

2018 Annual Capital Expenditures Survey (ACES) Capital Expenditures For Robotics

Robotics Workshop

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Disclaimer: Any opinions and conclusions expressed herein are those of the authors and do not necessarily represent the views of the U.S. Census Bureau. The Census Bureau has reviewed this data product for unauthorized disclosure of confidential information and has approved the disclosure avoidance applied. **DRB approval 6/22/20**

ACES Overview

- Provides data on capital investment in new and used structures and equipment by private, non-farm businesses
- Sample
 - Employer businesses - 50,000
 - Non-employer businesses - 20,000
- Reporting Unit
 - Data are collected at the company or firm level.
- Geographic Coverage
 - National
- Industry Coverage
 - Select 3-digit and 4-digit NAICS industries in all covered NAICS sectors.

Motivation/Strategy for Adding the Robotic Question to the ACES

- Data Gap
 - Growing interest and high demand by researchers and congress, etc. on measuring robotics as part of official government statistics
 - Measures of robot adoption intensity
 - Impact on employment and productivity
- Strategy
 - Design the question in the same format as an existing question on the survey for capitalized computer software

Robotics Question

CAPITAL EXPENDITURES FOR ROBOTIC EQUIPMENT

Report capital expenditures for new and used robotic equipment in 2018, Include other one-time costs, including software and installation.

Robotic equipment (or robots) are automatically controlled and reprogrammable machines capable of performing a series of complex tasks autonomously or semi-autonomously.

Robots react to some events and conditions without need of external direction or control and can make decisions or navigate situations they encounter without assistance.

Some of the tasks performed by robots include:

- Assembly
- Cleaning
- Construction and Demolition
- Delivery
- Dispensing
- Inspection
- Machine Tending
- Material Handling
- Mining
- Packaging
- Painting
- Palletizing
- Pick and place
- Rescue
- Security
- Surgical assistance
- Therapy/rehabilitation
- Welding

Exclude:

- Automated teller machines (ATMs)
- CNC machining equipment
- Kiosks – A stationary, consumer oriented machine with a graphic interface and no visible moving parts.

Report dollar values **rounded to thousands**.

(Example: If figure is \$1,179,628.00 report as – \$1,180)

Report capital expenditures in 2018 for new and used robotic equipment, including software, installation, and other one-time costs. (Estimates are acceptable)

If "None", enter "0."

Remarks:

- Briefly list the types of robotic equipment the company purchased in 2018.
- If you are unable to report the capital expenditures for some or all of the robotic equipment the company purchased in 2018, please explain:

2018

Bil.	Mil.	Thou.

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Robotics Editing - Online Reporting Instrument

Internal **Soft Edits** trigger warning messages:

- If both the \$ value and the Remarks box were blank.
 - “Please provide a \$ value [If “None”, enter “0”] or provide an explanation in the Remarks box if no \$ value can be provided.”
- If the dollar value reported for robotic equipment exceeded the company’s total investment in equipment for 2018 reported in an earlier item.
 - “Total robotic equipment should not exceed the total equipment, \$X, you previously entered.”

Analyst Review of Reported Data

Multiple listings were created and made available to the staff to assist them in their review

- By sampled industry – company’s reported and weighted data and percent of industry total
- Aggregate total - descending order of weighted data, sampled industry and percent of total
- Dollar value > ‘0’ with Remarks
- Dollar value > ‘0’ but Remarks box blank
- Dollar value = ‘0’ and Remarks box not blank
- Dollar value missing and Remarks box not blank
- Dollar value missing and Remarks box blank

Analyst Edits of Reported Data

- Reconciled Remarks box with reported data
 - Adjust for out of scope equipment. Ex., kiosks
 - Remarks indicate “no robots” but Robot expenditures is blank
- Reconcile Robotic capex with other data items – Total capex and Equipment Capex
- Respondent follow-up
 - Request an estimate if remarks indicate robots but left Robot expenditures blank
 - Validate/clarify type of robotic equipment

2018 ACES Response Rates

	Percent
Unit Response Rate	78.0
Total Quantity Response Rate (TQRR)	91.0

Robotics Responses

	Percent of Responses
Robotics Capex >0	3.1
Robotics Capex = 0	95.8
Robotics Capex – yes, not tracked	0.2
Robotics Capex – unknown	0.9
Total Respondents	100.0

Impute for Missing Robotics

- ACES nonresponse of equipment expenditures is accounted for by sample weight adjustment
- Missing robotics expenditures is accounted for by imputation
 - Calculate ratio of Robotics capex as percent of Equipment capex
 - By size and industry (for each sample strata)
 - Apply ratio to Equipment capex for cases missing robotics

ACES Robotics Data

Firm Level Statistics

- Robotics estimate is produced at the firm/enterprise level
- Assigned a NAICS to the enterprise
- ACES equipment and structure expenditures are collected for each industry the firm operates in

Example – Equipment Expenditures by Sampled NAICS compared to NAICS segment

	SAMPLED NAICS	Equip Ex – Firm Total	Equip Ex – 61 (Education)	Equip Ex – 62 (Health Care)
Firm A	61 – Education	\$100,000	\$50,000	\$50,000
Firm B	61- Education	\$75,000	\$75,000	0
Firm C	61- Education	\$100,000	0	\$100,000
Total		\$275,000	\$125,000	\$150,000

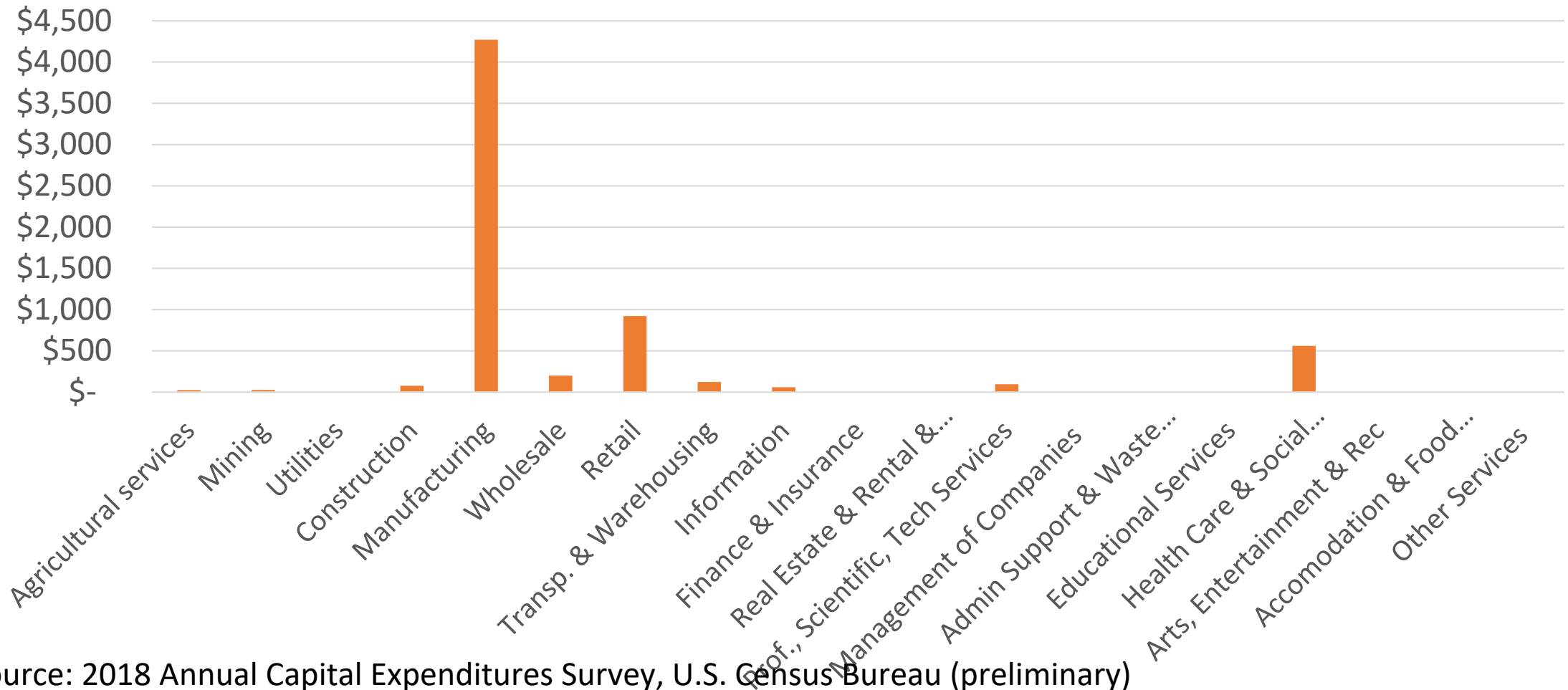
Experimental Data Products

Robotics estimates

- Firm level data- NAICS assigned to firm based on primary activity
 - ACES published estimates – firms report for all industries they operate in
- Robotics – weighted estimate using sample weight adjusted for nonresponse
- Preliminary data

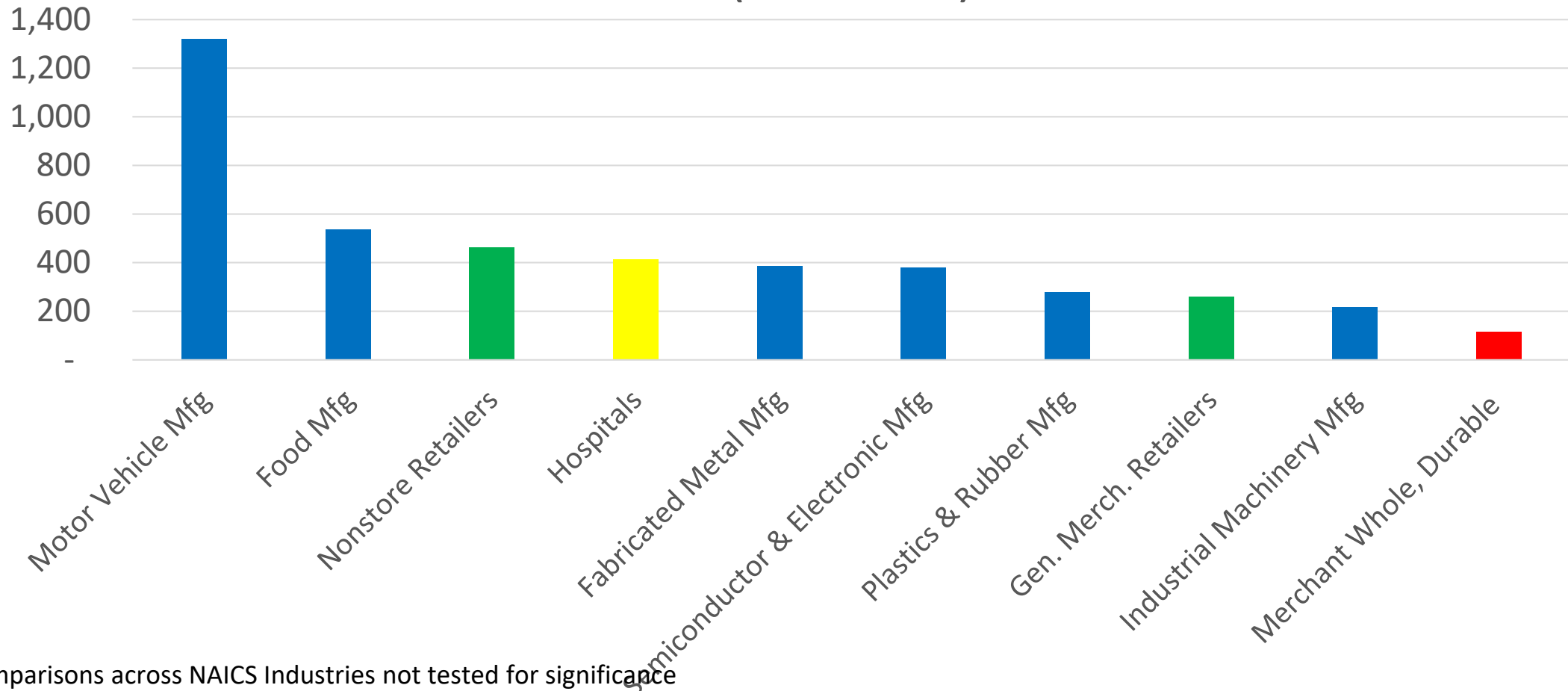
2018 Robotics Expenditures by Sector

(NAICS By Firm) (\$millions)



Source: 2018 Annual Capital Expenditures Survey, U.S. Census Bureau (preliminary)

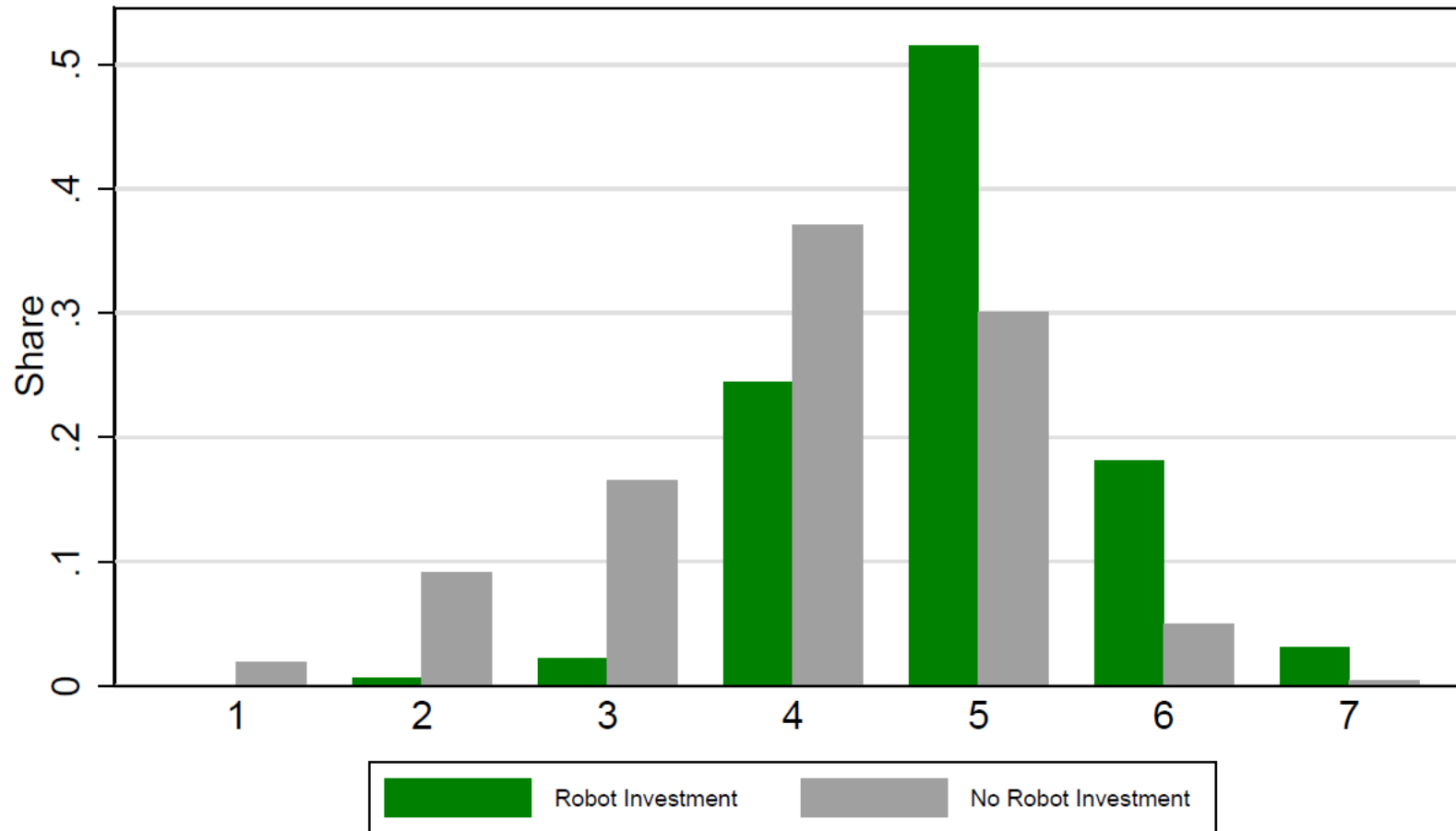
Robotic Capital Expenditures - Top 10 Industries (NAICS by Firm) (\$millions)



Comparisons across NAICS Industries not tested for significance
 Source: 2018 Annual Capital Expenditures Survey, U.S. Census Bureau (preliminary)

Firm Size Distribution: Robot Equipment Expenditures vs Not

2018 ACES, Unweighted. Size class [1-7] based on equidistant log payroll bins.

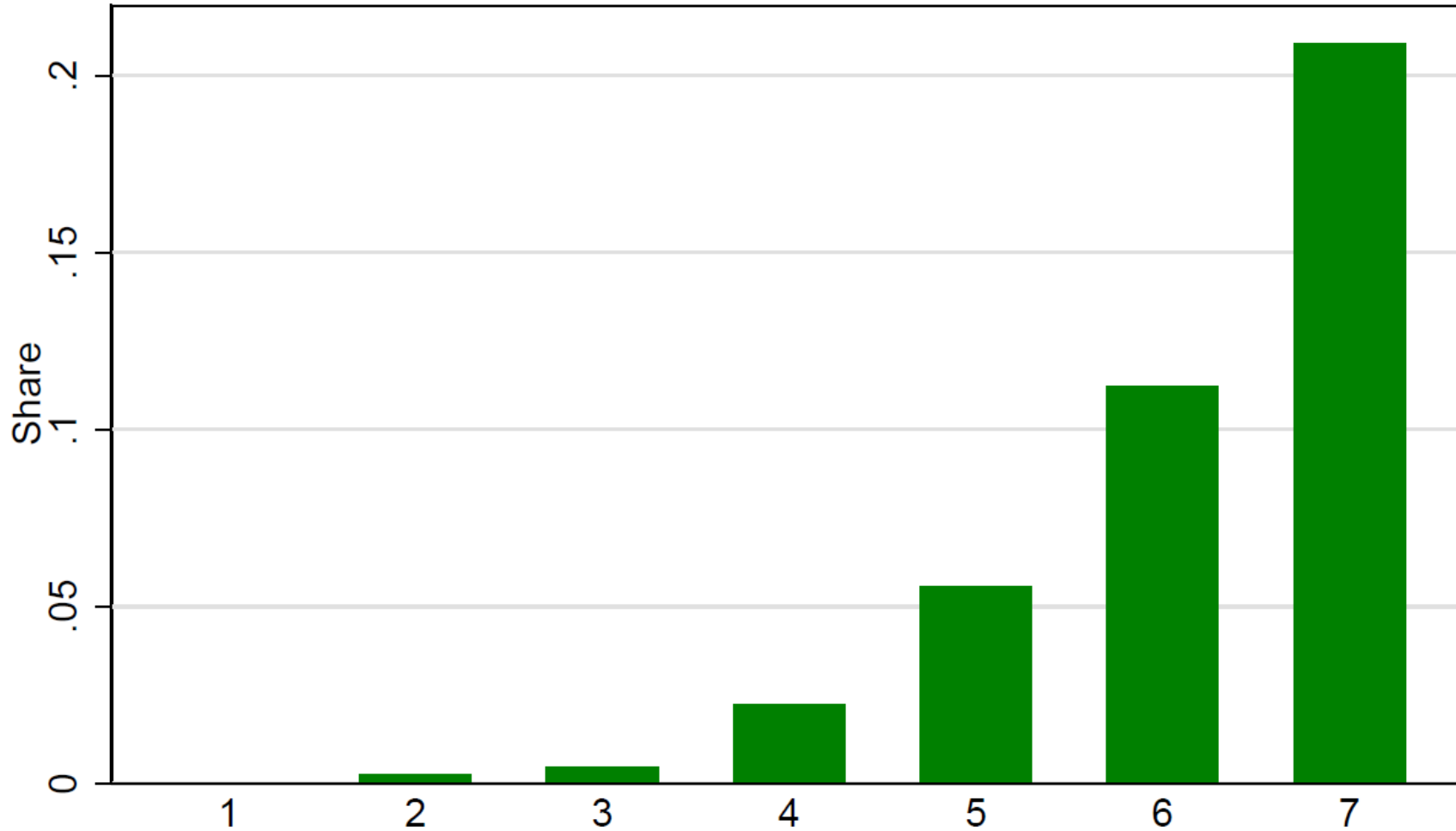


Note: Imputed for delinquents and Non Response.

Source: U.S. Census Bureau. Preliminary.

Share of Firms with Robot Expenditures: By Firm Size Class

2018 ACES, Unweighted. Size class [1-7] based on equidistant log payroll bins.

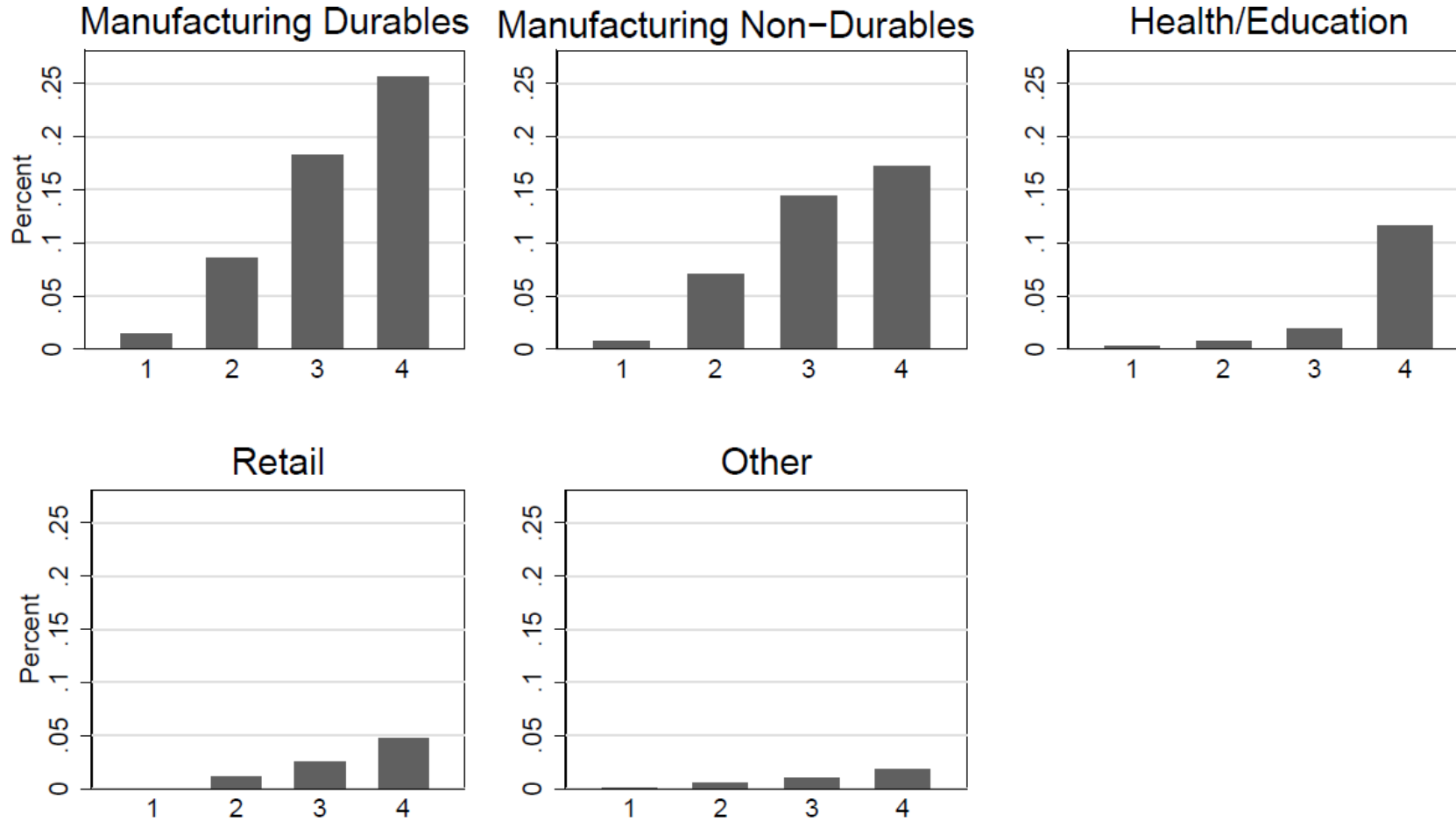


Note: Imputed for delinquents and Non Response.

Source: U.S. Census Bureau. Preliminary.

Share of Firms with Robot Expenditures: by Payroll Quartile

2018 ACES, Unweighted



Note: Imputed for delinquents and Non Response.

Source: U.S. Census Bureau. Preliminary.

Next Steps

- Experimental Data product by 9/30/20
 - ACES web page
 - Tech Stats <https://www.census.gov/techstats>
- Finalize data review
- Refine imputation methods
- Explore creating confidence intervals for Robotics estimates
- Continue data collection and review for 2019 ACES

Explore – Longer Term

- Explore asking for Robotics expenditures by Industry segment
- Explore ways to increase sample size
- Explore adding questions about presence of robotics in firm (y/n checkbox)

Questions/Comments

Thank you!

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