Labor Displacement and Re-Tasking with Accounting Software Adoption*

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Abstract

Business software is becoming ubiquitous, but little is understood about adoption decisions or the implications for displaced professionals. To address this, we study the interaction between business software adoption and labor market conditions. We first show that adoption is increasing in business and financial operations worker wages. We confirm this finding in a Bartik-style estimation that studies accounting software adoption by private firms and exploits the passage of the Sarbanes-Oxley Act and states' differences in pre-Act exposure to public firm accounting labor markets. We then show that software adoption frees up accountants to focus on operational and finance tasks, and enables the firm-level implementation of practices such as supply chain management and enterprise risk management. Our results illustrate how labor market scarcity can induce technology adoption, which in turn spurs employee re-tasking, consistent with models of directed technological change.

JEL Classification: M41, M48, G30, G31, L51, O33, J23
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1. Introduction

Technological advances are transforming commerce—the tools available to firms, the mix of labor and capital engaged in operations, and the tasks employees perform (Kogan et al. 2023; Kalyani et al. 2025). Such advances are particularly salient in accounting, where software and artificial intelligence are taking over many tasks, raising questions about the outlook for accounting professionals and students (Acemoglu and Restrepo 2019; Friedman, Sutherland, and Vetter 2025). In particular, there is interest in understanding the nature of re-tasking (i.e., employee reassignment to different tasks), if any, that occurs following labor displacement.

Understanding re-tasking requires a framework that connects technology adoption to the labor market conditions that both motivate adoption and shape its consequences. Such a framework is formalized in models of directed technological change (henceforth "DTC"), which predict that when labor becomes expensive, firms adopt technologies that substitute for that labor, displacing workers from tasks and creating the conditions for re-tasking (Acemoglu 2002, 2010). In addition, the framework lends itself to empirical implementation by making explicit the timing and nature of the interactions between labor market conditions and technology adoption.

We study displacement and re-tasking in the context of accounting software adoption among private industrial firms in the early 2000s. This setting maps naturally to the DTC framework: new securities regulation in this period significantly increased demand for accountants, raising wages and creating labor scarcity, which we argue prompted firms to search for labor-saving tools such as accounting software. Labor-saving tool adoption then provides a setting to examine accountant re-tasking.

Focusing on software adoption during the early 2000s allows us to explore meaningful changes in technology use. The 2003 Current Population Survey reports that just 55% of employees used a computer at work, and only 40% connected to the internet or used email while

on the job (U.S. Bureau of Economic Analysis 2003). The typical private firm we study is small (the median firm has 20 employees) and relatively unsophisticated, so their adoption of accounting software is not a given. An additional benefit of this setting is that it permits us to track accountants and the tasks they perform after their firm adopts software.

We identify private firms and software adoption based on task descriptions provided in a large set of resumes from the Revelio database. Our sample contains 57 million jobs from 33 million employees working at 2.4 million private firms. We develop a dictionary of terms indicating an employee's involvement with their employer's adoption (e.g., mentioning "install QuickBooks" or "accounting system implementation" on their resume during a specific employment spell), similar to Babina et al. (2024). We then aggregate our resume-based measures to the state-year level, and examine how adoption patterns (i.e., the number of firms first adopting software that year) vary with labor market conditions.

Survey evidence and software reviews from our sample window indicate that private firms of the sort we study almost exclusively relied on labor for their accounting tasks. These firms typically dealt with financial statement preparation in one of two ways (AICPA 2004; Kawamoto 2004; Bertolucci 2005). First, employees—sometimes accounting managers, other times financial managers or owners—prepared financial statements, often using spreadsheets or paper records. Second, external accountants would prepare the financial statements, either because the firm did not have internal accounting help or because they preferred outsourcing accounting functions.[1] In both cases, the firm is exposed to shifts in prevailing wages in the accounting labor market. They can respond to wage increases by adopting software, either through substituting for their internal accounting help (the first case), or as part of an "insourcing" effort (the second).

[1] The AICPA (2004) survey reports financial statement preparation approaches by firm size. Forty percent of firms with under $5 million of revenue rely on an internal accountant, while 58% use an outside accountant. For firms with between $5 million and $25 million of revenue (>$25 million of revenue), the shares are 71% and 29% (83% and 14%), respectively.

Whether significant adoption follows wage increases is uncertain, however. U.S. private firms are largely exempt from reporting mandates, and we lack evidence on the elasticity of their financial statement production. Facing cost increases, they could simply reduce accounting output (e.g., by decreasing the frequency, length, or verification of financial reports) and eschew preparation options that may require hardware and software investment or learning new tools.

Our first tests examine software adoption as a function of wages and the labor supply in a given state the previous year, state and year fixed effects, and GDP and unemployment controls. Our results provide initial support for the DTC hypothesis. First studying *all business software* to provide motivating aggregate evidence, Figure 1 finds adoptions correlate with measures of labor scarcity: business software adoption increases with business and financial operations worker wages, holding constant the number of these workers in the state-year. Then, we show that a similar pattern emerges when we focus on accounting software and accounting workers. Economically, a one-dollar increase in accountant hourly wages is associated with a 1.8% increase in the number of firms adopting accounting software.

To more rigorously examine the link between wages and software adoption, our main empirical strategy employs a Bartik-style estimation that exploits the labor demand shock resulting from the Sarbanes-Oxley Act ("SOX"), the enactment of Section 404 in particular. Under Section 404, public firm managers now had to evaluate the effectiveness of internal controls over financial reporting and obtain an external auditor's attestation of management's evaluation. The new requirements significantly increased auditor and internal accountant effort, as evidenced by the spike in audit fees and compliance costs occurring upon the 2004 implementation of Section 404 (Coates and Srinivasan 2014; Audit Analytics 2022). Crucial for our purposes, the regulation

created large ripple effects for *private* firms not subject to the rule but relying upon a common, rather inelastic accountant labor pool.[2]

The second piece of our empirical strategy utilizes pre-SOX differences in states' exposure to public firm accounting labor markets, as measured by the ratio of the number of accountants to the number of public firms. Intuitively, holding constant the number of accountants in a state, those states with more public firms will experience a bigger post-SOX labor demand shock, leading to higher wages and a smaller pool of accountants available to private firms. Throughout our paper, we refer to such states as "shortage states."

We validate our empirical strategy multiple ways. First, we document CPA firms and regulators discussing an accountant shortage and large audit firms aggressively seeking talent from unconventional sources following the SOX enactment (PCAOB 2005; Haskell & White 2006). Second, we develop a dataset of job transitions, and find elevated accountant switching from private firms or small audit firms to public firms or the Big N audit firms that typically audit them post-SOX. Notably, the switching increase is starkest in shortage states—those with the lowest ratio of accountants to public firms. Third, we find the greatest post-SOX accountant wage increases in these same states, in line with the theoretical construct of factor cost shocks incentivizing technology adoption in DTC models (Acemoglu 2002, 2010). Collectively, even if accounting labor is not fully substitutable across the entire labor supply from bookkeepers to partners on large public engagements, this evidence points to sufficient overlap to result in private firms facing accountant shortages and wage increases.

[2] Supporting this, audit fee increases for non-accelerated filers *not subject to SOX* exceeded 40% (Ettredge, Sherwood, and Sun 2018), and private firms reduced their propensity to provide attested financial statements to their banks (Duguay, Minnis, and Sutherland 2020). In Section 3.b, we offer additional evidence of only partial segmentation in the accountant labor market: developments affecting large audit firms and their public clients often spill over to other segments of the accountant labor market, given the inelasticity of the accountant labor supply.

Results from our Bartik-style estimation reinforce our initial findings: following SOX, accounting software adoption increases more in shortage states. This finding is not sensitive to alternative approaches to either measuring shortages or gleaning software adoption information from resumes. Moreover, placebo tests indicate that we are not merely picking up a common investment trend unrelated to the labor shortage construct: anti-virus software adoption does not vary with our accounting labor market measures in the post-SOX period.

In subsequent tests, we leverage this software adoption and our main empirical strategy to investigate displacement and re-tasking of accountants. Software is a form of automation technology that can displace labor from routine tasks (Acemoglu and Restrepo 2018). Displaced workers may then struggle to find alternative work, or, be re-assigned to different, less automatable tasks. Lending support for displacement and re-tasking in our setting, QuickBooks advertisements state "accounting software should be such that it automates your accounting process *so that you get time on your side for core business activities*" (emphasis added).[3]

To study displacement and re-tasking, we use accountants' resumes and our Bartik framework to track their employment, job titles, and tasks over time. In terms of displacement, in shortage states we find a greater increase in accountants exiting the labor market, and especially, accountants switching job titles within their firm. For the latter, the most common new roles include investment analyst, credit analyst, operations manager, and business analyst.

This then motivates our investigation of tasks, with a focus on three task categories linked to these new job titles: strategy & operations, finance & risk, and management accounting. We find a significant increase in shortage states of the proportion of accountants taking on tasks in all three categories. Our instrumental variable tests find this re-tasking is happening through software adoption. We then study management practice adoption at the firm level (e.g., Bloom and Van

[3] https://quickbooks.intuit.com/global/resources/accounting-and-bookkeeping/cloud-accounting-software/

Reenen 2007), and find that the re-tasking results in the firm picking up new practices altogether, particularly those related to supply chain optimization, enterprise risk management, and credit analysis, and not merely reassigning accountants to their existing practices.

Our final tests examine how the transition from labor- to software-driven financial statement preparation affects an additional dimension of private firm accounting labor demand: seasonality. Given the preponderance of December 31 fiscal year ends, accounting labor demand is highly seasonal. As a result, "busy season" is a defining characteristic of accounting work, and has been linked to attention, staffing, and quality issues that lead to audit failures (Sundgren and Svanstrom 2014; Maksymov et al. 2024). We find accounting software adoption is associated with less concentration in accounting job start dates and fewer January start dates, consistent with software adoption reducing the seasonality of private firm accounting labor demand.

We make three contributions. First, our paper adds to the burgeoning literature studying firm technology adoption (Bloom, Sadun, and Van Reenen 2012; Fedyk et al. 2022; Babina et al. 2024; Law and Shen 2024; Kalyani et al. 2025). One research stream focuses on compliance as an important adoption motive, as firms implement software to comply with new reporting requirements or industry regulations (Charoenwong et al. 2024; Heese and Pacelli 2025; Kim et al. 2026). Less is understood about how market forces shape adoption. This is notable because much technology adoption occurs absent an apparent compliance motive; adoption is also prevalent among private firms facing limited regulation. Our analyses of business software indicate that labor market conditions, and labor scarcity in particular, are an important adoption driver. As we elaborate in our conclusion, our findings and framework can motivate and inform analyses of other technology adoption settings, including artificial intelligence (AI), where labor costs can spur adoption and automation leads to the reallocation of workers to tasks requiring judgment and other skills less subject to automation.

Second, our evidence adds to ongoing discussions of how technology adoption affects professional labor markets (Kogan et al. 2023; Eloundou et al. 2024). In particular, there is heightened interest in employee re-tasking in accounting, as Acemoglu and Restrepo (2018) highlight how "white-collar workers in accounting… and some managerial occupations are seeing some of the tasks they used to perform being replaced by specialized software and artificial intelligence" (p. 4). Our finding of accountant re-tasking to operational duties contributes to ongoing analyses of accountant labor demand amidst technological change (Boke et al. 2024; Eloundou et al. 2024; Choi and Xie 2025; Downing 2025; Friedman et al. 2025) and connects to work studying the career paths of accountants (Barrios 2022; Le 2025; Pandey et al. 2025).

Last, we provide large sample evidence on software's growing role in private firms' accounting practices. Research on financial statement preparation choices focuses on the overall decision to prepare or whether to use accrual accounting (Allee and Yohn 2009; Cassar, Ittner, and Cavalluzzo 2015; Lisowsky and Minnis 2020). Less is understood about how firms choose between labor- versus software-driven preparation.[4] In the ensuing two decades since our sample period, software has emerged as a leading preparation approach for private firms (e.g., in 2023, Intuit reported having over seven million QuickBooks subscribers).[5] Our analyses shed some light on how this transition occurred. In addition, our results indicate this transition resulted in firms implementing several new management accounting practices, which research has linked to improved productivity and profitability (Drexler, Fischer, and Schoar 2014; Bruhn, Karlan, and Schoar 2018; Barrios et al. 2025; Call et al. 2026a). In this respect, we add to the literature linking financial and managerial accounting (Hemmer and Labro 2008; Labro 2025).

[4] Using survey data on microenterprises in Central America, Aguilar, Lind, and Ramesh (2025) find that owner motivations, financing needs, and business strategies predict accounting system adoption.
[5] See https://www.intuit.com/oidam/intuit/ic/en_us/content/intuit-fact-sheet-document-icom-20230906.pdf

2. Theoretical Foundations

Technology adoption at firms has been traced to several motives, including compliance (Charoenwong et al. 2024; Heese and Pacelli 2025; Kim et al. 2026), strategic considerations (Liberti, Sturgess, and Sutherland 2022), and risk management (Kim 2025). The motive we focus on relates to factor market conditions for the firm's production inputs. Specifically, DTC models posit that technological innovation and adoption can often be traced to factor scarcity, labor in particular. As Acemoglu (2010) explains, "if a factor becomes more expensive, the demand for it should decrease, and we may expect some of this adjustment to take place by technology substituting for tasks previously performed by that factor" (p. 1039) (see also Hicks 1932).[6]

DTC models build upon the Habakkuk hypothesis in economic history (Habakkuk 1962). Habakkuk posited that labor scarcity was an important driver of the across-country differences in industrial development during the nineteenth century: "It seems obvious—it certainly seemed so to contemporaries—that the dearness and inelasticity of American, compared to British, labour gave the American entrepreneur with a given capital a greater inducement that his British counterpart to replace labour by machines" (p. 17). The Habakkuk hypothesis has been used by Allen (2009) and Elvin (1972) to explain the link between wage levels and adoption of the spinning jenny, water frame, and carding machine.

The DTC framework is useful for understanding accounting software adoption in the early 2000s period we study. Accounting processes around this time were labor-driven, with firms relying on accounting labor to help with financial statement compilation, verification, analysis, and reporting. As summarized in the introduction, this accounting labor reliance took two forms. First, firm accountants or managers prepared financial statements, often using spreadsheets or

[6] While this excerpt focuses on cases where technology is labor-saving, Acemoglu (2010) also describes instances where technology is labor-complementary, in which case labor scarcity reduces technology adoption. For our purposes, the key takeaway is that the relationship between technology adoption and factor scarcity hinges on whether the technological change of interest is labor-saving versus labor-complementary.

paper records. Second, external accountants would prepare statements for firms lacking internal accountants or preferring outsourcing.

The two cases share a common theme of exposure to the accounting labor market that could affect firms' willingness to consider alternative preparation approaches, including software adoption.[7] Notably, during this same period, the accounting labor market was subject to multiple forces that contributed to labor scarcity, including the passage of SOX as described in Section 4, as well as the preponderance of December 31 fiscal year ends that results in "busy season" for accounting work. Compounding this, much accounting work is performed by Certified Public Accountants (CPAs), who face significant licensing requirements that inhibit the responsiveness of the labor supply to demand shocks.[8] Even the unlicensed staff accountants working for audit firms or publicly traded firms take classes and undergo training spanning multiple years, given the specialized nature of accounting work, adding another source of labor supply inelasticity.

Turning to the consequences of technology adoption, Acemoglu and Autor (2011) and Acemoglu and Restrepo (2018) show how novel technologies—which expand the degree to which capital (e.g., information technology investments) can substitute for labor—affect the *tasks* performed by professionals. On the one hand, technology can displace tasks. For example, basic accounting tasks such as consolidation, report generation, or invoicing can be automated by software. On the other hand, technology can also create or enable new higher-productivity tasks, which Acemoglu and Restrepo label as a reinstatement effect. Related to reinstatement is re-tasking—the reassignment of displaced workers to other tasks. Using an example from our setting, accountants and other financial managers at small firms often wear multiple "hats." The

[7] Offshoring was far less common in the early 2000s than today (da Silva Soares et al. 2025), and we expect offshoring to be used exceedingly rarely for the small private firms dominating our sample.
[8] For example, the Uniform Accounting Act "reserves the issuance of reports in standard form on audited, reviewed and compiled financial statements and other attest information to licensees who have demonstrated qualifications to perform attest and compilation services" (UAA 2018).

automation of basic accounting tasks may then enable these time-constrained managers to turn their attention to more operations-oriented tasks such as supply chain management or marketing. In some cases, the firm may no longer need the labor of the displaced accountant, but in many others it will make sense to leverage the accountant's familiarity with the firm and its financial performance by re-tasking them.

3. Setting, the Sarbanes-Oxley Act, and Data

a. Setting

We study accounting software adoption at U.S. private firms. Private firms maintain relatively unsophisticated accounting systems—most do not undergo audits, and many do not even use GAAP (Allee and Yohn 2009; Lisowsky and Minnis 2020; Call et al. 2026b). In the early 2000s era of our sample, reliance on internal and external accounting labor for compilation and assurance services was common. For example, a 2004 AICPA survey of private firms indicates that over 80% of participants prepare financial statements, and that preparation is most commonly handled by internal financial managers, followed by outside accountants (AICPA 2004). This reliance was ripe for disruption, as computers became widely adopted and business software was increasingly capable of taking over tasks that employees typically handled.

One particularly noteworthy development around this time was the growth in QuickBooks accounting software, produced by Intuit. Intuit was started in 1983 by Scott Cook and Tom Proulx as a personal finance software company (HMS 2023). By the late 1980s, their product Quicken was among the best-selling tools in the personal finance software category, and they began entering the commercial market with QuickPay, a payroll processing tool. In 1992, Intuit launched QuickBooks, an accounting software application aimed at small business owners with little or no formal accounting knowledge. For historical context, Figure 2 provides a timeline of key developments in the accounting software market since 1975.

Subsequent versions of QuickBooks included expanded functionality, double-entry bookkeeping, full audit trail capabilities, and industry-specific licenses. During our sample period, QuickBooks became widely adopted by small and medium-sized businesses, and to a modest extent, professional accountants and consultants. A 2005 BusinessWeek article estimated that QuickBooks had a 74% market share of the retail (i.e., SME) market, and three million customers. Even with the growth of artificial intelligence, QuickBooks offers many distinct tools and modules that large language models are not yet capable of replicating. Supporting this, the program remains highly popular with private firms, with over seven million paying subscribers.

QuickBooks' Simple Start edition was popular with business owners lacking expertise in accounting, and in 2005 priced competitively at $99. "Premier" and "Enterprise" editions priced at $499 and $3,500, respectively (Lacy and Greene 2005). One business owner stated that the software saved her 10 hours per week, explaining "I needed something I could just let do the work for me." QuickBooks' success attracted competitors to the accounting software market, and we include these vendors in our adoption analysis described later.

While adopting accounting software can help firms reduce their preparation time and effort, there are costs that factor into the decision beyond the price of a software license. Adopting first requires having a personal computer, and, depending on the particular software product, an internet connection. The direct costs of these requirements may be modest. However, the indirect costs can be significant. In the early 2000s period preceding the regulatory change we study, adopting accounting software required a "leap of faith" for many business owners lacking training or experience in business software applications.[9] This is particularly true for the private firms that QuickBooks and other vendors were targeting. As we discuss later, the typical firm in our sample

[9] To illustrate, in 2003 only 63% of U.S. households reported having a computer, and the figure is only 39% for individuals with just a high school education or lower (BLS 2010).

is small (under 50 employees), led by an owner without a university degree, and disproportionately involves construction and related services. Moreover, it seems natural that in these years of emerging software growth, some business owners would remain leery of sharing sensitive financial information, particularly if they perceive a risk of their information being hacked, lost, shared on the web, or reported to the Internal Revenue Service. Awareness costs that are known to be at play for small firms may also deter adoption (Gassen and Muhn 2025). Overall, although accounting software licenses per se were not particularly expensive, there existed meaningful financial, educational, and psychological barriers to adoption.

b. Sarbanes-Oxley Act

In 2002, U.S. Congress passed the Sarbanes-Oxley Act in the wake of multiple major accounting scandals. Section 404 of SOX requires a public firm's management and auditors to report on the adequacy of the internal controls over financial reporting (Iliev 2010; Ge, Koester, and McVay 2017). Accelerated filers were required to comply with these internal control reporting provisions beginning in fiscal years ending on or after November 15, 2004. This represented one of the most consequential changes in securities regulation in the past half century, and resulted in a significant demand shock for accounting labor particularly to help with developing, documenting, and testing controls and meeting new disclosure requirements. Indeed, audit fees increased significantly in 2004 upon the implementation of Section 404 (Coates and Srinivasan 2014; Audit Analytics 2022).

These developments are relevant to our study because the accountant labor market is not fully segmented by client ownership type. To illustrate using a simple example, assume there are three categories of auditor and client employers in the accountant labor market: 1) large public accounting firms and their clients; 2) small public accounting firms and their clients; and 3) bookkeepers and their clients. New securities or audit regulations often increase accountant labor

demand, leading employers in category 1 to expand their candidate searches to those working in category 2. Facing this poaching, category 2 employers may expand their candidate searches to those working in category 3. Thus, even if bookkeeper accountants (category 3) are incapable of serving on a large public firm engagement (category 1), their wages may still increase following major securities reform because there is only partial segmentation in the labor market. Such ripple effects are shaped in part by the inelasticity of the accountant labor supply. Accountants undergo specialized training that takes multiple years, and CPAs comprising much of the labor pool face licensing requirements that restrict entry (Cascino, Tamayo, and Vetter 2021; Barrios 2022; Sutherland, Uckert, and Vetter 2024).[10]

Regulator, employer, and media accounts from the SOX-era support our assumption that the accountant labor market is not fully segmented. A 2005 PCAOB commentary explains:

> The first year of internal control reporting was enormously challenging for all involved. Section 404 of the Sarbanes-Oxley Act prompted the biggest change in the auditor's work in 70 years… *There was a shortage of personnel; especially experienced people. We know that the major firms were scrambling for personnel*. (PCAOB 2005; emphasis added).

Haskell & White, a mid-sized accounting firm serving both private and public firms from pre-revenue to $500 million, authored a 2006 report titled "Accountant Deficit" stating[11]:

> Accountants are in such high demand in Southern California that Haskell & White LLP has offered to pay its employees $20,000 if they refer an experienced accountant to the firm and the candidate is hired.
>
> Demand for accountants really took off after the passage of Sarbanes-Oxley legislation in 2002, which put new burdens on the accounting done by public companies. Public companies are hiring additional in-house auditors to ensure the accuracy of their financial statements following the high-profile scandals at Enron Corp., Adelphia Communications Inc. and Worldcom Inc. With audits now taking up as much as 60 percent more time to complete, and at higher costs, accounting firms say they are being squeezed as never before. Not only do clients have more complex work for auditors but firms also have fewer experienced accountants to do the work. (Haskell & White 2006).

[10] We study accounting wages and employment for the accounting occupation generically, because the DTC hypothesis applies to both licensed CPAs and other accountants, and we cannot separate the two types of workers in our data.

[11] See also the Wall Street Journal commentary titled "Accountant Shortage Solved: Pay them More" https://www.wsj.com/articles/SB111655896101439011

In terms of academic evidence, Duguay, Minnis, and Sutherland (2020) find that private firms' propensity to provide an attested financial statement to their bank declined by 6.3% following the passage of SOX. Ettredge, Sherwood, and Sun (2018) find that non-accelerated filers *not subject to the Act* experienced audit fee increases exceeding 40%. Those subject to the Act experienced increases exceeding 80%. Collectively, such findings illustrate the inelasticity of the accounting labor supply, and the resulting exposure of private firms to major securities reforms targeted at public firms.

c. Data

We identify software adoption using the employee resume dataset from Revelio Labs. Revelio is a workforce intelligence company that collects unstructured employment records from professional networking websites and other sources, structures the records, and sells them to consulting firms, investors, academics, and governments. As part of their data structuring, they extract, clean, and tabulate each employee's job title, start and end date, employer, qualifications, and tasks that the employee describes in their position description. According to Revelio's website, their resume dataset contains "hundreds of millions of publicly available employment records."[12] Given our focus on private firms and our use of Sarbanes-Oxley as a shock to these firms, we eliminate public firm employers and accounting firms from our accounting software analysis sample, but note that this choice does not affect our inferences.

The "description" field and employment dates are key to our adoption identification. Specifically, we rely on employees describing key work activities during each employment spell to identify whether and when their firm adopted software. We developed a data dictionary of adoption terms based on our research of the software market, and create measures for both business

[12] https://www.reveliolabs.com/

software generally and accounting software in particular. Our objective in considering both measures is to provide both generalizable (business software) and well-identified (accounting software) evidence on the DTC hypothesis.

For business software, we consider a variety of applications including enterprise resource planning, payroll and human resources, customer relationship management, marketing, supply chain management, expense tracking software, and accounting software. For accounting software, we note that QuickBooks has a dominant market share; "QuickBooks" is the most commonly triggered term in our dictionary (over 60% of identified adoptions). However, there are other brands (e.g., "Peachtree" or "Sage 50") and terms ("accounting software" or "financial reporting package") that we also consider (our criteria are not case sensitive). We employ a broad, generic accounting software measure because incorporating different software editions or comparing brands introduces complexity and does little to inform our main analyses. We exclude accounting software that is part of broader ERP software (e.g., "NetSuite") as well as software names that may also refer to other concepts (e.g., "Sunrise" or "Tally"). The full keyword list for business software and accounting software is presented in Appendix B, and Figure 3 details how frequently individual accounting software keywords appear.

We estimate when the firm adopted software using two steps. First, we classify firms as using software in a given year if they have an employee whose job description for that year includes our dictionary terms. Second, we identify the earliest of these years under the classification scheme as the adoption year. Our approach to using resumes from professional networking websites to detect technology adoption is standard in the literature (e.g., Fedyk et al. 2022; Babina et al. 2024). Figure 4 provides example resumes that are representative of the type we identify as demonstrating accounting software use.

The increasingly popular approach of using resume data to infer technology adoption comes with tradeoffs. On the one hand, the approach helps researchers develop measures of technology adoption that is otherwise rather difficult to infer from, for example, public filings or company websites. Moreover, the approach allows for analysis of private firms that lack such filings and websites but are important drivers of economic activity (Bernard and Sutherland 2026). On the other hand, individuals in today's labor force may have incentives to overstate their technological skills and experience, such as by embellishing their exposure to artificial intelligence. It is important to note that strategic behavior of this sort is less relevant to our study, as the motives for embellishing involvement in software adoption *two decades ago* are less clear.[13] Ultimately, resume data offer unique advantages over other datasets for identifying software adoption during our sample period. Nevertheless, the limitations of this data inform our shift-share design described later, which abstracts away from resume features that are presumably common to all accountants by comparing adoption across states during a given year.

For wage and employment data, we access the Occupational Employment and Wage Statistics table from the Bureau of Labor Statistics (BLS). We identify individuals working as business and financial operations workers based on occupation code 13-0000 and as accountants based on the occupation code 13-2011. The BLS is also the source for our macroeconomic control variables. We obtain data on the number of firms from the Statistics of U.S. Businesses (SUSB). We access Dun & Bradstreet to estimate the number of employees for each firm in our Revelio dataset (e.g., Black and Strahan 2002; Barnatchez, Crane, and Decker 2017).

d. Summary statistics

[13] Related, LinkedIn (an important data source for Revelio) launched in 2003 and only obtained a sizable user base over the following decade. Thus, many of the software adoption references we study were historical rather than contemporaneous experiences by individuals seeking work.

Table 1 presents summary statistics for the state-year level variables used in our main tests.[14] Our sample spans 1999-2008. The median (average) state-year has 41 (87) instances of accounting software adoption. For context, the median (average) firm that newly adopts accounting software in our sample period has 20 (74) employees, is 15 (26) years old, and disproportionately comes from the engineering and construction, information technology services, and healthcare and wellness services industries. In terms of our accounting labor variables, the median (average) hourly wage is $24.68 ($24.92) and there are 11,360 (19,375) accountants (Standard Occupational Classification: 13-2011). Half of our observations are from the post-SOX period beginning in 2004.

4. Research Design and Results

a. Accounting software adoption

Our initial tests model software adoption using the following Poisson specification for the count variables (Cohn, Liu, and Wardlaw 2022) and OLS for the ratio variables:

$$y_{s,t+1} = \beta_1 Wage_{s,t} + \beta_2 Emp_{s,t} + \gamma_1 GDP_{s,t} + \gamma_2 Unemp_{s,t} + \alpha_s + \alpha_t + \varepsilon_{s,t}. \quad (1)$$

The unit of observation is state-year, where *s* indexes states and *t* indexes years. The sample spans 1999-2008, such that there are five pre-SOX years and five post-SOX years. For our dependent variable, we examine the number of software-adopting firms in the state-year, for both business software adoption generally ($BusSW_{s,t+1}$) and accounting software specifically ($AcctSW_{s,t+1}$). We measure the dependent variable in year t+1 to avoid issues related to reverse causality. *BusWage* (*AcctWage*) and *BusEmp* (*AcctEmp*) are the average hourly business and financial operations worker (accountant) wage and log number of these workers (accountants) in the state-year. We

[14] We use state-level measurement because Revelio's more granular geographic variables (e.g., MSA) are unstandardized.

control for log GDP and the unemployment rate in the state-year. We also control for state fixed effects (α_s) to account for time-invariant state-level firm composition and labor market characteristics, and year fixed effects (α_t) to account for the overall state of the economy, business cycles, and their effect on software adoption. We cluster standard errors by state.

Figure 1 presents a binned scatterplot of business software adoption on business and financial operations worker wages. The plot controls for GDP, unemployment, and state and year fixed effects. We find a significantly positive relationship between adoption and wages, lending support to the DTC hypothesis.

Table 2 presents the results of estimating Equation (1). Holding constant the number of workers, Column 1 shows that as business and financial operations worker wages rise, business software adoption increases. We then present analyses focused on accounting software and accounting labor markets. Column 2 shows that accounting software adoption follows periods of high accounting wages in the state-year. Economically, the 0.018 $AcctWage_t$ coefficient implies that a one-dollar increase in accounting hourly wages is associated with a 1.8% increase in the number of firms adopting accounting software.[15] When we consider quantities (holding constant wages), the -0.148 coefficient on *AcctEmp* implies that a one standard deviation increase in the pooled sample (within-state) accounting employment is associated with 16% (1.3%) less adoption.

b. Bartik

Our next analyses employ a Bartik-style estimation (e.g., Bartik 1991; Breuer 2022) to examine the drivers of accounting software adoption, using the following Poisson estimation for the count variables and OLS for the ratio variables:

[15] A one standard deviation increase in the pooled sample (within-state) accounting hourly wages is associated with a 7.0% (5.4%) increase in the number of firms adopting accounting software.

$$y_{s,t} = \beta_1 Shortage_{s,pre} \times SOX_t + \gamma_1 GDP_{s,t} + \gamma_2 Unemp_{s,t} + \alpha_s + \alpha_t + \varepsilon_{s,t}. \quad (2)$$

The unit of observation is state-year, where *s* indexes states and *t* indexes years. The sample spans 1999-2008. As before, the dependent variable is *AcctSW*, the number of firms adopting accounting software in the state that year. $Shortage_{s,pre}$ is an ordinal variable equal to three minus the tercile ranking of the average ratio of accountants to Compustat (i.e., public) firms ($AcctEmp_{scaled}$), *measured in the pre-SOX period* (1999-2003) (i.e., before the regulatory change to avoid mechanical issues, hence the *pre* subscript). *Shortage* thus takes values of 0, 1, or 2, with higher values indicating greater exposure to the SOX-induced labor demand shock. *SOX* is an indicator variable equal to one starting in 2004, the first year of accelerated filers' compliance with Section 404. Similar to Equation (1), we control for log *GDP* and the unemployment rate in the state, as well as state fixed effects (α_s) to account for time-invariant state-level firm composition and labor market characteristics, and year fixed effects (α_t) to account for the overall state of the economy and its effect on accounting software adoption. We cluster standard errors by state.

Intuitively, our estimation compares how states with more versus less exposure to the SOX shock differ in their post-SOX accounting software adoption patterns. To illustrate, consider two states, A and B. Both states have 1,000 accountants, but state A has one public firm while state B has five public firms. Our analysis compares software adoption rates in the two states during the post-SOX period, while controlling for state and year fixed effects and GDP and unemployment. Under a DTC hypothesis, state B should have higher post-SOX accountant wage increases than state A, because state B faces a greater SOX-induced shortage.[16]

[16] A potential concern is that SOX might not create a shortage for states with a low accountants-to-public-firm ratio if, before SOX, a large majority of accountants already worked for private firms or at non-Big N audit firms, thus allowing the state to absorb the extra demand from public firms. However, we find that high *Shortage* states have a smaller percentage of accountants working for private firms or non-Big N audit firms (71%), compared to low *Shortage* states (89%).

We validate the assumptions underlying our empirical approach in multiple ways. First, Section 3.b discusses institutional and academic evidence of an accountant shortage following SOX (PCAOB 2005; Ettredge et al. 2018; Duguay et al. 2020). Second, we use Equation (2) to study job transitions between private firms and smaller (i.e., not Big N) accounting firms to public firms and the Big N accounting firms that typically audit them. If the labor market for accountants is shared as the Section 3.b evidence suggests, then we should see elevated transition rates, particularly in states with more public firms. Table 3 presents evidence consistent with this prediction: column 1 shows a positive coefficient for *SOX*, indicating more job switches to public firms and Big N accounting firms, and column 2 shows a greater increase in shortage states. Figure 5, Panel A presents an event-time version of the column 2 regression results, and finds that the switching increase is concentrated in the post-SOX period.

Third, we examine accountant wages. We find that in the post-SOX period, accounting wages increase generally (column 3), and more so in shortage states (column 4), thus supporting our assumption that SOX generated a meaningful shift in the cost of accounting labor to private firms. Once again, we validate our inference in event-time plots in Figure 5, Panel B and find little indication that our results come from pre-SOX wage trends. Economically, states in the top scarcity tercile experience a $1.11 greater increase in accounting wages compared to states in the bottom tercile, and this difference represents 37% of the within-state standard deviation in accounting wages. We further show that this pattern is not driven by a more general rise in white-collar wages in shortage states. Columns 5 and 6 present a placebo test using the mean wages of appraisers and assessors of real estate (BLS occupation code 13-2021). Although this occupation falls within the same broad category as accountants (BLS occupation code 13-2011), it is unlikely to have been directly affected by SOX. Columns 5 and 6 show no significant post-SOX wage increase for appraisers and assessors in shortage states.

Table 4 then presents our results of modelling software adoption using Equation (2). Column 1 finds that in the post-SOX period, there is more accounting software adoption in shortage states, reinforcing our Table 2 inference that labor scarcity drives technology adoption. Column 2 examines a complementary specification based on indicator variables for terciles of *Shortage*, and finds the greatest adoption for the most labor-constrained states.

We then conduct several analyses to strengthen our inferences. First, Figure 5, Panel C presents an event-time version of column 1. In the pre-SOX period (i.e., before 2004), there is no statistical software adoption difference across high and low *Shortage* states. Then in 2004, states with a greater shortage during the pre-period see an adoption increase, consistent with SOX inducing a major shift toward software- from labor-based accounting work. This evidence supports a causal interpretation of our Table 4 results, as opposed to an interpretation based on pre-existing trends or concurrent events uncorrelated with accounting labor shortages.

Second, Table 5 assesses the sensitivity of our results to alternative specifications. Panel A examines a *Shortage* measure with a denominator based on the total market capitalization of public firms in the state. This allows the shortage effect to vary with public firm size. We continue to find more switching, greater wage increases, and more software adoption in shortage states.

Another concern is that changes in the number or size distribution of private firms in the state could confound our estimation. Panel B adds controls for the number of private firms (column 1), and the size distribution of private firms (HHI in column 2 and number of firms with fewer than 100 employees in column 3). We continue to find a significantly positive coefficient on *Shortage*×*SOX*. Panel C then scales our adoption count measure by the number of private firms in the state-year, and re-estimates Equation (2). Our inferences are similar: labor shortages are associated with more software adoption in the post-SOX period.

Another concern is that measurement error related to our attempt to identify software adoption using resumes somehow biases the results in our favor. We therefore repeat our tests using an adoption variable based only on resumes including references to "QuickBooks," which unambiguously captures accounting software use. Panel D shows that our results are similar.

Then, we evaluate a broader concern that our results are simply picking up a technology adoption trend that has little to do with accounting labor market conditions or demand for accounting software. For example, our early 2000s sample period coincided with widespread growth in the number of firms adding computers, software, and websites; this adoption may be difficult to model and could correlate with our labor market variables of interest. Related, our *Shortage* measure could capture underlying differences in states' exposure to the economy or technological shifts, rather than accounting labor market conditions.

To address these possibilities, we first conduct a placebo test where the dependent variable measures anti-virus software adoption (as identified from employee resumes) rather than accounting software adoption. Under a trend explanation, we should find greater post-SOX adoption for shortage states. However, Panel E reports an insignificant coefficient on *Shortage* × *SOX*. Second, in Appendix C we examine the characteristics of our *Shortage* states. We find that in 2003, *Shortage* states have higher GDP than other states, but there is no statistical difference in the IT workforce (*ITempratio*), internet penetration rate (*InternetAccess*), or unemployment rate (*Unemp*). Moreover, our adoption results are quite similar to our main findings when we control for interaction terms for SOX and these four variables, which we would not expect to happen under a latent technology adoption trend or economic growth explanation.

Finally, we consider the possibility that heightened concerns about fraud explain the software adoption patterns we document during our sample period. Even absent SOX, investors reacting to the prominent fraud cases of the early 2000s may have demanded improved controls

and disclosure (Leuz and Wysocki 2016). Media coverage of fraud was extensive, and changed attitudes around governance and reporting. Pressure to enhance controls and disclosure can also come from supply contract relationships with public firms subject to SOX. Then, software adoption may stem from the desire to improve record keeping, as opposed to a response to accountant labor shortages.

Several aspects of our setting and results indicate that fraud concerns alone cannot explain our collection of results. First, as highlighted earlier, the typical firm in our sample has just 20 employees. Such firms are frequently owner-managed, unlikely to have material supply contract relationships with public firms (e.g., local construction firms and restaurants are common), and do not have the same agency concerns as larger firms with more dispersed ownership and greater separation of ownership and control. Second, fraud concerns are largely a common development affecting all states, whereas our Table 4 and Figure 5 evidence is based on across-state variation in pre-SOX accounting labor market characteristics. In untabulated analyses, we find that our results are not sensitive to eliminating Pennsylvania, Texas, and Virginia—headquarter states for Adelphia, Enron, and WorldCom respectively, or to controlling for media coverage of these frauds as proxied by the number of news articles. Third and related, the state-specific accountant switching and accountant wage increase results are much more aligned with explanations rooted in labor shortages than overall attitudes around fraud prevention.

Overall, our evidence in this section is most consistent with accounting software adoption stemming from labor scarcity induced by the enactment of the Sarbanes-Oxley Act.

5. Software Adoption Consequences

In our next set of tests, we investigate how accounting software adoption affects accountants' employment, re-tasking, the firm's implementation of management practices, and the seasonality of accounting labor demand.

a. Employment changes

After adopting accounting software, firms are likely to have less demand for accountants. We therefore trace accountant employment outcomes using Equation (2). First, we examine the extreme case of accountants exiting the workforce altogether, as measured by the number of accountants in the state whose job ends that year and with no subsequent employer on their resume. Second, we study accountant job titles and record the number of accountants in a state-year who transition to a new, non-accountant role either at a different firm or with the same firm.

Table 6 presents the results. Column 1 finds a statistically greater increase in accountants exiting the workforce in shortage states. Economically, the 0.031 coefficient on *Shortage*×*SOX* corresponds to a 6.2% greater exit increase for the highest than the lowest shortage states. Figure 5, Panel D plots an event-time version of column 1, and finds no indication that our results stem from pre-SOX trends in accountants exiting the workforce. To link this finding to software adoption, we estimate an instrumental variables specification based on a control-function approach (e.g., Wooldridge 2015). Specifically, we run the first-stage regression of *AcctSW* on *Shortage*×*SOX* based on our Equation (2).[17] Then, our second-stage regresses *Exit_Workforce* on the instrumented value of the number of accounting software adopting firms. Column 2 shows that our inferences are the same.

As for accountant transitions to new roles, columns 3 and 4 find little evidence of accountants in shortage states being more likely to take on new roles at new employers. By

[17] The first-stage F-statistic exceeds 10 and the p-value is <0.01 in our instrumental variable estimations.

contrast, column 5 finds a statistically significant increase in shortage states for accountants taking on roles within their same employer. The 0.063 coefficient on *Shortage×SOX* corresponds to a 12.6% greater increase for the highest than the lowest shortage states. Figure 5, Panel E finds that the job transitions are concentrated in shortage states in the post-SOX period. Column 6 arrives at a similar inference using our instrumental variables approach. For context, Figure 6 lists the occupations that accountants most frequently transition to after their firm adopts accounting software, using Revelio's occupation categories to sort job titles. Investment Specialist (common job titles in this category involve capital allocation and project investment planning), Financial Advisor (financial consulting, credit analysts) and Business Operations (business analyst, project analyst) show up the most, suggesting that accountants often transfer to operations- and finance-related roles.

Overall, the Table 6 evidence is consistent with displacement: after adopting accounting software, there is a modest increase in accountants exiting the workforce (and perhaps only modest given there is some overlap with the public firm labor market for accountants), and a larger increase in accountants transitioning to new roles within their firm.

b. Re-tasking

Next, we build on our accountant job transition evidence by examining the specific tasks accountants perform. The particular jobs listed in Figure 6 lend credibility to the hypothesis that accountants take on tasks outside of accounting but that draw on their business training and the firm's improved information environment. Further motivating our re-tasking analysis is the QuickBooks advertisement shown in Figure 7, Panel A claiming that their software frees up accountants to work on "core business activities."

To explore re-tasking empirically, we examine the non-accounting tasks listed on accountants' resumes. Specifically, we examine the same sample of private firms that we use to

identify accounting software adoption in our main tests, and see whether the proportion of accountants with certain new tasks changes. We create three categories of tasks: strategy & operations, finance & risk, and management accounting. For strategy & operations, we create a dictionary of keywords from the following Revelio skill groups: budget management / reporting / reporting & analysis; operations management / inventory management / logistics; and strategic planning / team leadership / negotiation. We then exclude proper nouns for specific systems and those not suited for our purposes (e.g., consumer behavior, team leadership).[18] For finance & risk, we start from financial analysis / finance / financial modeling, and risk management / banking / credit skill groups and again exclude proper nouns and keywords not suited for our purposes (e.g., a number of bank-specific keywords). And for management accounting, we create a list of keywords based on reviewing management accounting textbooks (Revelio does not have a dedicated skill group for this category). Appendix B presents the keywords. Common ones for strategy & operations (finance & risk; management accounting) include "inventory," "strategic planning," and "logistics" ("credit analysis" and "financial analysis"; "inventory management" and "demand forecasting.") To identify accountant task uptake for each of the categories, we count the number of private firm accountants in the state-year with job descriptions containing at least one keyword, and scale by the number of private firm accountants in the state-year. We then multiply the count by 100 to facilitate economic interpretation.

Table 7 models task uptake using Equation (2). Column 1 finds more strategy & operations tasks among accountants in the post-SOX period in shortage states. In terms of economic magnitudes, compared to low shortage states, the high shortage states have a 0.444 percentage point greater increase in the proportion of accountants with strategy & operations tasks, which corresponds to 1.4 times the within-fixed effects standard deviation. To trace the re-tasking to

[18] Our inference remains when using all keywords from two groups.

accounting software adoption, column 2 implements our instrumental-variables strategy. Our inference is the same as in the reduced form estimation: there is an increase in strategy & operations tasks, happening through accounting software adoption. Columns 3-6 study finance & risk and management accounting tasks, and likewise find significant task uptake concentrated in shortage states.

c. Firm practices

Our tests in the prior two subsections document the new roles and new tasks for accountants displaced by their firm's accounting software adoption. Motivated by this evidence, we now explore whether the task take-up we uncover captures practices that are *new to the firm altogether*. In other words, following accounting software adoption, are accountants merely reassigned to practices that firms are already engaging in, or does adoption help the firm pick up new practices?

Tools featured in many software programs lend support to the latter possibility: Figure 7 Panels B and C show budgeting, forecasting, and inventory management modules within popular accounting software programs. Additionally, many accounting software programs embed linkages to banking, credit card, payroll, tax, and shipping vendors, enabling new decision and control capabilities even for firms that previously had an external accountant compile their financial statements (Kawamoto 2004). New practice adoption could then result from either 1) a more structured system of recording and analyzing financial information, 2) accountants having additional capacity as a result of their firm's software adoption, or both. Although our empirical framework cannot disentangle between these channels, exploring practice adoption is worthwhile given the lack of archival adoption evidence in the literature and research linking practices to productivity (Drexler et al. 2014; Bruhn et al. 2018; Barrios et al. 2025).

Analyses summarized in Figure 8 explore this question. Specifically, we use Equation (2) to model the number of new *firm* adopters of a large set of management practices, based on the

union of the strategy & operations, finance & risk, and management accounting tasks studied in Table 7. We then present the *Shortage*×*SOX* interaction coefficients, ranking them from largest to smallest, and highlighting those that are statistically significant. We limit the practices to those that at least 100 firms engage in during the 1999-2003 pre-SOX period, to focus our analyses on relevant practices. No change in new adopters would indicate that our Table 6 and 7 results merely capture reassignment of accountants to existing practices, whereas positive interaction coefficients suggest that firms are picking up the practice for the first time. We find significant interactions for a number of practices, including supply chain optimization, enterprise risk management, cross-selling, credit analysis, and variance analysis.

d. Labor demand seasonality

Our final tests examine the seasonality of accounting labor demand. Intuitively, accounting labor demand is highly seasonal given the large share of firms with December 31st fiscal year ends. Additionally, tax filing deadlines are concentrated several months after: C-corporation (S-corporation) returns are due on or before the 15th day of the fourth (third) month after the tax year's end, which is typically December 31st. Then, software adoption can reduce seasonality by reducing the role for accountants in the production of accounting outputs.

We examine labor demand seasonality in a state-year using two measures. The first measure is the percentage of accountants beginning their jobs in the month of January. The second is the Herfindahl-Hirschman index (HHI) of the distribution of accountant job start months during the year ($AcctMonth^{HHI}$).

Table 8 presents the results of modeling these two variables using Equation (2) (odd columns) and our instrumental variables approach (even columns). Column 1 shows that post-SOX, the state-level January share declines significantly more in shortage states. In terms of

economic magnitudes, the highest tercile shortage states experience a 1.6 percentage point greater reduction in January share than the lowest.

Figure 5, Panel F plots an event-time version of this result, and shows that the January share decline occurs only after the enactment of SOX. Column 2 arrives at a similar inference using our instrumental variables framework. Columns 3 and 4 repeat these tests using the HHI-based measure, and again arrive at similar inferences.

6. Conclusion

Recent technological advances have provided firms with new reporting and managerial tools, which have transformed the mix of labor and capital engaged in operations and the nature of work for managers. These developments have raised questions from both researchers and practitioners around the drivers of technology adoption, as well as the implications for displaced professionals. Our paper examines the interaction between labor market conditions and business software adoption, drawing on DTC theories. These theories suggest that firms respond to input factor scarcity by adopting labor-saving technologies, thereby reducing subsequent reliance on the constrained resource.

Our analysis reveals that business software adoption positively responds to professional labor market scarcity—firms are more likely to adopt in environments with rising wages or limited labor supply. To confirm this finding, we employ a Bartik-style estimation approach, using SOX as a labor demand shock that amplified scarcity in states with more public firm exposure. Consistent with the DTC hypothesis, states facing greater shortages exhibit higher adoption rates, highlighting the role of labor market constraints in shaping technology adoption patterns.

Using this setting and the same empirical strategy, we then explore the displacement and re-tasking consequences of software adoption. Adoption leads to private firm accountants exiting

the workforce or taking on new job titles within the same firm, consistent with displacement, but also to accountants taking on new strategy & operations, finance & risk, and management accounting tasks, consistent with re-tasking. In some cases, as a result of this re-tasking, firms implement new management practices involving supply chain management and risk management for the first time. Finally, we show that software adoption reduces the seasonality of accountant hiring. Overall, our findings document a novel interaction between business software adoption and labor market conditions.

To what extent might our results generalize to AI settings, which are attracting heightened interest? On the one hand, the DTC framework is rather broad, and has been used to understand a range of adoption choices from machinery to digital technology, as well as industrial development more broadly. The same mechanism at play in our setting—labor cost pressures—could very well induce AI adoption at many firms, regardless of size or ownership type. How our re-tasking evidence speaks to AI is less clear. Software adoption is typically a centralized firm-level decision, whereas AI adoption is frequently decentralized across workers and tasks. In addition, AI is broader in scope than accounting software and may affect a wider range of tasks within the firm. Consequently, any resulting reallocation of work may be less immediate or coordinated. Even so, as in our software setting, workers displaced from more automatable tasks by AI may be reassigned toward activities requiring greater judgment, coordination, interpretation, or other capabilities that remain less susceptible to automation. Similarly, just as software adoption in our setting is associated with the adoption of new management practices, AI adoption may also allow firms to undertake new practices that they previously lacked the capacity to engage in. Overall, we view our software-focused analysis as providing new evidence on a prominent type of accounting technology adoption, but we strongly encourage further research that explicitly models adoption decisions and their consequences in other technology settings, including AI.

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Appendix A: Variable Definitions
This table provides definitions for the key variables in our analyses.

Variable	Definition	Source
AcctSW	The number of accounting software adopting firms in the state-year. Accounting software adoption is measured as the first mention of accounting software keywords in resume descriptions. Refer to Appendix B for keywords.	Revelio
$AcctSW^{QB}$	The number of accounting software adopting firms in the state-year. Accounting software adoption is measured as the first mention of 'quickbooks' in resume descriptions.	Revelio
BusSW	The number of business software adopting firms in the state-year. Common software types include accounting software, ERP software, payroll/HR software, CRM software, marketing software, supply chain management software, and expense management software. Refer to Appendix B for keywords.	Revelio
AcctSwitch	The number of accountants who switch employment from private firms or non-Big N audit firms to public firms or Big N audit firms, scaled by the total number of accountants in the state-year and expressed as a percentage.	Revelio
AcctWage	The mean wage of accountants (BLS occupation code 13-2011) in the state-year.	U.S. Bureau of Labor Statistics (BLS)
AcctEmp	The total number of accountants (BLS occupation code 13-2011) in the state-year, log transformed.	BLS
$AcctEmp_{scaled}$	The total number of accountants (BLS occupation code 13-2011) scaled by the total number of Compustat firms in the state-year.	BLS & Compustat
BusWage	The mean wage of business and financial operations employees (BLS occupation code 13-0000) in the state-year.	U.S. Bureau of Labor Statistics (BLS)
BusEmp	The total number of business and financial operations employees (BLS occupation code 13-0000) in the state-year, log transformed.	BLS

ApprWage	The mean wage of appraisers and assessors of real estate (BLS occupation code 13-2021) in the state-year.	U.S. Bureau of Labor Statistics (BLS)
SOX	An indicator variable for years beginning in 2004.	N/A
Shortage	Three minus the tercile ranking of mean $AcctEmp_{scaled}$ from 1999 to 2003 for each state. High *Shortage* corresponds to low $AcctEmp_{scaled}$.	BLS & Compustat
$Shortage_{mid}$	An indicator variable equal to one for states with the middle tercile of *Shortage,* and zero otherwise.	BLS & Compustat
$Shortage_{high}$	An indicator variable equal to one for states with the highest tercile of *Shortage,* and zero otherwise.	BLS & Compustat
GDP	GDP in the state-year, log transformed.	BLS
Unemp	The unemployment rate in the state-year	BLS
PrivateFirms	The number of private firms calculated as the total number of firms based on SUSB minus the total number of public firms in Compustat in the state-year	SUSB & Compustat
FirmSizeHHI	The Herfindahl-Hirschman index measuring concentration of firms across employee-size categories in the state-year. The size categories are firms with fewer than 20, 20–99, 100–499, and 500 or more employees.	SUSB
$Firms^{small}$	The number of firms with less than 100 employees based on SUSB in the state-year.	SUSB
AntiVirus	The number of antivirus software adopters in the state-year. Antivirus software adoption is measured as the first mention of either 'antivirus' or 'anti-virus' in resume descriptions.	Revelio
Exit_Workforce	The number of accountants in a given state-year who exit the firm and have no subsequent employer in the data.	Revelio
Exit_NewRole	The number of accountants in a given state-year who exit the firm and transition to a non-accounting role in a different firm.	Revelio
Stay_NewRole	The number of accountants in a given state-year who exit an accountant role and transition to a non-accounting role within the same firm.	Revelio

StratOps	The number of accountants (Revelio role_k50= "Accountant") in the state-year with job descriptions including strategy and operations keywords scaled by the total number of accountants employed by private firms in the state-year, expressed as a percentage. Refer to Appendix B for keywords.	Revelio
FinRisk	The number of accountants (Revelio role_k50= "Accountant") in the state-year with job descriptions including finance and risk management keywords scaled by the total number of accountants employed by private firms in the state-year, expressed as a percentage. Refer to Appendix B for keywords.	Revelio
MgAcct	The number of accountants (Revelio role_k50= "Accountant") in the state-year with job descriptions including management accounting practice keywords scaled by the total number of accountants employed by private firms in the state-year, expressed as a percentage. Refer to Appendix B for keywords.	Revelio
$AcctMonth^{HHI}$	The Herfindahl-Hirschman index of the monthly distribution of accountant job start dates, expressed as a percentage.	Revelio
$AcctMonth^{Jan}$	The percentage of accountants who begin their jobs in January.	Revelio

Appendix B: Keywords
This table lists the keywords (not case-sensitive) for identifying software use, task adoption, and management accounting practice adoption from resumes.

Variable	Keywords
AcctSW	quickbooks, accounting software, peachtree, accounting program, financial reporting package, accounting application, accounting package, accounting platform, accounting solution, financial reporting software, ledger software, sage 50, financial reporting tool, financial reporting application, ledger application, accounting tool, record keeping software, financial reporting platform, freshbooks, accountedge, ledger package, record keeping platform, record keeping program, ledger program, financial reporting solution, ledger platform, financial reporting program, record keeping application, ledger solution, bookkeeping software
$AcctSW^{QB}$	quickbooks
ErpSW	sap erp, sap hana, sap s/4hana, sap ecc, oracle erp, oracle fusion cloud erp, oracle e-business suite, oracle netsuite, jd edwards, microsoft dynamics erp, microsoft dynamics ax, microsoft dynamics nav, microsoft dynamics 365 business central, microsoft dynamics 365 finance and operations, infor erp, infor cloudsuite, epicor erp, epicor prophet 21, sage erp, unit4 erp, abas erp, iqms erp, acumatica erp, odoo erp, syspro erp, priority erp, qad erp, enterprise resource planning, erp software, erp system, erp platform, erp solution, erp application, erp package, cloud erp, on-premise erp, erp implementation, erp migration
Payroll/HrSW	adp, paychex, gusto, rippling, trinet, justworks, zenefits, namely, paycom, bamboohr, ceridian, dayforce, kronos, ukg, workday hcm, peoplesoft, deputy, tsheets, clockify, toggl track, hubstaff, paycor, payroll software, hr software, human resources system
CrmSW	salesforce, hubspot crm, zoho crm, microsoft dynamics crm, sugarcrm, pipedrive, freshsales, copper crm, nimble, insightly, outreach, salesloft, apollo.io, gong.io, chorus.ai, crm software, customer relationship management system, sales automation software, pipeline management tool, lead management software
MarketingSW	marketo, eloqua, pardot, hubspot marketing, mailchimp, constant contact, activecampaign, klaviyo, drip, sendinblue,

	campaign monitor, getresponse, convertkit, hootsuite, buffer, later.com, marketing automation software, email automation software, digital marketing platform, campaign management software
SupplyChainSW	sap ariba, oracle scm, netsuite scm, infor supply chain, epicor scm, fishbowl inventory, manhattan associates, kinaxis, blue yonder, coupa, procurify, brightpearl, tradegecko, unleashed software, shipstation, logiwa, skuvault, dearsystems, supply chain management software, inventory management software
ExpenseSW	concur, expensify, navan, airbase, brex, plastiq, chrome river, tripactions, travelperk, expense management software, travel booking software
AntiVirus	antivirus, anti-virus
StratOps	air freight, benchmarking, business modeling, business operations, business strategy, commercialization, competitive analysis, competitive intelligence, consulting, contract management, contract negotiation, cross-functional coordination, customs regulations, demand forecasting, demand planning, dispatching, distribution center operations, entrepreneurship, e-procurement, freight, freight forwarding, innovation, innovation management, inventory, inventory analysis, inventory control, inventory management, logistics, logistics management, negotiation, operations management, organizational change, procurement, product launch, product lifecycle management, product management, product strategy, production planning, purchase management, purchase orders, purchasing negotiation, purchasing processes, reverse logistics, segmentation, shipping, small business, spend analysis, stock control, strategic alliances, strategic consulting, strategic negotiations, strategic partnerships, strategic planning, strategic sourcing, strategic thinking, strategy, strategy development, supplier development, supplier evaluation, supplier negotiation, supplier quality, supply chain, supply chain management, supply chain optimization, supply management, transportation management, trucking, truckload, warehouse management, warehouse operations, warehousing
FinRisk	business finance, business valuation, cash management, compliance, compliance management, corporate development, corporate finance, credit analysis, credit cards, credit risk, cross selling, cross-border transactions, debit cards, deposits, due diligence, electronic payments, executive

	management, finance, financial analysis, financial modeling, financial risk, financial statement analysis, financial structuring, funding, operational risk, operational, risk management, payments, regulatory compliance, relationship management, risk analysis, risk assessment, risk management, small business lending, trade finance, valuation
MgAcct	balanced scorecard, benchmarking, budget forecasts, budget management, budget monitoring, budget process, capital budgeting, cash flow, cash flow forecasting, contract management, cost accounting, demand forecasting, demand planning, department budgeting, enterprise risk management, financial forecasting, financial management, inventory analysis, inventory management, KPI reports, management accounting, managerial finance, operating budgets, operations management, production planning, risk, spend analysis, strategic sourcing, supply chain, supply chain management, supply chain optimization, variance analysis, working capital management

Appendix C: Examining *Shortage* States

This table examines the 2003 characteristics of *Shortage* states and assesses the sensitivity of our adoption results to controlling for the interaction between *SOX* and these characteristics. In column 1, the dependent variable is *Shortage,* three minus the tercile ranking of mean $AcctEmp_{scaled}$ from 1999 to 2003 for each state. In column 2, the dependent variable is *AcctSW*, the number of new software adopters. $ITempratio_{2003}$ is the ratio of IT employees to total employees in the state in 2003. $InternetAccess_{2003}$ is the internet penetration rate in the state in 2003, measured based on household broadband internet adoption (Tolbert and Mossberger 2015). *GDP* is the log transformed GDP in the state in 2003. *Unemp* is the unemployment rate in the state in 2003. *SOX* is an indicator equal to one starting in 2004. Standard errors are clustered at the state level. *, **, *** indicate significance at the two-tailed 10%, 5%, and 1% levels, respectively.

	(1) *Shortage*	(2) *AcctSW*
$ITempratio_{2003}$	29.804	
	(1.41)	
$InternetAccess_{2003}$	2.846	
	(1.54)	
GDP_{2003}	0.357***	
	(3.15)	
$Unemp_{2003}$	-0.042	
	(-0.35)	
Shortage×*SOX*		0.114***
		(3.69)
Shortage×$ITempratio_{2003}$		-3.074
		(-0.93)
Shortage×$InternetAccess_{2003}$		-0.267
		(-0.66)
Shortage×GDP_{2003}		-0.026
		(-1.11)
Shortage×$Unemp_{2003}$		0.013
		(0.78)
Controls	Yes	Yes
Observations	50	500
FE	-	State, Year
Cluster	State	State
Adjusted R-squared	0.446	0.947

Commented [AS2]: David: can you create a table that shows col 1 from your xls and col 2 as the AcctSW test with SOX x controls on RHS? Thanks

Figure 1: Business Software and Wages
This figure presents binned scatterplots of business software adoption against business and financial operations worker wages. *BusSW* is the number of business software adopters, residualized after controlling for *BusEmp, GDP*, *Unemp*, and state and year fixed effects.

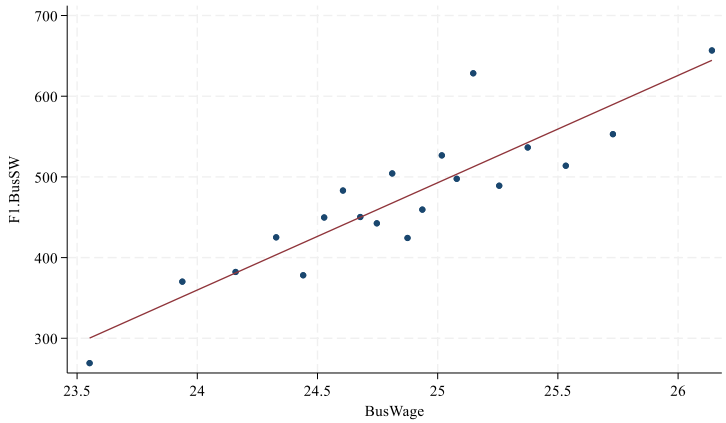


Figure 2: Advances in Accounting Software
This figure presents a timeline of key advances in the history of the accounting software market.

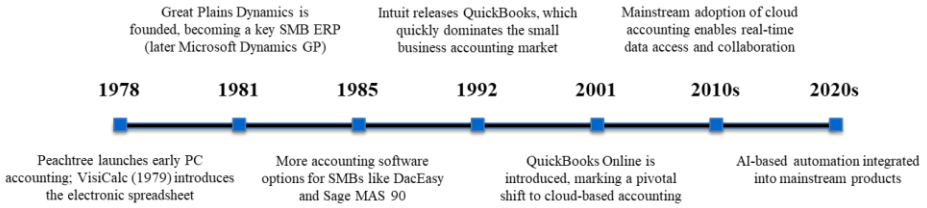
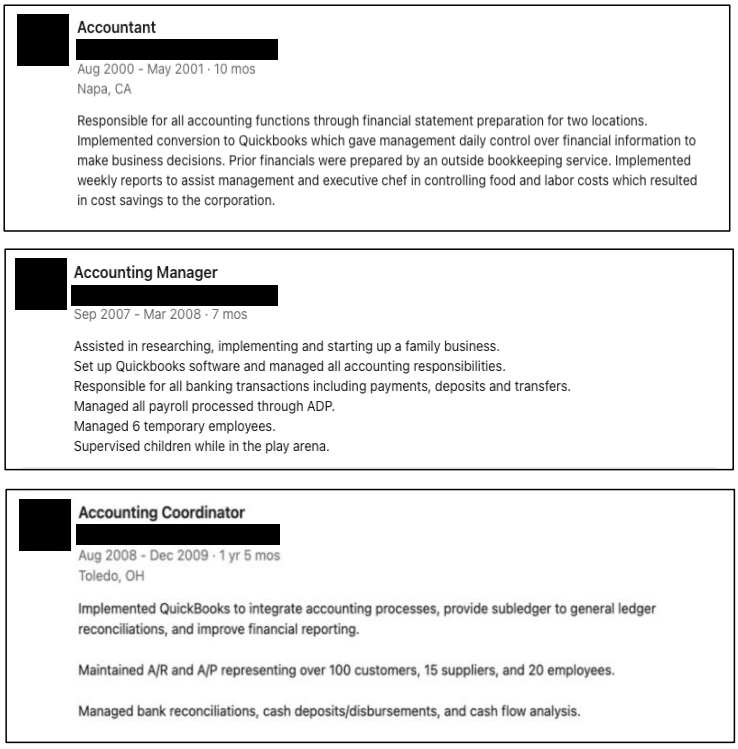


Figure 3: Measuring Accounting Software Adoption
This figure presents the keywords (not case-sensitive) we use to identify accounting software adoption. Count is the number of resume descriptions containing each keyword in our sample.

Keywords	Count
quickbooks	91,064
accounting software	28,698
peachtree	11,253
accounting program	3,366
financial reporting package	2,744
accounting application	1,978
accounting package	1,355
accounting solution	980
accounting platform	787
sage 50	587
financial reporting tool	500
financial reporting software	359
ledger software	341
accounting tool	312
financial reporting application	279
ledger application	201
financial reporting solution	103
record keeping software	95
freshbooks	80
financial reporting platform	75
record keeping program	74
accountedge	70
ledger package	68
financial reporting program	58
ledger platform	47
ledger program	46
record keeping platform	46
ledger solution	28
record keeping application	28
bookkeeping software	16

Figure 4: Example Resumes
This figure presents examples of resumes that we identify as indicating the use of accounting software at the firm. To preserve anonymity, we have redacted the employer and firm names.



Accountant
[redacted]
Aug 2000 - May 2001 · 10 mos
Napa, CA

Responsible for all accounting functions through financial statement preparation for two locations. Implemented conversion to Quickbooks which gave management daily control over financial information to make business decisions. Prior financials were prepared by an outside bookkeeping service. Implemented weekly reports to assist management and executive chef in controlling food and labor costs which resulted in cost savings to the corporation.

Accounting Manager
[redacted]
Sep 2007 - Mar 2008 · 7 mos

Assisted in researching, implementing and starting up a family business.
Set up Quickbooks software and managed all accounting responsibilities.
Responsible for all banking transactions including payments, deposits and transfers.
Managed all payroll processed through ADP.
Managed 6 temporary employees.
Supervised children while in the play arena.

Accounting Coordinator
[redacted]
Aug 2008 - Dec 2009 · 1 yr 5 mos
Toledo, OH

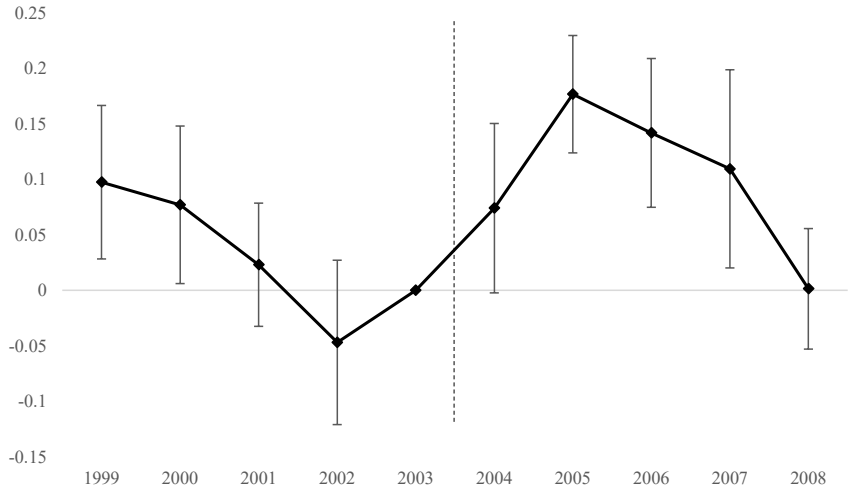
Implemented QuickBooks to integrate accounting processes, provide subledger to general ledger reconciliations, and improve financial reporting.

Maintained A/R and A/P representing over 100 customers, 15 suppliers, and 20 employees.

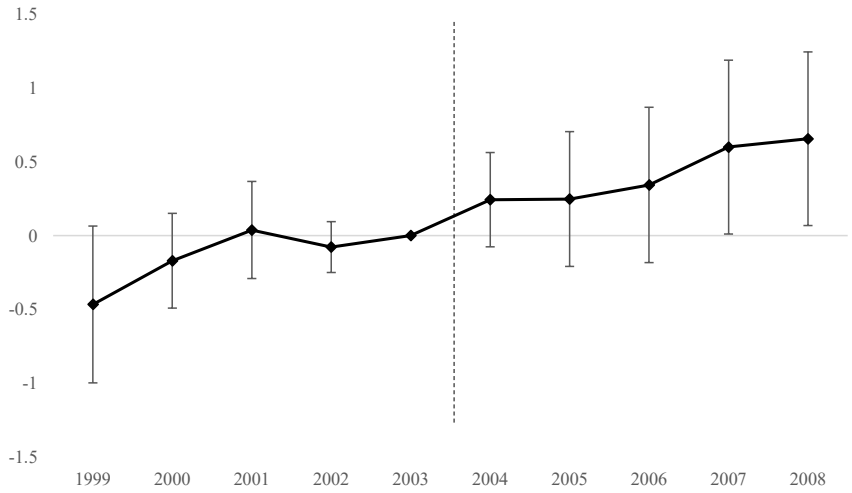
Managed bank reconciliations, cash deposits/disbursements, and cash flow analysis.

Figure 5: Event Time Plots
This figure plots the coefficients and 90% confidence intervals from an event time version of Equation (2). Each panel title notes the dependent variable. The holdout year is 2003.

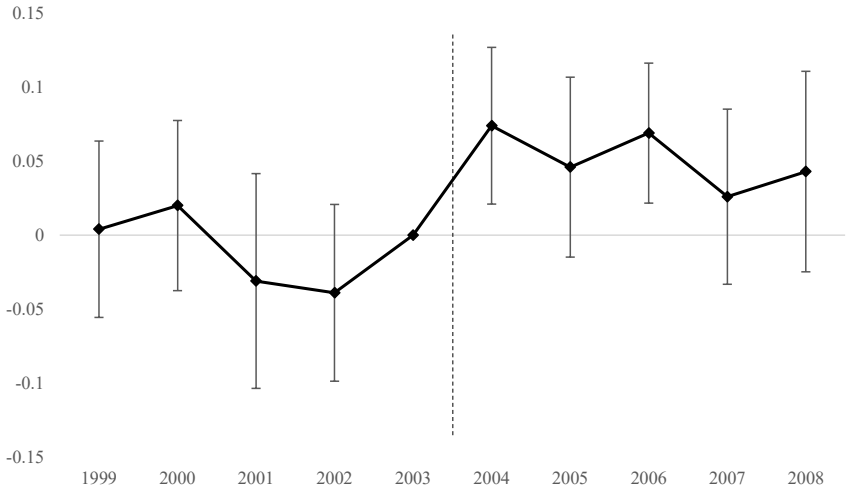
Panel A. Accountant Job Switches to Public Firms or Big N Audit Firms (*AcctSwitch*)



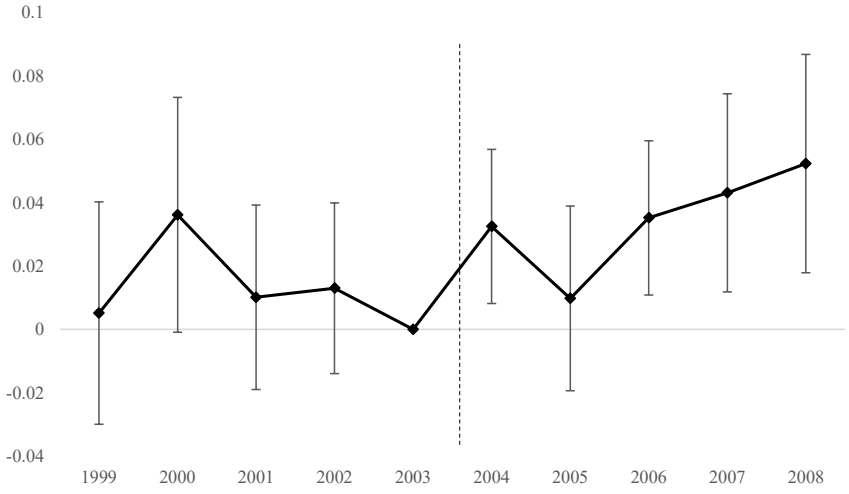
Panel B. Accountant Wages (*AcctWage*)



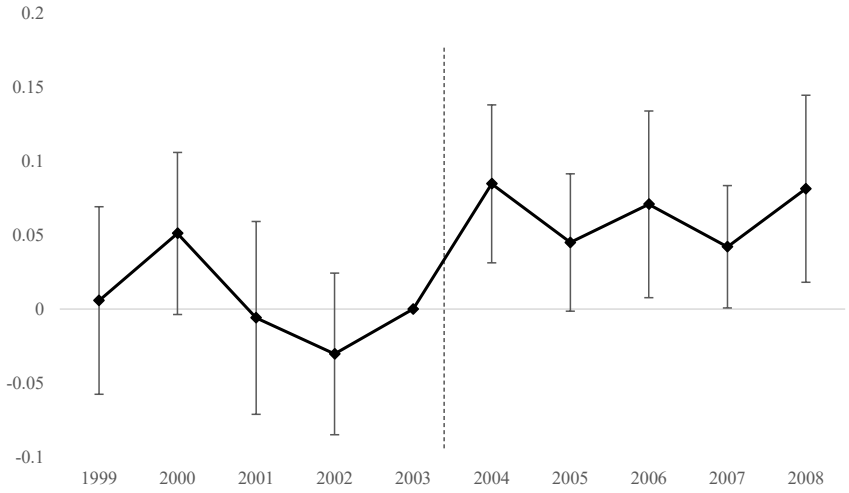
Panel C. Accounting Software Adoption (*AcctSW*)



Panel D. Accountants Exiting Workforce (*Exit_Workforce*)



Panel E. Accountants Taking on New Roles at the Same Employer (*Stay_NewRole*)



Panel F. Seasonality in Accountant Hiring ($AcctMonth^{Jan}$)

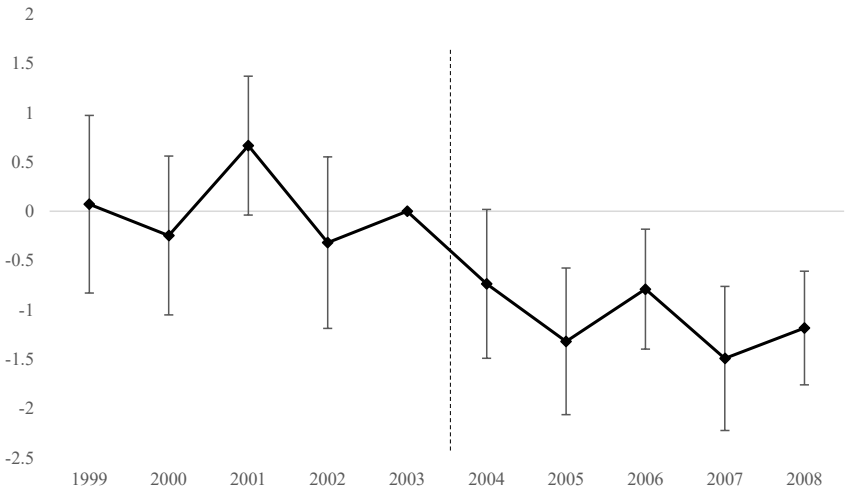
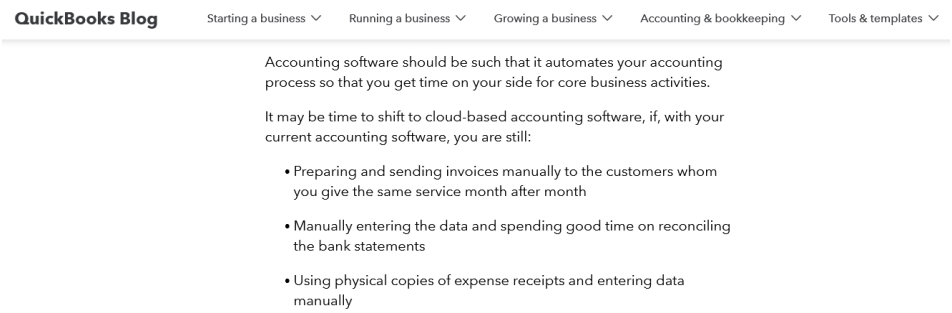


Figure 6: Occupations for Accountants with New Roles
This figure lists the 20 occupations accountants most commonly transition to within their firm after it adopts accounting software. We use the Revelio k150 occupation categories to sort job titles, excluding accounting and bookkeeping jobs. See Table 6 for the corresponding regression analyses. The right column below reports the percentage of transitioning accountants taking on that new occupation.

Occupation	Percentage
Investment Specialist	11.67%
Financial Advisor	11.26%
Business Operations	8.01%
Business Analyst	7.33%
Risk Analyst	6.14%
Compliance	3.98%
Operations Administrator	3.96%
Logistics	3.81%
Data Analyst	3.75%
Corporate Strategy	3.73%
Officer	3.19%
Project Manager	3.18%
Payroll Specialist	2.89%
IT Project Manager	2.89%
Procurement Specialist	2.70%
Client Services	1.93%
Business Process Specialist	1.85%
Human Resources Specialist	1.80%
Operations Manager	1.74%
Marketing	1.72%

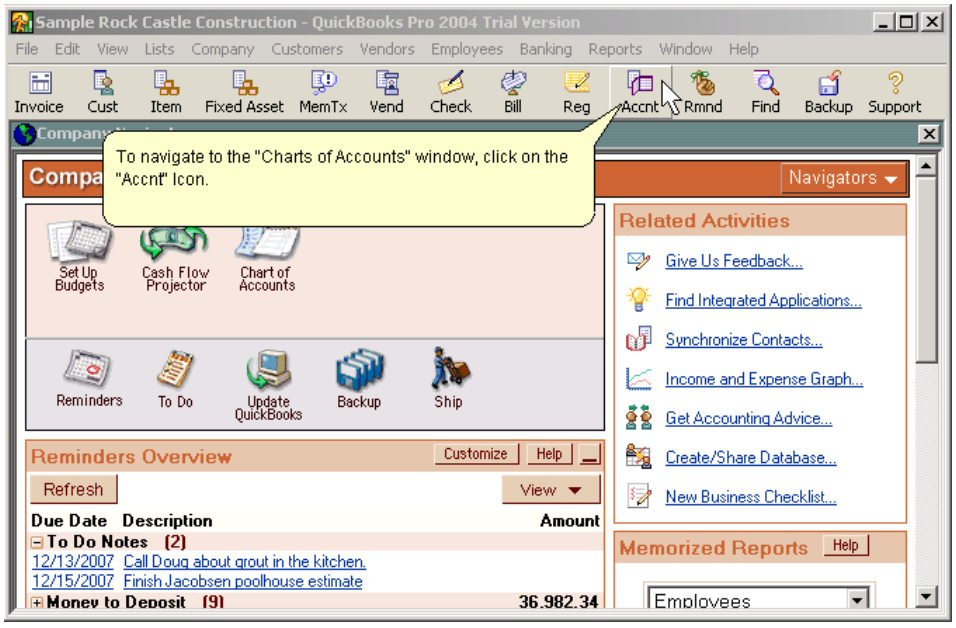
Figure 7: Accounting Software Advertisements
This figure compiles software advertisements and software screenshots describing program features and adoption benefits. Sources are provided under the advertisements.

Panel A. Automation and Time Reallocation



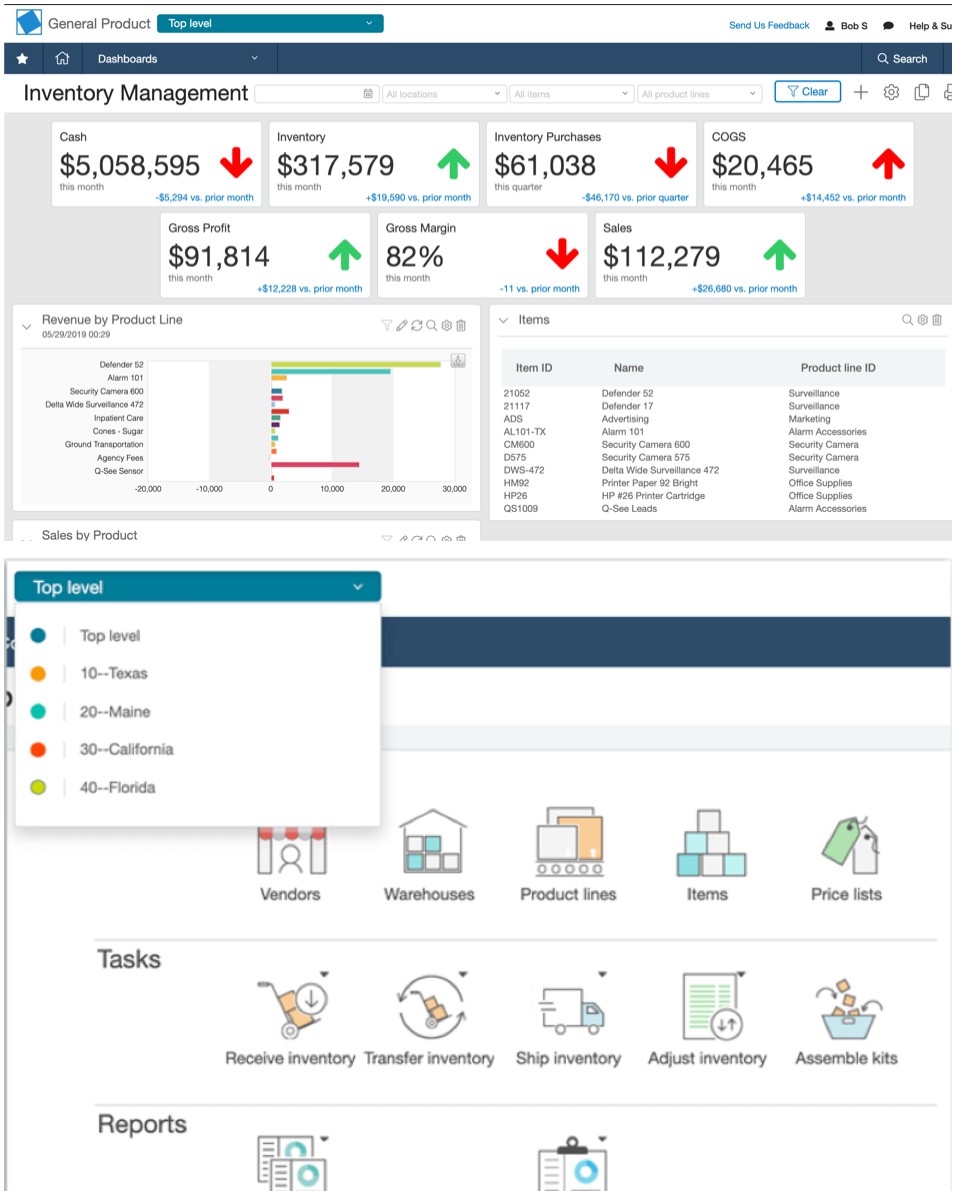
Source: https://quickbooks.intuit.com/global/resources/accounting-and-bookkeeping/cloud-accounting-software/

Panel B. Budgeting and Cash Flow Projection Tools



Source: https://www.conficio.com/plan-b/examples/quickbooks/create_account/credit_card/flat_excerpt.html

Panel C. Inventory Management Tools



Source: https://www.sage.com/en-ca/sage-business-cloud/intacct/additional-financial-management-modules/cloud-inventory-management-system/

Figure 8: Firm-Level Management Practice Adoption
This figure plots *Shortage*×*SOX* coefficients for an analysis of individual strategy & operations, finance & risk, and management accounting practices using Equation (2). The dependent variable is the number of new adopters of the given practice, measured at the firm level. The practices are listed in Appendix B. The figure displays the top 20 practices, ranked by coefficient magnitude, among those with at least 100 new adopters between 1999 and 2003. Black bars indicate coefficients significant at the 10% level.

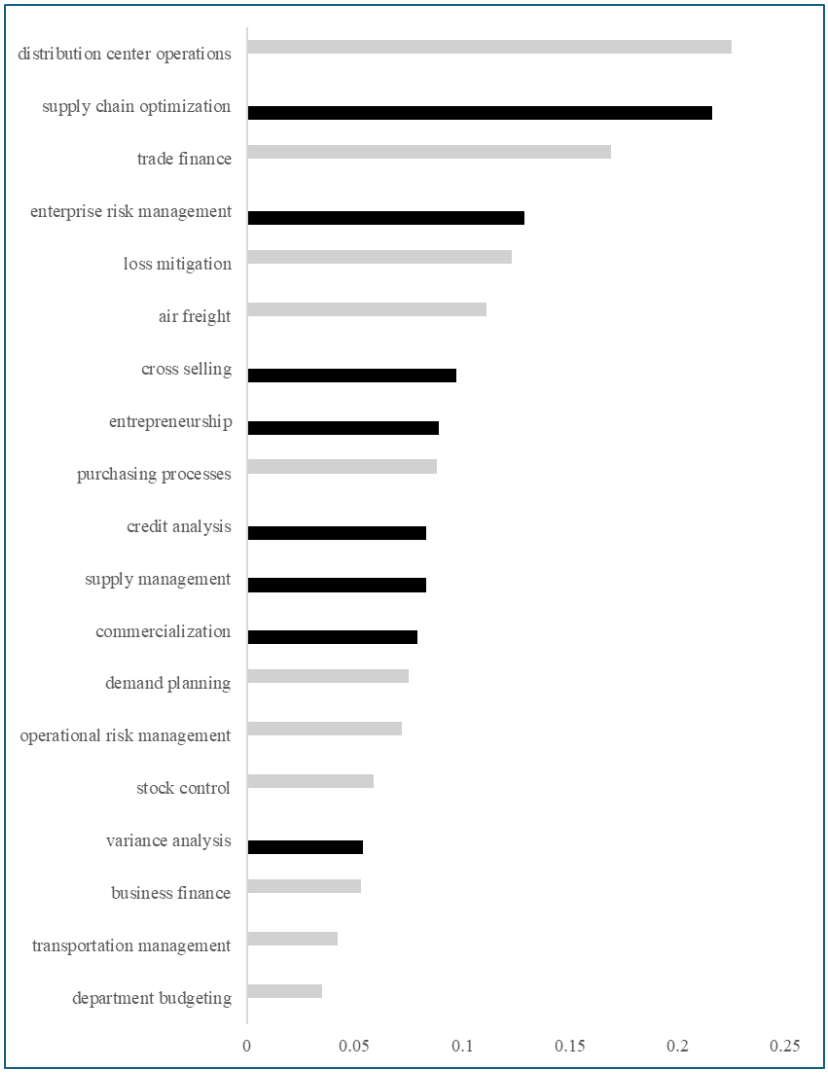


Table 1: Summary Statistics
This table provides summary statistics for the variables used in our analyses. The sample spans 1999-2008 for 50 states in the U.S. *Emp* and *GDP* variables are in log form. Refer to Appendix A for variable descriptions.

Variable	N	Mean	SD	Q1	Median	Q3
AcctSW	500	86.61	130.11	14	41	106
$AcctSW^{QB}$	500	51.49	89.61	7	22	59
AcctWage	500	24.92	3.86	22.01	24.68	27.41
AcctEmp	500	9.31	1.08	8.40	9.34	10.07
AcctSwitch	500	1.20	0.41	0.90	1.20	1.50
BusSW	500	427.83	608.43	80	219	540
BusWage	500	24.84	3.77	22.01	24.68	27.30
BusEmp	500	10.96	1.11	10.03	10.95	11.81
ApprWage	495	21.81	4.52	18.92	21.59	24.98
GDP	500	12.09	1.05	11.18	12.13	12.87
Unemp	500	4.75	1.14	3.90	4.70	5.50
AntiVirus	500	28.17	35.85	6	15	37
Exit_Workforce	500	731.57	1,316.98	101	285	732
Exit_NewRole	500	164.89	233.08	25	75	205
Stay_NewRole	500	60.68	74.81	10	31	84
StratOps	500	8.47	1.19	7.70	8.56	9.41
FinRisk	500	14.69	2.37	12.89	14.78	16.36
MgAcct	500	7.28	1.44	6.14	7.37	8.45
$AcctMonth^{Jan}$	500	30.56	5.38	25.91	29.98	34.79
$AcctMonth^{HHI}$	500	14.27	2.66	12.01	13.68	16.18

Table 2: Software Adoption and Labor Scarcity

This table studies software adoption using Equation (1). The unit of observation is state-year. *BusSW* is the number of business software adopters. *BusWage* is the mean wage for business and financial operations employees. *BusEmp* is the number of business and financial operations workers, log transformed. *AcctSW* is the number of accounting software adopters. *AcctWage* is the mean accountant wage. *AcctEmp* is the number of accountants, log transformed. *GDP* is the log transformed GDP. *Unemp* is the unemployment rate. Standard errors are clustered at the state level. *, **, *** indicate significance at the two-tailed 10%, 5%, and 1% levels, respectively.

	(1) $BusSW_{t+1}$	(2) $AcctSW_{t+1}$
$BusWage_t$	0.018**	
	(1.96)	
$BusEmp_t$	-0.157**	
	(-2.04)	
$AcctWage_t$		0.018**
		(2.38)
$AcctEmp_t$		-0.148*
		(-1.94)
GDP_t	0.466**	0.605**
	(2.37)	(2.55)
$Unemp_t$	-0.027***	-0.031**
	(-2.58)	(-2.21)
Observations	500	500
FE	State, Year	State, Year
Cluster	State	State
Adjusted R-squared	0.986	0.950

Table 3: Accountant Switches and Wages

This table studies accountant job switches and wages using Equation (2). The unit of observation is state-year. *AcctSwitch* is the number of accountants who switch from private firms or non-Big N audit firms to public firms or Big N audit firms, scaled by the total number of accountants in the state-year and expressed as a percentage. *AcctWage* is the mean accountant wage. *ApprWage* is the mean real estate appraiser wage. *SOX* is an indicator equal to one starting in 2004. *Shortage* is three minus the tercile ranking of mean $AcctEmp_{scaled}$ from 1999 to 2003 for each state. *GDP* is the log transformed GDP. *Unemp* is the unemployment rate. Standard errors are clustered at the state level. *, **, *** indicate significance at the two-tailed 10%, 5%, and 1% levels, respectively.

	(1) *AcctSwitch*	(2) *AcctSwitch*	(3) *AcctWage*	(4) *AcctWage*	(5) *ApprWage*	(6) *ApprWage*
SOX	0.308***		1.556***		0.491	
	(9.19)		(4.43)		(0.93)	
Shortage×*SOX*		0.070**		0.554***		0.292
		(2.66)		(3.02)		(0.69)
GDP	-0.800***	-0.669**	19.804***	-3.923	16.420***	12.202**
	(-3.93)	(-2.44)	(9.79)	(-1.47)	(6.65)	(2.32)
Unemp	-0.108***	-0.035*	0.916***	0.133	0.664***	0.467*
	(-10.04)	(-2.00)	(8.70)	(1.02)	(3.97)	(1.75)
Observations	500	500	500	500	495	495
FE	State	State, Year	State	State, Year	State	State, Year
Cluster	State	State	State	State	State	State
Adjusted R-squared	0.763	0.803	0.856	0.934	0.757	0.761

Table 4: Software Adoption and Labor Scarcity—SOX

This table studies software adoption using Equation (2). The unit of observation is state-year. *AcctSW* is the number of new software adopters. *SOX* is an indicator equal to one starting in 2004. *Shortage* is three minus the tercile ranking of mean $AcctEmp_{scaled}$ from 1999 to 2003 for each state. $Shortage_{high(mid)}$ is an indicator variable equal to one for states with the highest (middle) tercile of *Shortage,* and zero otherwise. *GDP* is the log transformed GDP. *Unemp* is the unemployment rate. Standard errors are clustered at the state level. *, **, *** indicate significance at the two-tailed 10%, 5%, and 1% levels, respectively.

	(1) *AcctSW*	(2) *AcctSW*
Shortage×*SOX*	0.059***	
	(2.92)	
$Shortage_{mid}$×*SOX*		-0.000
		(-0.01)
$Shortage_{high}$×*SOX*		0.086*
		(1.84)
GDP	0.926***	0.922***
	(2.90)	(2.99)
Unemp	-0.011	-0.013
	(-0.79)	(-0.92)
Observations	500	500
FE	State, Year	State, Year
Cluster	State	State
Adjusted R-squared	0.947	0.947

Table 5: Robustness

This table studies software adoption using variations of Equations (1) and (2). The unit of observation is state-year. In Panel A, *Shortage* is replaced with $Shortage^{mcap}$, where the denominator is based on the total market capitalization of Compustat firms instead of Compustat firm count. Panel B adds controls for the number and characteristics of private firms. *PrivateFirms* is the number of private firms. *FirmSizeHHI* is the Herfindahl-Hirschman index of firms across employee-size categories. $Firms^{small}$ is the number of firms with fewer than 100 employees. In this panel, we exclude the *GDP* control to avoid multicollinearity. In Panel C, the dependent variable is $AcctSW^{ratio}$, the number of new software adopters divided by the number of firms in Revelio, expressed as a percentage. In Panel D, the dependent variable is $AcctSW^{QB}$, the number of QuickBooks adopters. In Panel E, the dependent variable is *AntiVirus,* the number of antivirus software adopters. *Shortage* is three minus the tercile ranking of mean $AcctEmp_{scaled}$ from 1999 to 2003 for each state. *SOX* is an indicator equal to one starting in 2004. *AcctSwitch* is the number of accountants who switch from private firms or non-Big N audit firms to public firms or Big N audit firms, scaled by the total number of accountants in the state-year. *AcctWage* is the mean accountant wage. *AcctEmp* is the number of total accountants, log transformed. Standard errors are clustered at the state level. *, **, *** indicate significance at the two-tailed 10%, 5%, and 1% levels, respectively.

Panel A. Market Capitalization-based *Shortage*

	(1)	(2)	(3)
	AcctSwitch	*AcctWage*	*AcctSW*
$Shortage^{mcap} \times SOX$	0.073***	0.403**	0.031**
	(2.79)	(1.96)	(2.16)
Controls	Yes	Yes	Yes
Observations	500	500	500
FE	State, Year	State, Year	State, Year
Cluster	State	State	State
Adjusted R-squared	0.804	0.932	0.947

Panel B. Controlling for the Number and Distribution of Private Firms

	(1) *AcctSW*	(2) *AcctSW*	(3) *AcctSW*
Shortage×SOX	0.048**	0.042**	0.047**
	(2.50)	(2.18)	(2.45)
PrivateFirms	1.218***	1.082***	
	(4.91)	(4.08)	
FirmSizeHHI		2.344	
		(1.26)	
$Firms^{small}$			1.199***
			(4.95)
Controls	Yes	Yes	Yes
Observations	500	500	500
FE	State, Year	State, Year	State, Year
Cluster	State	State	State
Adjusted R-squared	0.948	0.948	0.948

Panel C. Scaled Adoption

	(1) $AcctSW^{ratio}_{t+1}$	(2) $AcctSW^{ratio}_{t}$
$AcctWage_t$	0.003**	
	(2.10)	
$AcctEmp_t$	-0.030**	
	(-2.32)	
$Shortage_t \times SOX_t$		0.017***
		(4.94)
Controls	Yes	Yes
Observations	500	500
FE	State, Year	State, Year
Cluster	State	State
Adjusted R-squared	0.803	0.822

Panel D. QuickBooks-based Adoption Measure

	(1) $AcctSW^{QB}_{t+1}$	(2) $AcctSW^{QB}_{t}$
$AcctWage_t$	0.022**	
	(2.20)	
$AcctEmp_t$	-0.178	
	(-1.47)	
$Shortage_t \times SOX_t$		0.071**
		(2.50)
Controls	Yes	Yes
Observations	500	500
FE	State, Year	State, Year
Cluster	State	State
Adjusted R-squared	0.936	0.931

Panel E. Placebo Tests

	(1) $AntiVirus_{t+1}$	(2) $AntiVirus_t$
$AcctWage_t$	-0.014	
	(-1.18)	
$AcctEmp_t$	0.249	
	(1.43)	
$Shortage_t \times SOX_t$		-0.003
		(-0.12)
Controls	Yes	Yes
Observations	500	500
FE	State, Year	State, Year
Cluster	State	State
Adjusted R-squared	0.858	0.858

Table 6: Software Adoption and Accountant Displacement

This table studies accountant displacement. The unit of observation is state-year. The dependent variable is *Exit_Workforce (Exit_NewRole, Stay_NewRole)*, the number of accountants in a given state-year who exit the firm and have no subsequent employer in the data (exit the firm and transition to a non-accounting role in another firm, exit an accountant role and transition to a non-accounting role within the same firm). Columns 1, 3, and 5 report reduced form Poisson regressions. Columns 2, 4, and 6 report instrumental-variables Poisson estimators using a control-function approach, with Equation (2) as the first-stage regression. To ease interpretability, coefficients on *AcctSW* are multiplied by 100. *Shortage* is three minus the tercile ranking of mean $AcctEmp_{scaled}$ from 1999 to 2003 for each state. *SOX* is an indicator equal to one starting in 2004. Control variables include *GDP* and *Unemp*. For even-numbered columns, we report first-stage F-statistics and their corresponding p-values. Standard errors are clustered at the state level. *, **, *** indicate significance at the two-tailed 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	Exit_Workforce	*Exit_Workforce*	*Exit_NewRole*	*Exit_NewRole*	*Stay_NewRole*	*Stay_NewRole*
Shortage×SOX	0.031***		-0.010		0.063***	
	(2.70)		(-0.60)		(2.91)	
$AcctSW_{IV}$		0.040**		-0.030		0.103**
		(2.09)		(-1.01)		(2.52)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	500	500	500	500	500	500
FE	State, Year	State, Year	State, Year	State, Year	State, Year	State, Year
Cluster	State	State	State	State	State	State
Adjusted R-squared	0.993	-	0.968	-	0.920	-
First-stage F-statistic		11.46		11.46		11.46
		(0.00)		(0.00)		(0.00)

Table 7: Software Adoption and Accountant Re-tasking

This table studies accountant involvement in strategy & operations, finance & risk, and management accounting tasks. The unit of observation is state-year. The dependent variables are *StratOps (FinRisk, MgAcct),* the number of accountants with job descriptions including strategy & operations (finance & risk, management accounting) practices keywords scaled by the number of accountants at private firms in the sample, multiplied by 100. Appendix B contains the keyword lists. Columns 1, 3, and 5 report reduced form regressions. Columns 2, 4, and 6 report instrumental-variables estimators using a control-function approach, with Equation (2) as the first-stage regression. To ease interpretability, coefficients on *AcctSW* are multiplied by 100. *Shortage* is three minus the tercile ranking of mean $AcctEmp_{scaled}$ from 1999 to 2003 for each state. *SOX* is an indicator equal to one starting in 2004. Control variables include *GDP* and *Unemp*. For models using predicted values, we report first-stage F-statistics and their corresponding p-values. Standard errors are clustered at the state level. *, **, *** indicate significance at the two-tailed 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	StratOps	*StratOps*	*FinRisk*	*FinRisk*	*MgAcct*	*MgAcct*
Shortage×SOX	0.214***		0.250**		0.181***	
	(2.80)		(2.40)		(3.07)	
$AcctSW_{IV}$		0.413**		0.481**		0.349**
		(2.29)		(2.03)		(2.33)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	500	500	500	500	500	500
FE	State, Year	State, Year	State, Year	State, Year	State, Year	State, Year
Cluster	State	State	State	State	State	State
Adjusted R-squared	0.925	-	0.968	-	0.957	-
F-statistic		11.46		11.46		11.46
		(0.00)		(0.00)		(0.00)

Table 8: Software Adoption and Hiring Seasonality

This table studies hiring seasonality. The unit of observation is state-year. $AcctMonth^{Jan}$ is the percentage of accountants who begin their jobs in January. $AcctMonth^{HHI}$ is the Herfindahl-Hirschman index of the monthly distribution of accountant job start dates, expressed as a percentage. Columns 1 and 3 report reduced form regressions. Columns 2 and 4 report instrumental-variables estimators using a control-function approach, with Equation (2) as the first-stage regression. To ease interpretability, coefficients on *AcctSW* are multiplied by 100. *Shortage* is three minus the tercile ranking of mean $AcctEmp_{scaled}$ from 1999 to 2003 for each state. *SOX* is an indicator equal to one starting in 2004. Control variables include *GDP* and *Unemp*. For models using predicted values, we report first-stage F-statistics and their corresponding p-values. Standard errors are clustered at the state level. *, **, *** indicate significance at the two-tailed 10%, 5%, and 1% levels, respectively.

	(1) $AcctMonth^{Jan}$	(2) $AcctMonth^{Jan}$	(3) $AcctMonth^{HHI}$	(4) $AcctMonth^{HHI}$
Shortage×*SOX*	-0.813***		-1.141***	
	(-7.15)		(-4.90)	
$AcctSW_{IV}$		-1.565***		-2.192***
		(-3.32)		(-3.11)
Controls	Yes	Yes	Yes	Yes
Observations	500	500	500	500
FE	State, Year	State, Year	State, Year	State, Year
Cluster	State	State	State	State
Adjusted R-squared	0.909	-	0.917	-
F-statistic		11.46		11.46
		(0.00)		(0.00)