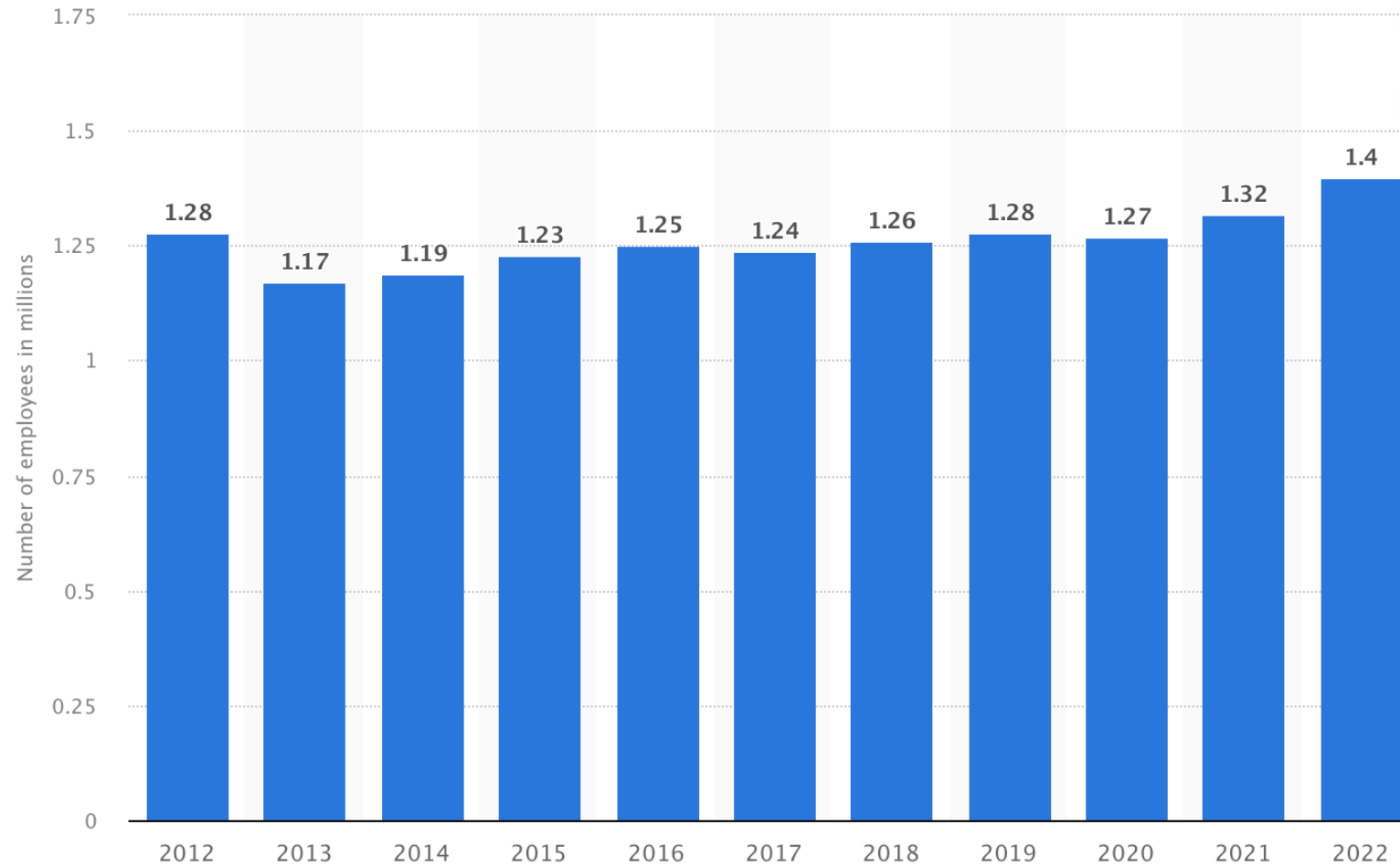# Accounting Skill Shifts
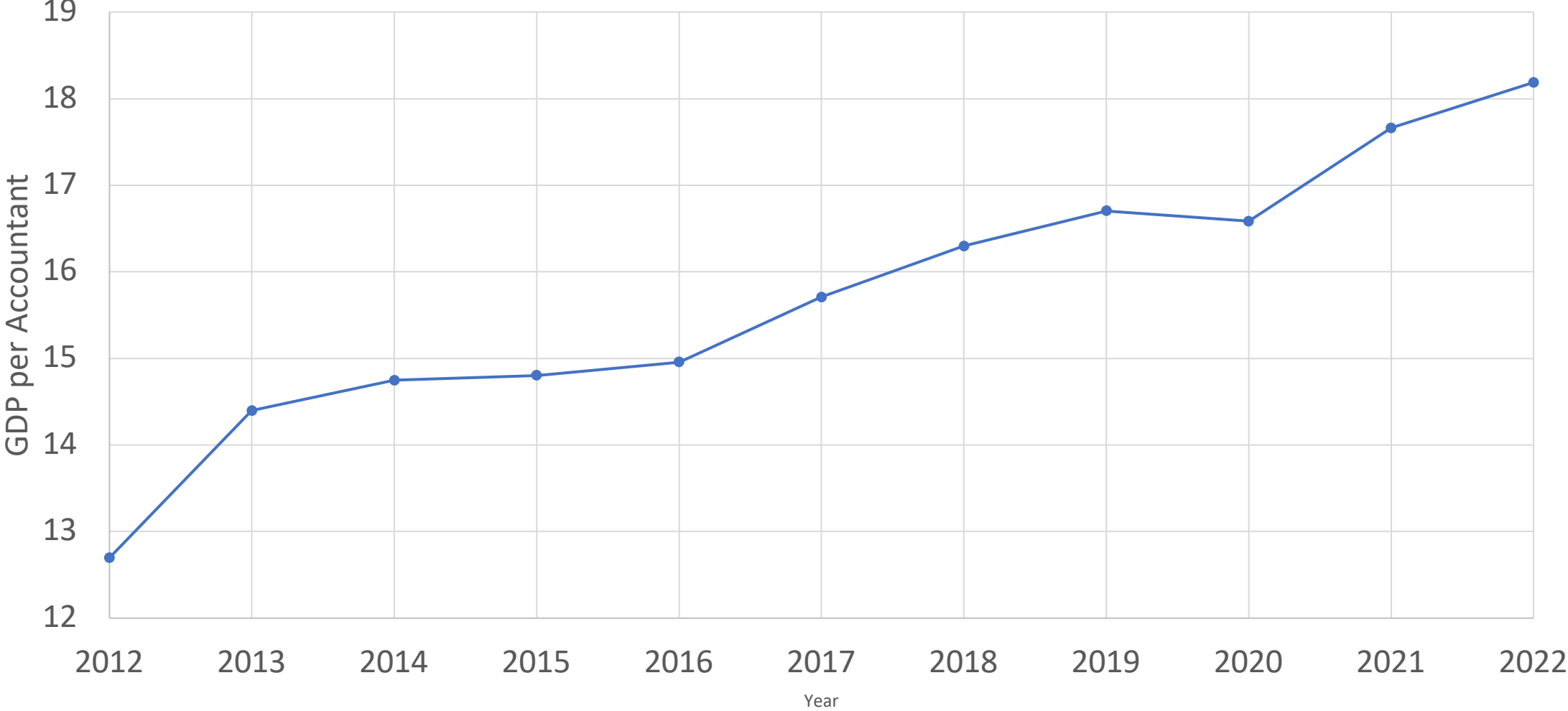
Adam Booker, PhD
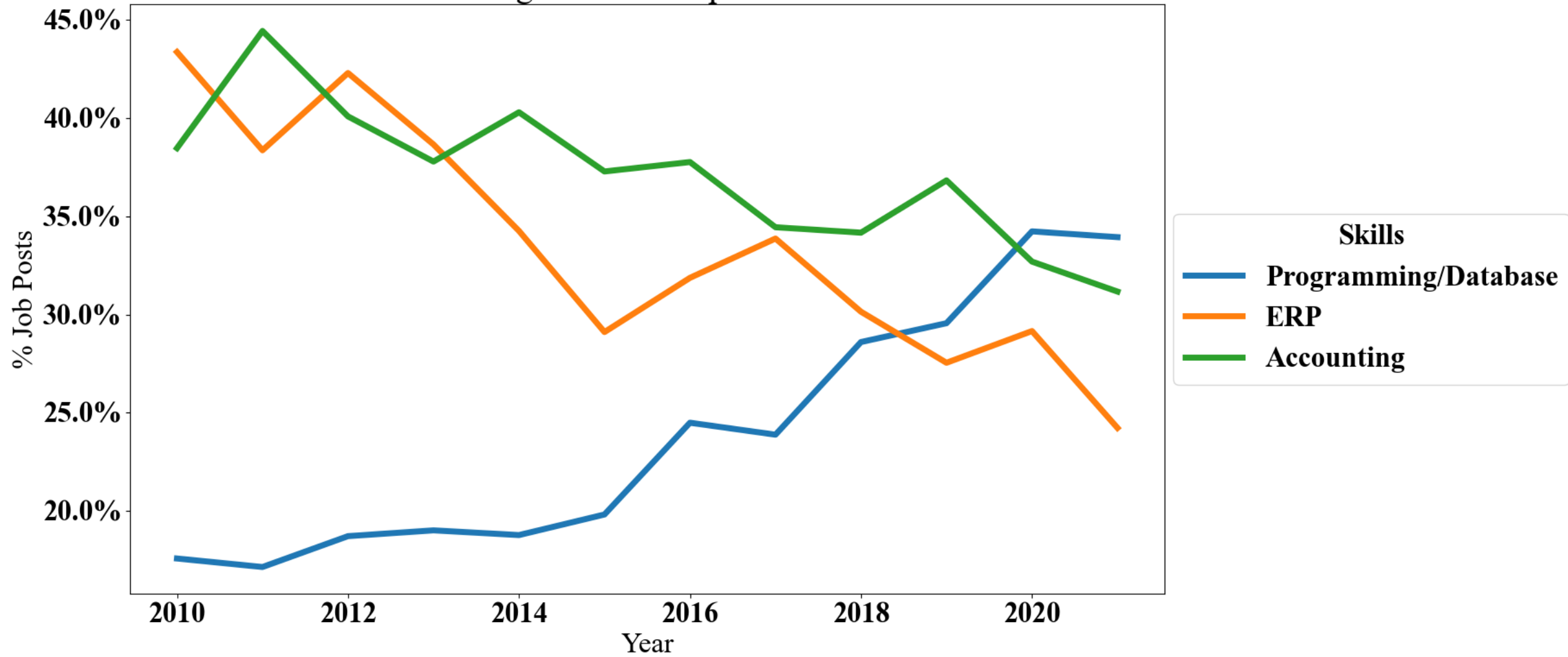
Number of accountants in the workforce

Accounting Efficiency Over Time (millions)

Big 4 Skill Comparison

In the next slides, think about how technologies might make the process more efficient

Financial Statement Preparation and Analysis

Input : Raw data from business transactions (sales, purchases, expenses, etc.).

Process: Accountants organize this data into structured financial statements: the balance sheet, income statement, statement of cash flows, and statement of changes in equity.

Output: Comprehensive financial statements that provide insights into a company's financial health, profitability, cash flows, and equity changes over a specific period.

Budgeting and Forecasting

Input: Historical financial data, market conditions, and company goals.

Process: Using past performance data and future expectations, accountants prepare detailed budgets that allocate resources for the upcoming period. They also use forecasting techniques to predict future financial conditions and results.

Output: Budget reports for internal use that guide spending, investment, and strategic decisions. Forecasts provide insights into future growth, financial needs, and performance expectations.

Cost Analysis and Management

Input: Detailed cost data related to production, operations, and procurement.'

Process: Accountants analyze these costs to identify areas of inefficiency, high expenditure, and opportunities for savings. This includes direct and indirect costs, fixed and variable costs, and product-level costing.

Output: Cost analysis reports that help management make decisions on pricing, product development, process improvements, and cost control measures.

Tax Planning and Compliance

Input: Financial earnings, deductible expenses, tax credits, and applicable tax laws.

Process: Accountants calculate tax liabilities, identify tax-saving opportunities, and ensure compliance with local, state, and federal tax laws. This involves understanding complex tax regulations and applying them accurately.

Output: Tax returns that comply with legal requirements, strategic plans that minimize tax liabilities, and advice on tax-efficient business practices.

Auditing and Assurance Services

Input: Financial statements and related disclosures.

Process: Through auditing, accountants independently examine financial records and statements to ensure accuracy, compliance, and fairness in financial reporting. This involves testing documentation, verifying transactions, and evaluating internal controls.

Output: Audit reports that provide an opinion on the fairness of the financial statements, enhancing the credibility and reliability of financial information for investors, creditors, and other stakeholders.

If technology is increasing efficiency, shouldn't we see a technology skill demand increase over time?

Controlling for *Location* and *Industry*
Occupation Coverage Code 13-2011

$$Skill\ Exposure = \qquad \sum_k \beta_k\ Fiscal\ Year_k \quad + \sum_i \beta_i LMA\ Exposure_i \quad + \sum_j D_j Industry_j$$

$$\frac{\#\ Job\ Posts\ with\ Technology\ Skill}{\#\ Company\ Accounting\ Job\ Posts} =$$

$B_{k=2010}$ is the association between skill demand and the year 2010
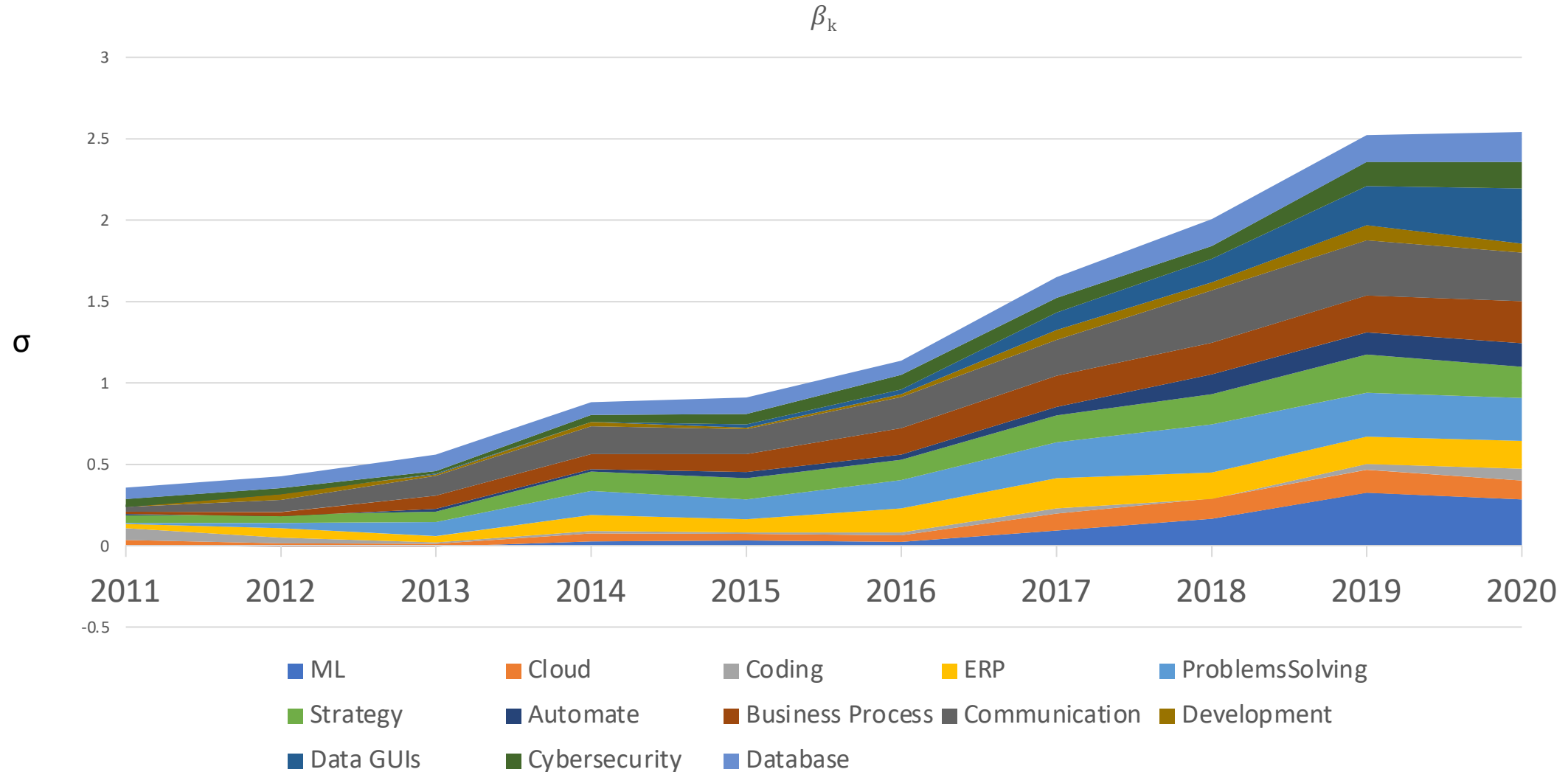
$$\sum_k \beta_k \, Fiscal \, Year_k$$

β_k (Largest Companies)
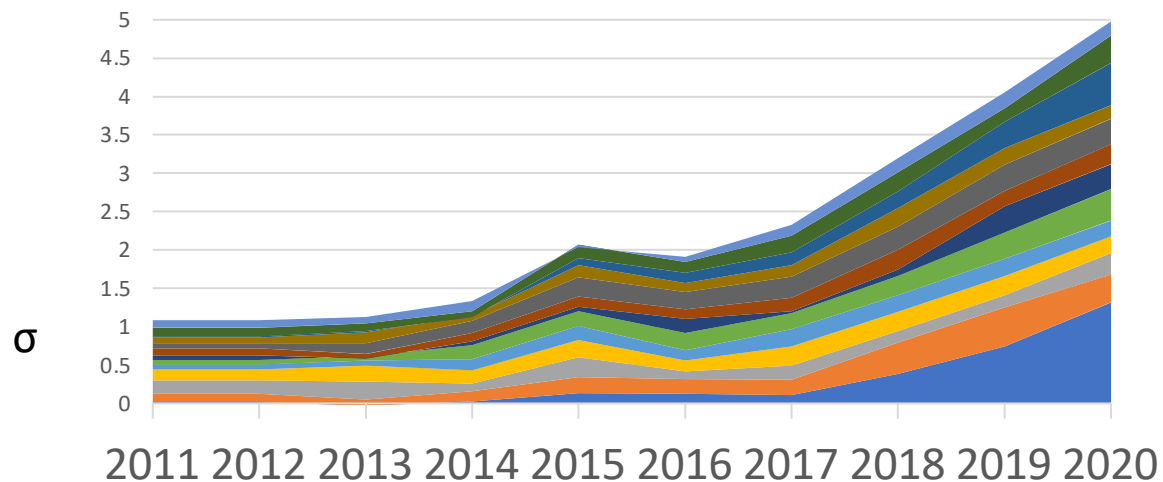
βk (Smallest Companies)
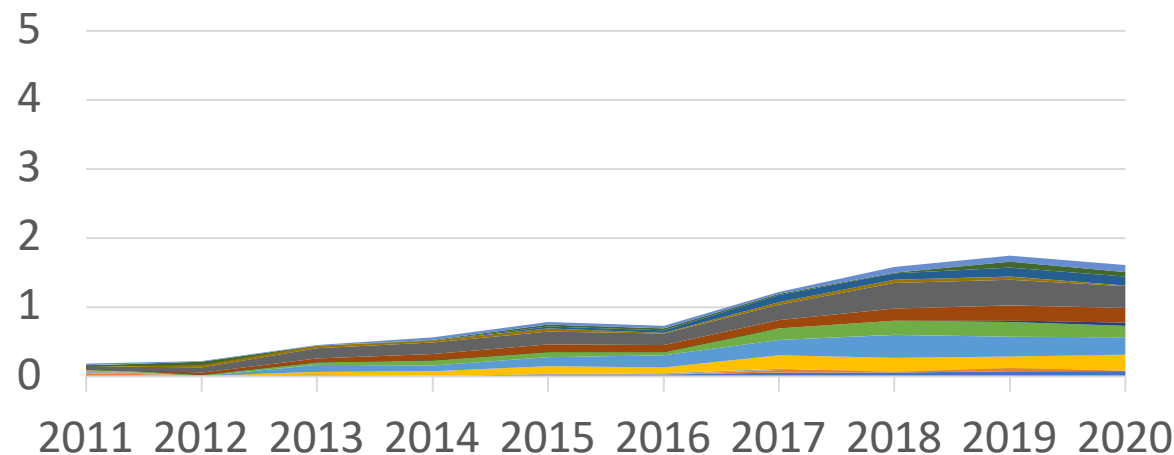
ML Cloud Coding

ERP ProblemsSolving Strategy

Automate Business Process Communication

Development Data GUIs Cybersecurity

Database

Automation and Efficiency ⬤ Data Analysis and Insights ⬤Integrated Systems

1. **Automation and Efficiency**: Accountants with technology skills can automate routine tasks, leading to more efficient processing of financial data. This automation can reduce errors, save time, and lower operational costs associated with sales activities.

2. **Data Analysis and Insights**: With strong technology skills, accountants can leverage advanced data analytics tools to identify cost-saving opportunities. They might find ways to optimize inventory management, reduce waste, or negotiate better terms with suppliers.

3. **Integrated Systems**: Technology-savvy accountants can help integrate various systems (e.g., ERP, CRM, supply chain management) to streamline processes and reduce costs. Improved integration can lead to better demand forecasting, inventory control, and customer relationship management, directly impacting the cost of sales positively.

Technologies & Culture Related to a Decrease in Cost of Sales

Machine Learning*	Automation Platforms
Cloud	Business Process
Coding	Strategy
Database	Communication/Team
Cybersecurity	Problem Solving
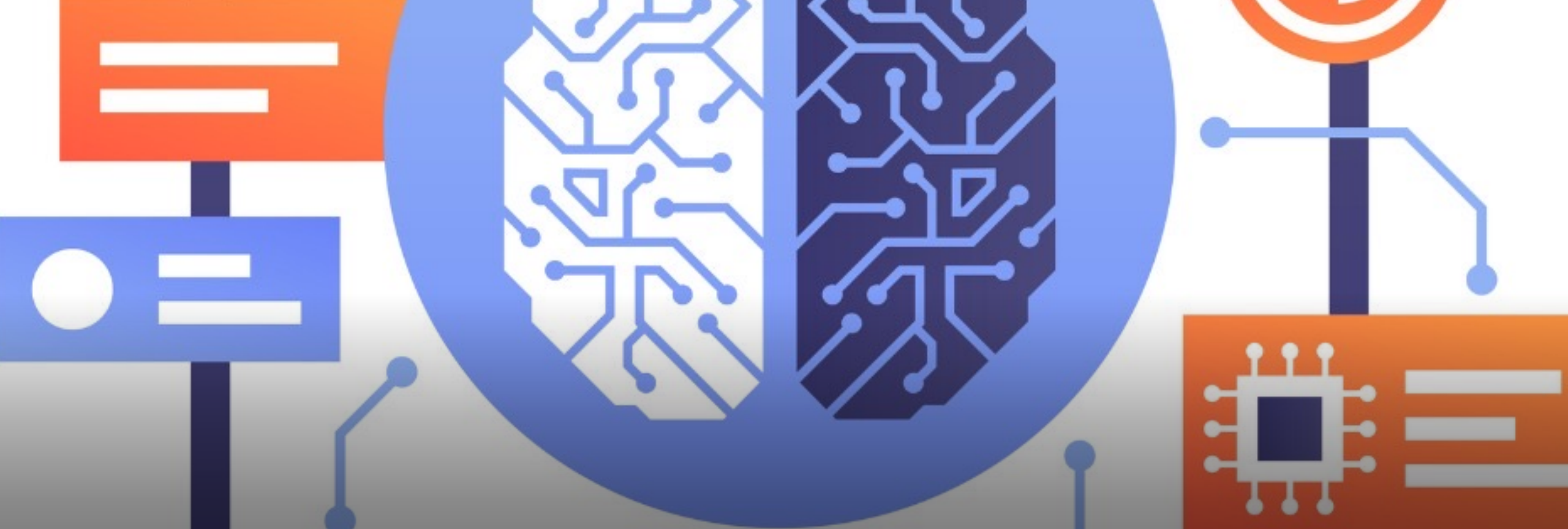
Machine Learning

Machine Learning Skills

- Unsupervised Learning
- TensorFlow
- Neural Networks
- Cluster Analysis
- Supervised Learning
- Unsupervised Learning
- Machine Learning

- Natural Language Processing
- Data Science
- Artificial Intelligence
- Classification Algorithms
- Clustering
- Predictive Models
- Deep Learning

Machine Learning: learn an underlying model of the world
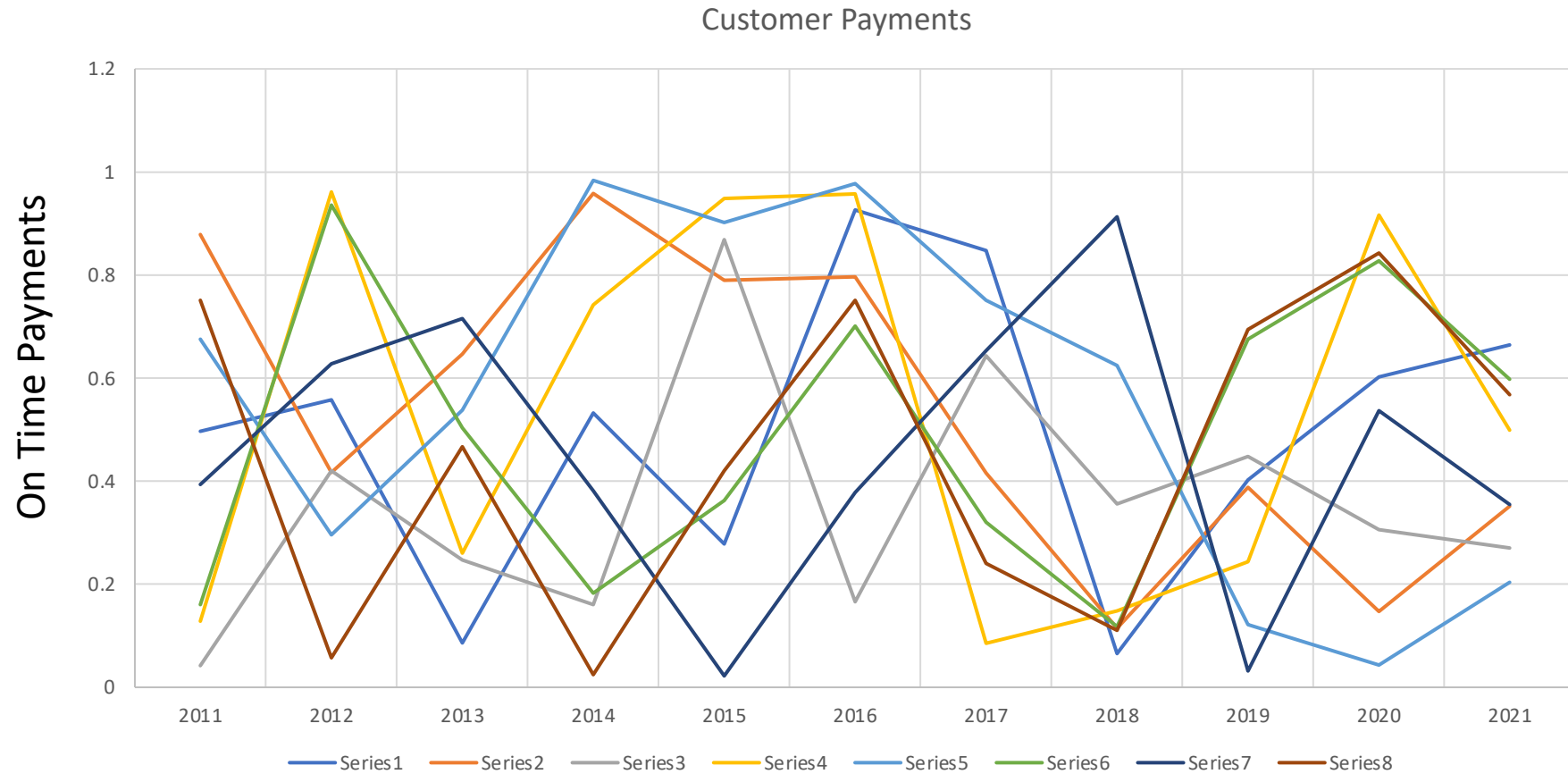
Customer Payments

$LYFT CEO: Taylor Swift fans are generous tippers

"There's a crazy stat that blows my mind. I think it's actually speaks very highly of Taylor Swift fans. They tend to Tip three times higher than average"

Learn how payments are related to customer datapoints

Inputs:

a) Taylor Swift

b) Location

c) Education

d) Homeowner

e) Hobbies

f) Credit Score

Output:

g) Payment Timeliness

Machine Learning can account for all possible combinations of these variables and learn an underlying model for predicting outcomes.

The model might find the following function:

$$g = 3a + 0.2a*0.4b*0.3c + 0.2a^2 + 0.3d^4*0.2f*0.3a + 0.9(f+b-e)^2$$

Deep neural network

Input layer   Multiple hidden layer   Output layer
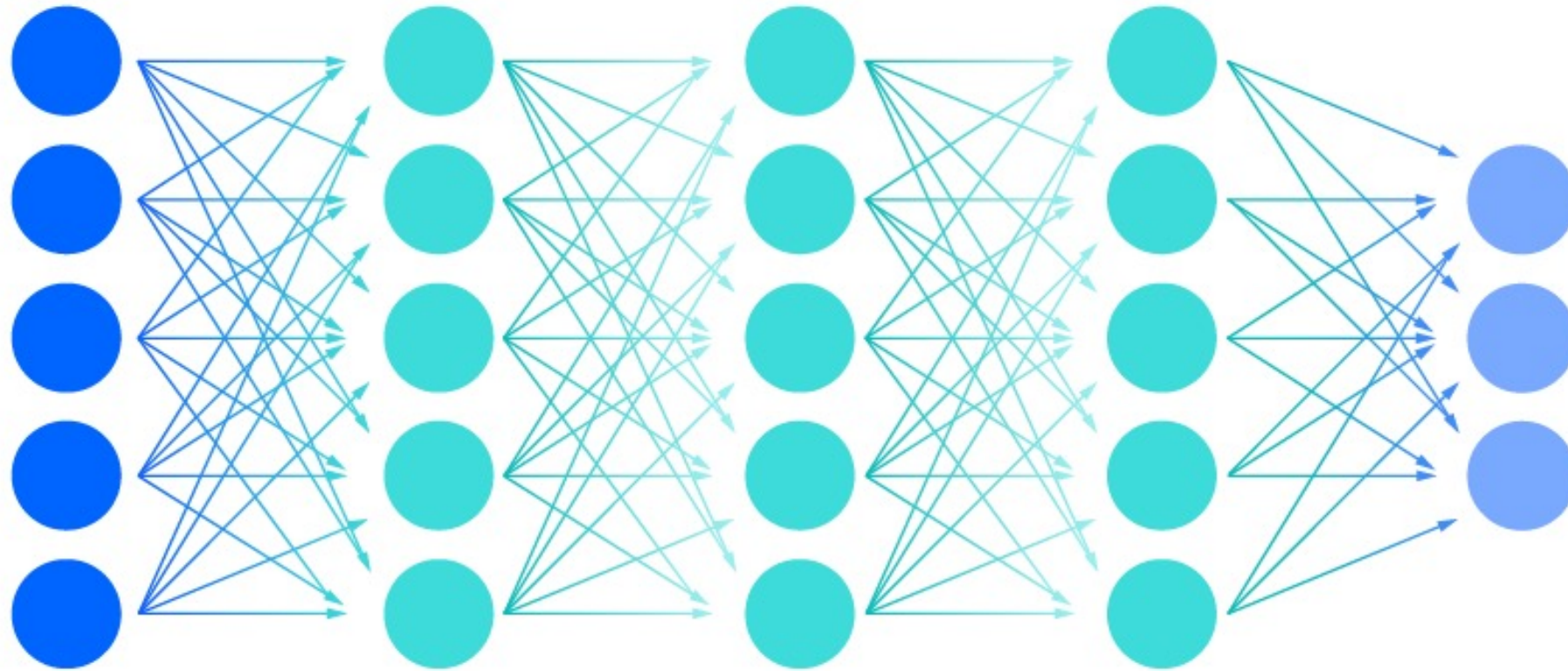
Word Frequency Differences (Recent-Past)

- **Machine:** +1.1
- **Learning:** +1.1

AI becomes more mainstream
- **Artificial:** -0.57
- **AI:** +0.55

- **Data:** +4.94
- **Analytics:** +2.58
- **Accounting:** -0.60

Cloud

Cloud Skills

- Cloud Foundry
- AWS Elastic Compute Cloud (EC2)
- AWS CloudFormation
- Apache Tomcat
- Hadoop Cloudera
- Cloudera
- OpenStack

- Cloud Computing
- Virtualization
- Kubernetes
- Cloud architecture
- Microsoft Azure
- VMware

What is the cloud?

processors + connection + cloud software
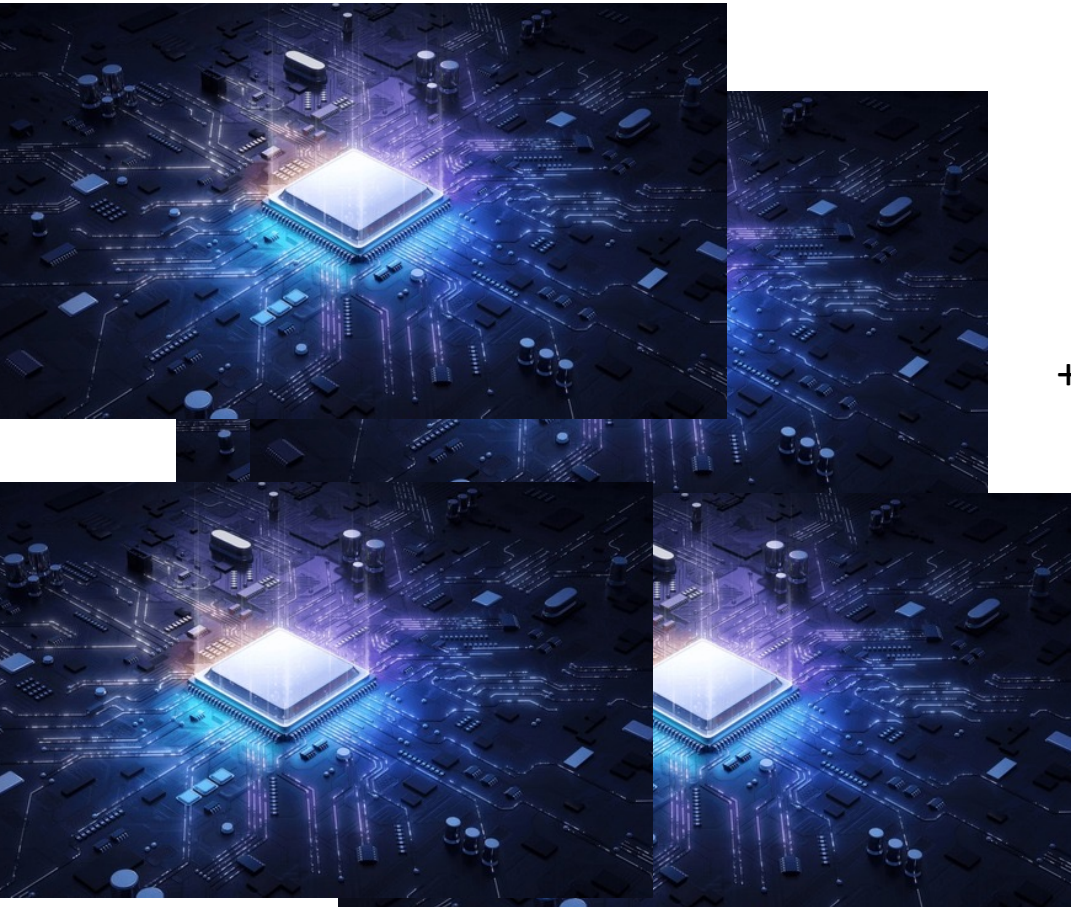
Automation and Efficiency ● Data Analysis and Insights ●Integrated Systems

- Centralized Data Access
- Real-time Data Access and Sharing
- Integrated Software Solutions
- Scalability and Flexibility
- Enhanced Collaboration
- Security and Compliance

Word Frequency Differences (Recent-Past)

- **AWS (Amazon Web Services)**: +0.085
- **Azure**: +0.082

- **Cloud**: -0.945
- **Computing**: -0.057
- **Virtualization**: -0.615
- **Accounting**: -1.459

Coding

Coding Skills

- Ruby

- Java

- Scala

- Hypertext Preprocessor (PHP)

- Bash

- Python

- C++

- Data Structures

- Microsoft C#

- Unit Testing

- Object-Oriented Analysis and Design (OOAD)

- JavaScript

- .NET,PERL Scripting Language

- Shell Scripting

- R

Automation and Efficiency ● Data Analysis and Insights ●Integrated Systems

- Automation of Repetitive Tasks (transforming data, data pipelines)
- Custom model add-ins (tensor flow and Excel or Tableau)
- Connecting systems (APIs)
- Understand accounting system implementations
- Understand how new technologies might impact the profession

Word Frequency Differences (Recent-Past)

- **Programming**: +0.19
- **Python**: +0.52
- **R**: +0.47

- **Computer**: -0.13
- **Server**: -0.21
- **Mainframe**: -0.21
- **Accounting**: -0.38

Automation Platforms

Automation Platforms

- Ansible
- Pega
- Blue Prism
- Puppet
- Chef Infrastructure Automation
- Atlassian JIRA
- UIPath
- Automation Tools

Automation and Efficiency ● Data Analysis and Insights ●Integrated Systems

- Automated Data Entry
- Real-time Financial Reporting
- Streamlined Invoice Processing and Payables/Receivables Management
- Tax Preparation and Compliance
- Payroll Processing
- Audit and Reconciliation
- Enhanced Security and Compliance

Word Frequency Differences (Recent-Past)

Robotic: +0.36

Efficiency: +0.34

Deployment: +0.04

Development: +1.21

Selling: -0.5

Networking: -0.40

Accounting: +1.03

Cybersecurity

Cybersecurity Skills

- PCI DSS
- ISO 27001
- ICS Security Standards - NERC CIP
- Vulnerability assessment
- Cryptography
- Security Operations
- Data Security
- Network Security
- Endpoint Protection

- Information Security
- NIST Cybersecurity Framework
- Certified Ethical Hacker
- Penetration Testing
- ERP Security Fundamentals
- SAP Security
- Data Privacy
- Intrusion detection

Automation and Efficiency ● Data Analysis and Insights ●Integrated Systems

- **Preventing Data Breaches**
- **Ensuring Data Integrity**
- **Compliance with Regulations**
- **Efficient Data Management**
- **Enhanced Trust and Reputation**
- **Risk Assessment and Management**
- **Training and Awareness**
- **Strategic Decision Making**

Word Frequency Differences (Recent-Past)

Compliance: +0.14

Security: +0.63

Cybersecurity: +1.17

Data: +0.58

Testing: +0.20

Reviewer: -0.02

Accounting: -0.26

Database
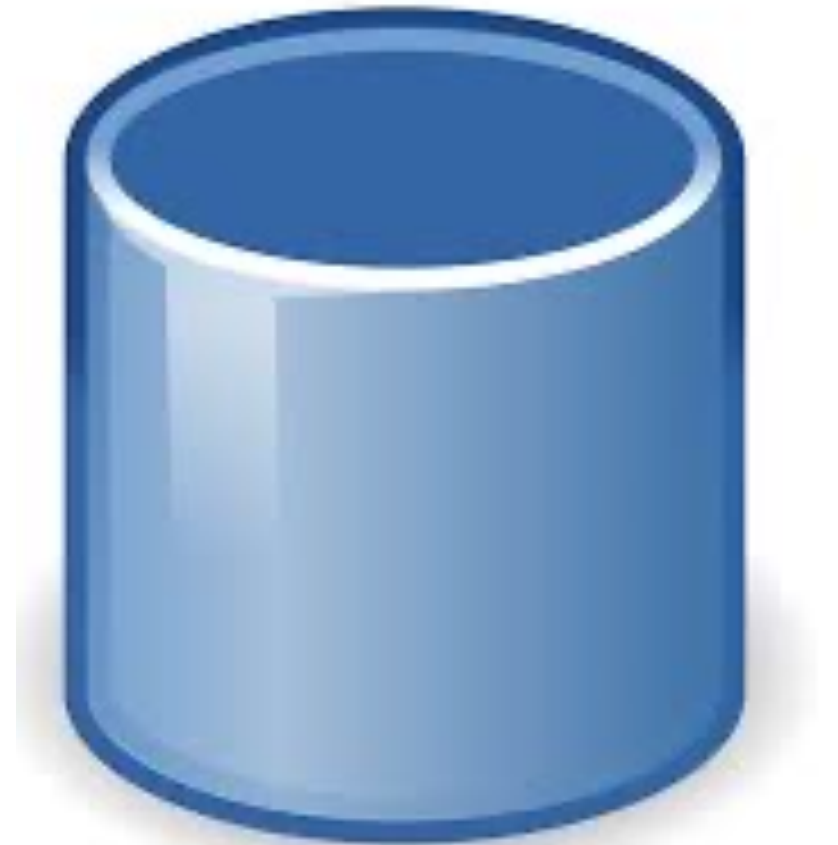
Database Skills

- Transact-SQL
- Relational Database
- Big Data
- MemSQL
- Extensible Markup Language (XML)
- JSON
- Data Warehousing
- Microsoft SQL
- XBRL
- Performance tuning
- SQL Server

- SQL Server Analysis Services (SSAS)
- SQL
- NoSQL
- MySQL
- MS SQL Database Administration
- Database Administration
- Oracle PL/SQL
- Extraction Transformation and Loading (ETL)
- PostgreSQL
- MongoDB
- SQL*Loader
- Database Design
- JavaScript Object Notation (JSON)
- XML
- SQL Server Reporting Services (SSRS)
- SQL Plus
- SQLite
- Relational Databases

Automation and Efficiency ● Data Analysis and Insights ● Integrated Systems

- **Efficient Data Retrieval**
- **Data Integrity and Accuracy**
- **Customized Financial Solutions**
- **Scalability and Flexibility**

Word Frequency Differences (Recent-Past)

Data: +3.66

Analytics: +2.11

SQL: +0.51

Systems: -0.15

Database: -0.15

Oracle: -0.07

Accounting: -0.71

Business Process

Business Process Skills

- Process Refinement
- Business and Processing Documentation
- Business Modeling
- Business Systems Analysis
- Change Management Process
- Business Process Modelling Notation (BPMN)

- Process Improvement
- Process Modeling
- Business Process
- Business Process Modelling
- Business Process Execution Langua (BPEL)

Automation and Efficiency ● Data Analysis and Insights ● Integrated Systems

- Streamlined Processes
- Better Integration
- Improved Forecasting and Budgeting
- Enhanced Decision Support
- Risk Management and Compliance
- Value-added Services
- Cross-functional Collaboration
- Technology Optimization

Word Frequency Differences (Recent-Past)

Management: +1.79

Efficiency: +0.34

Operational: +0.38

Compliance: +0.67

Processes: -0.12

Accounting: +1.03

Strategy Skills

- Cloud Strategy
- Strategy Alignment
- Strategy And Planning Data Protection
- Go-to-market Strategy
- Social Media Strategy
- Business Impact Analysis
- Decision Making
- Business Intelligence
- Business Strategy

- Pricing Strategy
- Branding Strategy
- Root Cause Analysis
- Cybersecurity Strategy
- Supply Chain Strategy
- Key Performance Indicators (KPIs)
- Sales Strategy
- IT Strategy
- Market Strategy

Automation and Efficiency ● Data Analysis and Insights ● Integrated Systems

- Prioritizing Resources
- Process Improvement
- Decision Support
- Technology Utilization
- Risk Management
- Compliance and Regulation
- Cross-functional Collaboration
- Long-term Planning and Forecasting

Word Frequency Differences (Recent-Past)

- **Strategic: 0.11**
- **Planning: 0.02**
- **Objectives: 0.18**
- **Leadership: 0.38**
- **Implementation: 0.03**
- **Optimization: 0.05**

- **Accounting**: -0.79

Communication / Team

Communication / Team Skills

- Teamwork / Collaboration
- Mentoring
- Thought Leadership
- Oral Communication
- Writing
- Organizational Skills

- Written Communication
- Building Effective Relationships

Automation and Efficiency ⬤ Data Analysis and Insights ⬤ Integrated Systems

- **Clear Communication**
- **Effective Collaboration**
- **Conflict Resolution**
- **Project Management**
- **Adaptability and Flexibility**
- **Building Trust and Rapport**
- **Enhanced Problem-Solving**
- **Professional Development**

Word Frequency Differences (Recent-Past)

Collaborate: 0.05

Leadership: 0.15

Support: 0.24

Relationships: 0.13

Communication: -0.071

Teamwork: -0.03

Accounting: -0.54
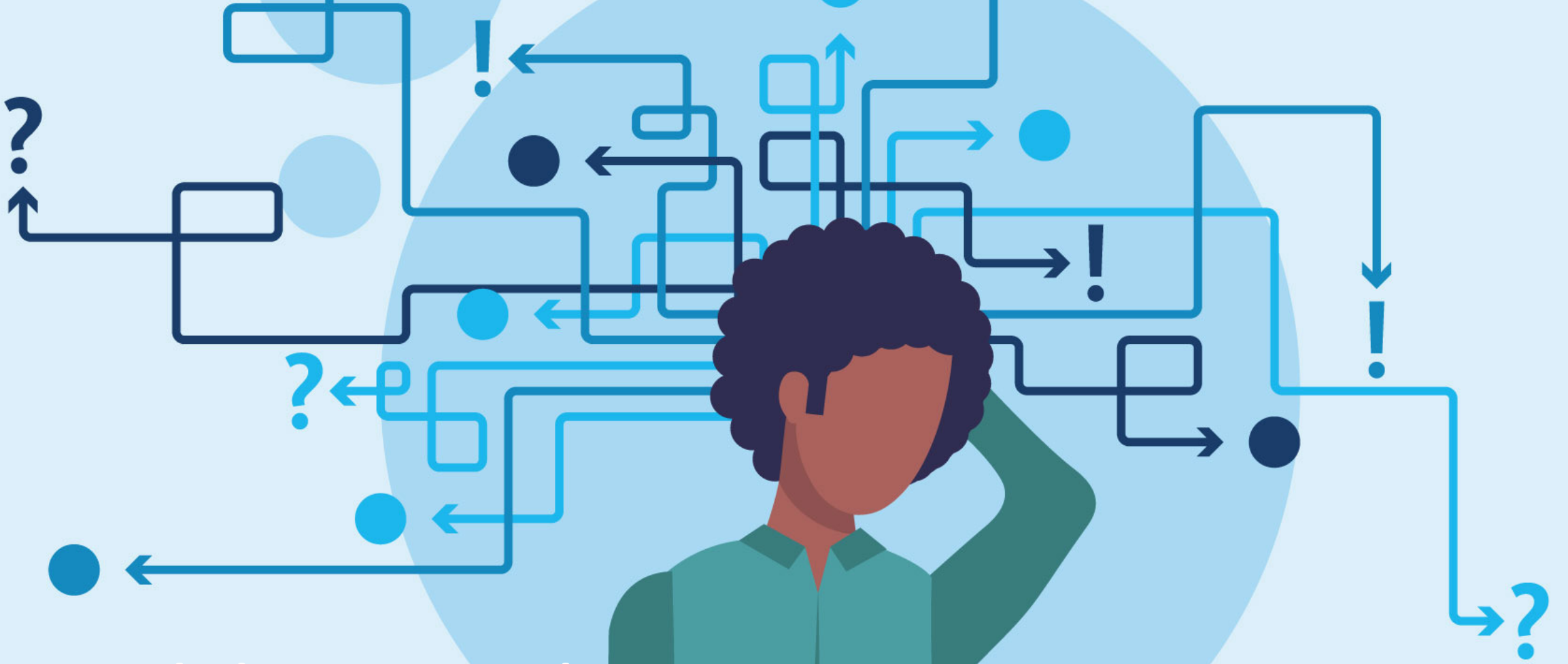
Problem Solving

Problem Solving Skills

- Research
- Critical Thinking
- Detail-Oriented
- Analytical Skills
- Creativity

Automation and Efficiency ● Data Analysis and Insights ●Integrated Systems

- **Data Analysis and Interpretation**
- **Troubleshooting and Debugging**
- **Continuous Learning and Professional Development**

Word Frequency Differences (Recent-Past)

- **Analysis**: +0.11
- **Training**: +0.13
- **Solutions**: +0.12
- **Intelligence:** +0.02

- **Innovative**: -0.02
- **Accounting**: -0.52

Conclusion

- Keenoy (1958)
  - 1900: 1 in 40 employees dealt with record keeping
  - 1940: 1 in 10 employees dealt with record keeping

- Shift toward focus on technology layer
  - Negative association with the word "accounting" except for categories related to automation and business process

- How to best communicate in the language of business?

Thank you

Pre-Post Dummies

	Cloud	Coding	Problem Solving	Strategy	Automation	Business Process	Communication & Team	Cybersecurity	Database
chg COS	0.003**	0.004***	-0.001	0.003	0.002*	-0.003	-0.003	0.002*	0.001
	(2.22)	(2.60)	(-0.52)	(1.45)	(1.87)	(-0.70)	(-0.99)	(1.78)	(0.39)
L=Large	0.198***	0.167***	-0.073**	0.069*	0.103**	0.022	-0.066**	0.181***	0.153***
	(3.51)	(3.11)	(-2.23)	(1.76)	(2.07)	(0.59)	(-2.03)	(3.54)	(3.52)
chg COS x L	-0.011***	-0.018***	-0.025***	-0.022***	-0.011***	-0.015***	-0.023**	-0.012**	-0.009*
	(-3.50)	(-3.77)	(-3.31)	(-4.08)	(-2.90)	(-2.62)	(-2.25)	(-2.45)	(-1.77)
Ind Concen	-0.014	0.019	-0.037	-0.013	-0.016	-0.007	-0.042	-0.021	-0.025
	(-0.49)	(0.60)	(-1.04)	(-0.47)	(-0.48)	(-0.24)	(-1.19)	(-0.82)	(-0.83)
Intangibles	0.002	-0.002	0.033***	0.029**	-0.008	0.028**	0.031***	0.014	0.025*
	(0.17)	(-0.14)	(2.85)	(2.25)	(-0.97)	(2.25)	(2.60)	(1.18)	(1.80)
CapiEx	0.025	0.063***	0.085***	0.101***	0.059***	0.115***	0.081***	0.061***	0.099***
	(1.48)	(3.74)	(8.58)	(8.25)	(3.89)	(9.80)	(8.53)	(3.83)	(7.56)
Goodwill	0.028**	0.048***	0.021*	0.038***	0.030***	0.029**	0.027**	0.044***	0.038***
	(2.39)	(3.86)	(1.92)	(3.08)	(3.62)	(2.41)	(2.46)	(3.77)	(2.80)
R&D	0.027	0.022	0.015	0.044***	0.003	0.043***	0.015*	0.015	0.034***
	(1.55)	(1.37)	(1.54)	(3.76)	(0.15)	(3.84)	(1.69)	(1.01)	(2.64)
R2	0.17	0.27	0.48	0.43	0.14	0.44	0.49	0.28	0.40
SIC & year FE	y	y	y	y	y	y	y	y	y
N Cluster	2220	2220	2220	2220	2220	2220	2220	2220	2220
N	20792	20792	20792	20792	20792	20792	20792	20792	20792

Exposures

	Cloud	Coding	Problem Solving	Strategy	Automation	Business Process	Communication & Team	Cybersecurity
chg COS	0.001	0.001	0.004	0.001	0.002*	0.001	-0.006	0.001
	(1.59)	(0.67)	(0.91)	(0.83)	(1.91)	(0.48)	(-0.96)	(1.11)
L=Large	0.062	0.025	-0.058*	0.065*	-0.002	-0.082***	-0.041	0.055
	(1.45)	(0.69)	(-1.83)	(1.71)	(-0.04)	(-2.78)	(-1.29)	(1.29)
chg COS x L	-0.006**	-0.010***	-0.022***	-0.016***	-0.010***	-0.012**	-0.018**	-0.008**
	(-2.41)	(-3.76)	(-2.71)	(-3.60)	(-2.92)	(-2.15)	(-2.19)	(-2.56)
Ind Concen	0.019	0.009	-0.021	0.002	0.032	-0.010	-0.033	-0.043
	(0.64)	(0.26)	(-0.53)	(0.06)	(0.94)	(-0.31)	(-0.95)	(-1.33)
Intangibles	-0.006	-0.002	0.042***	0.004	-0.010	0.023**	0.032***	0.010
	(-0.75)	(-0.19)	(3.51)	(0.30)	(-1.31)	(2.01)	(2.82)	(1.09)
CapiEx	0.030***	0.047***	0.064***	0.038***	0.038***	0.052***	0.071***	0.026**
	(2.92)	(4.41)	(6.92)	(3.64)	(3.03)	(5.89)	(7.56)	(2.04)
Goodwill	0.020**	0.011	-0.012	0.020*	0.017**	-0.012	0.020*	0.019*
	(2.36)	(1.34)	(-1.03)	(1.77)	(2.02)	(-1.14)	(1.91)	(1.94)
R&D	0.013	0.015	-0.000	0.055***	0.018	0.029***	0.009	0.015
	(0.98)	(1.26)	(-0.01)	(5.68)	(1.35)	(3.63)	(1.01)	(1.30)
R2	0.06	0.07	0.25	0.16	0.07	0.13	0.32	0.07
SIC & year FE	y	y	y	y	y	y	y	y
N Cluster	2220	2220	2220	2220	2220	2220	2220	2220