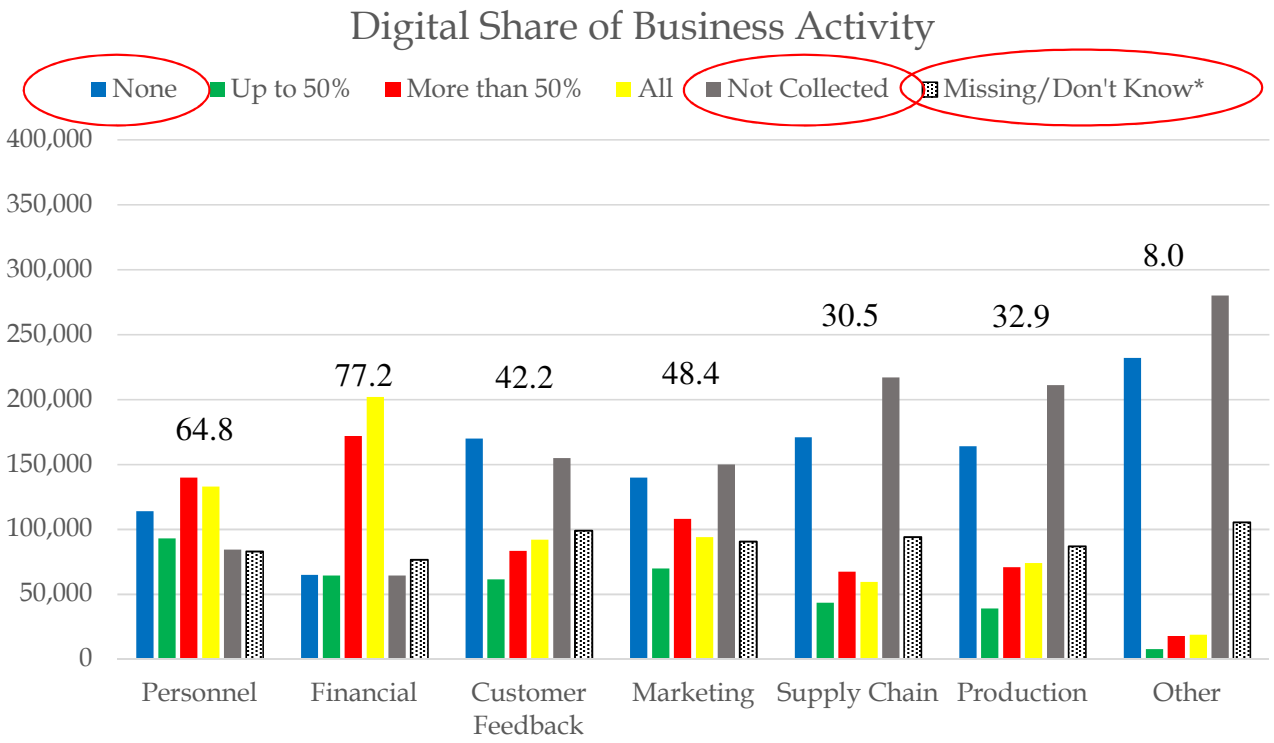
Response rate of 68.7%

Size Distribution

Employment	%	Weighted %	BDS
1 to 9	67	75	76
10 to 49	21	20	20
50 to 249	8	4	4
250 or more	3	1	1

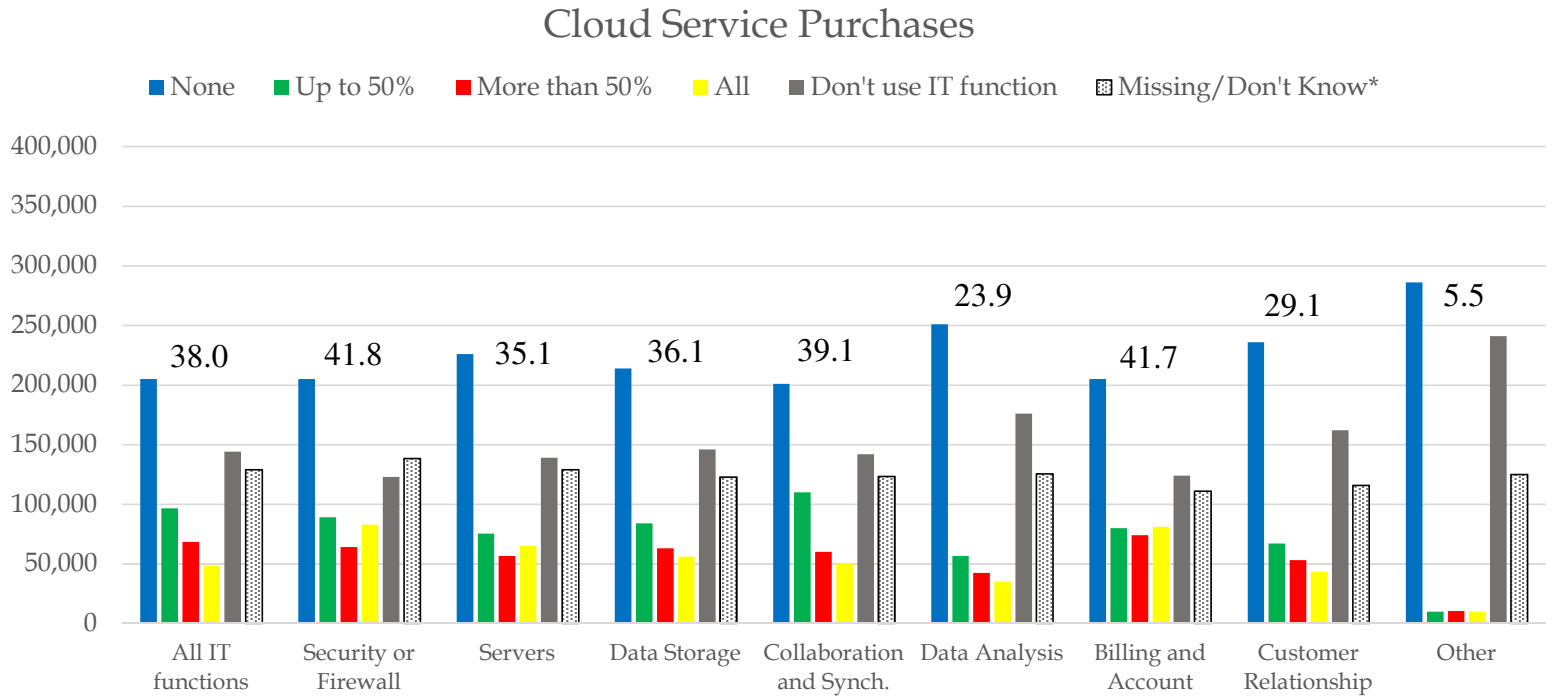
Digital Share of Business Activity (Question 1)

In 2017, how much of each type of information was kept in digital format at this business?



Cloud Service Purchases (Question 2)

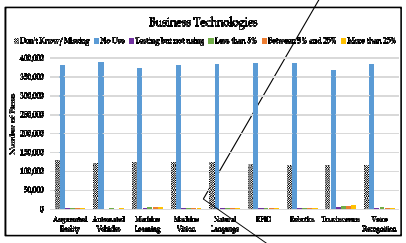
Considering the amount spent on each of these IT functions, how much was spent on cloud services?

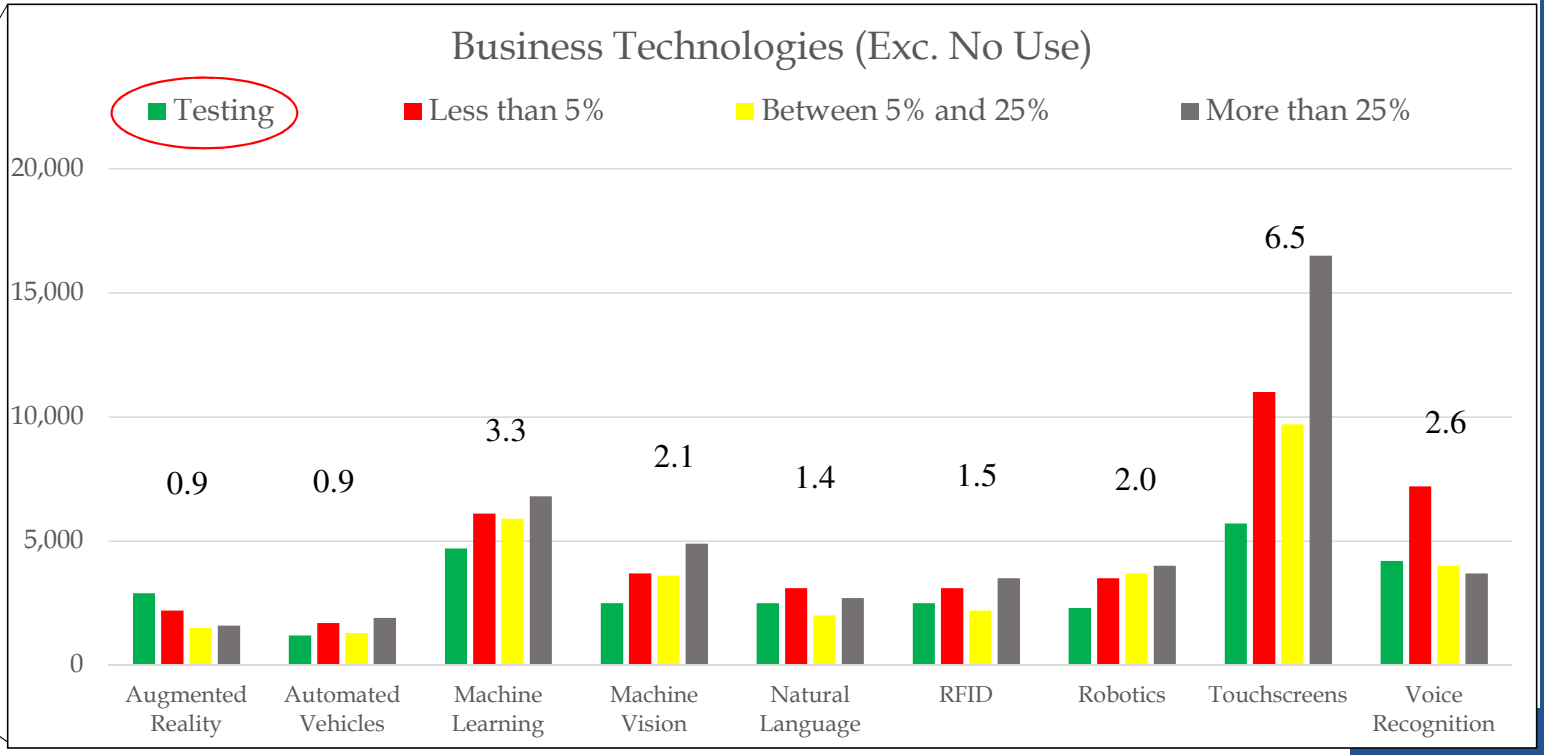


Business Technologies (Question 3)

In 2017, to what extent did this business use the following technologies in producing goods or services?

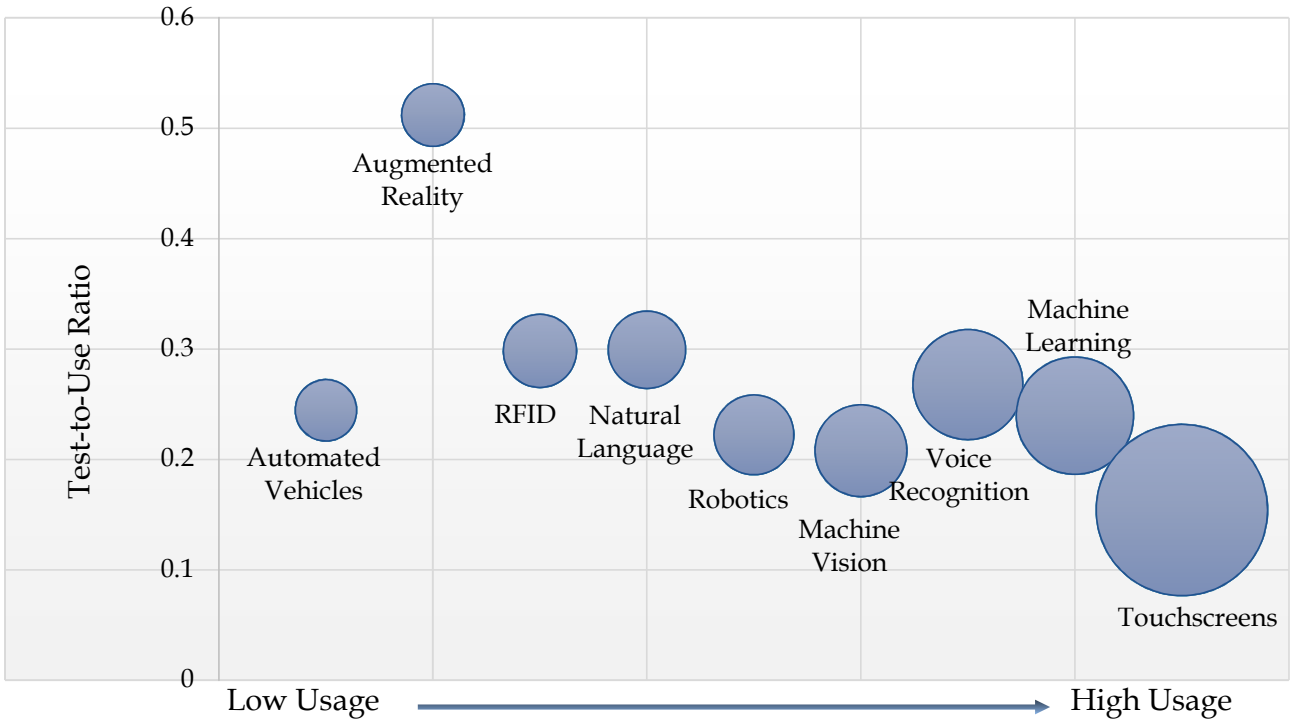
Only ~8-9% report at least one





Testing versus Use for Business Technologies

- Testing-to-Use ratios can help to explain how and why certain technologies get adopted and perhaps indicate future use of certain technologies



Diffusion of Technology is Skewed

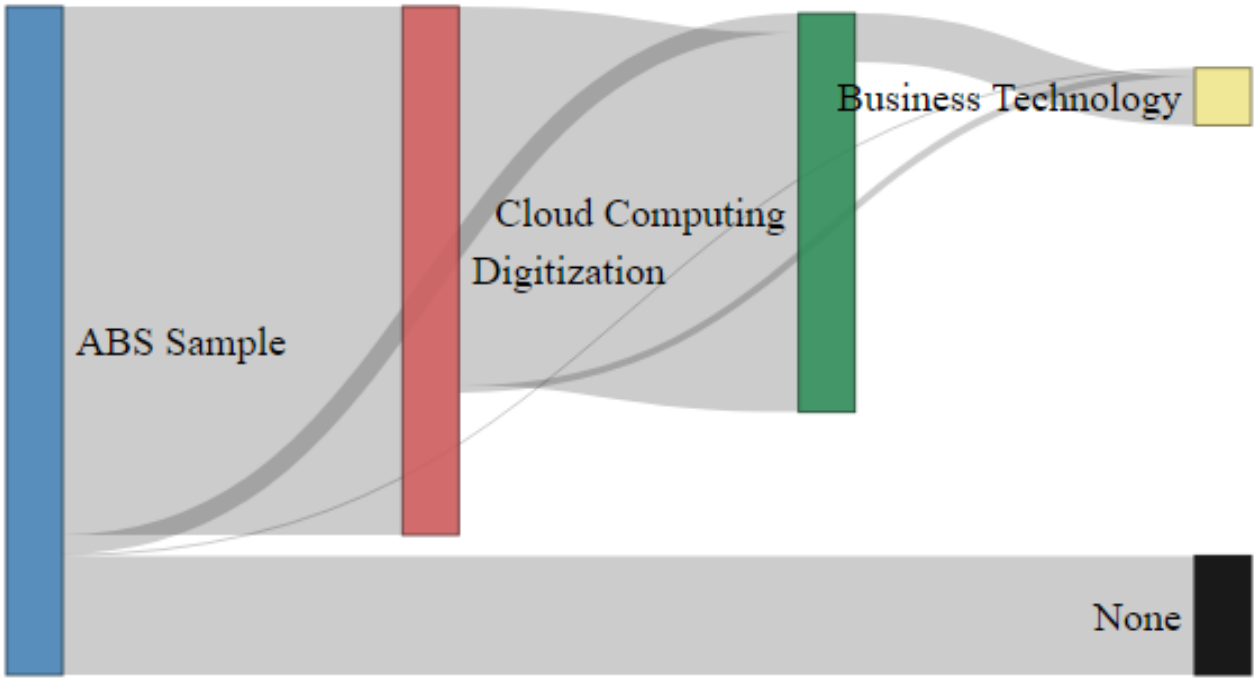
- Latest business technologies are not widely adopted
  - Diffusion is highest among oldest and largest firms
  - Usage increases with size across all age categories

Size and Age Predictors for Business Technology Use

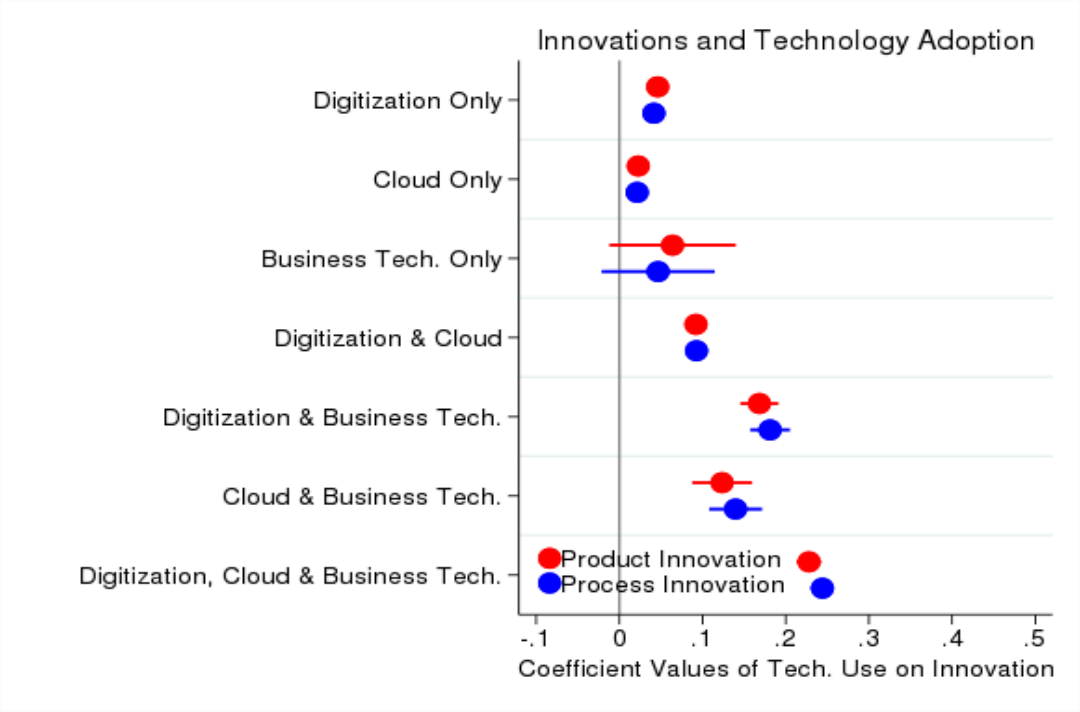
Age\Size	1 to 9 Employees	10 to 49 Employees	50 to 249 Employees	250 or More Employees
0 to 5 years	0.10 (0.08)	0.19 (0.14)	0.25 (0.16)	0.31 (0.15)
6 to 10 years	0.09 (0.07)	0.17 (0.13)	0.24 (0.17)	0.30 (0.18)
11 to 20 years	0.08 (0.06)	0.16 (0.13)	0.23 (0.17)	0.31 (0.19)
21 or more years	0.07 (0.05)	0.14 (0.12)	0.26 (0.21)	0.37 (0.26)

Technological Hierarchies

- Certain technological capabilities need to be fulfilled before firms can adopt new technologies



Technology Adoption and Innovation



Broader and more intensive technology use is positively associated with innovation

Other Open Questions

- "Technology as equalizer" – no evidence here
- Complementarities – lots to dig into
- **"Future of Work" – workers exposure is much higher than firm adoption (esp. for robots and RFID)**
- 2018 ABS data to be made available soon to researchers in FSRDC Network
- 2019 ABS data (technology and impact on workforce and worker types) is currently processing with expected 2021 release

Thank you!

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