

Breuer, Matthias; Le, Anthony; Vetter, Felix

**Working Paper**

## Audit mandates, audit firms, and auditors

New Working Paper Series, No. 333

**Provided in Cooperation with:**

George J. Stigler Center for the Study of the Economy and the State, The University of Chicago Booth School of Business

*Suggested Citation:* Breuer, Matthias; Le, Anthony; Vetter, Felix (2023) : Audit mandates, audit firms, and auditors, New Working Paper Series, No. 333, University of Chicago Booth School of Business, Stigler Center for the Study of the Economy and the State, Chicago, IL

This Version is available at:

<https://hdl.handle.net/10419/278751>

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*



**Stigler Center**

for the Study of the Economy and the State

## **Audit Mandates, Audit Firms, and Auditors**

Matthias Breuer

Columbia University

Anthony Le

Columbia University

Felix Vetter

University of Mannheim

September 2023

New Working Paper Series No. #333

### Abstract:

Audits by private, third-party auditors are frequently mandated to ensure compliance with regulations (e.g., accounting or environmental standards). We examine how such mandates shape the market for audits. In our empirical examination, we focus on one of the oldest and most prominent audit markets, the market for audits of firms' financial accounting. Using novel data on firms, audit firms, and auditors the key players in the market, we find that audit mandates increase the number of audits, audit firms, and auditors, but decrease average auditor wages. These findings are consistent with mandates creating demand for low-quality audits, originating from involuntarily audited firms, in a market with differentiated audit qualities. In line with this interpretation, we find that the regulatory audit demand emanates from smaller firms with limited incentives to obtain audits voluntarily; and is served by smaller audit firms and less experienced auditors. Collectively, our findings suggest that the promise of audit mandates as a means to ensure regulatory compliance may be limited by the emergence of low-quality audits.

Stigler Center for the Study of the Economy and the State  
University of Chicago Booth School of Business  
5807 S Woodlawn Ave  
Chicago, IL 60637

# Audit Mandates, Audit Firms, and Auditors\*

Matthias Breuer<sup>†</sup>     Anthony Le<sup>‡</sup>     Felix Vetter<sup>§</sup>

This version: September 2023

## Abstract

Audits by private, third-party auditors are frequently mandated to ensure compliance with regulations (e.g., accounting or environmental standards). We examine how such mandates shape the market for audits. In our empirical examination, we focus on one of the oldest and most prominent audit markets, the market for audits of firms' financial accounting. Using novel data on firms, audit firms, and auditors—the key players in the market—we find that audit mandates increase the number of audits, audit firms, and auditors, but decrease average auditor wages. These findings are consistent with mandates creating demand for low-quality audits, originating from involuntarily audited firms, in a market with differentiated audit qualities. In line with this interpretation, we find that the regulatory audit demand emanates from smaller firms with limited incentives to obtain audits voluntarily; and is served by smaller audit firms and less experienced auditors. Collectively, our findings suggest that the promise of audit mandates as a means to ensure regulatory compliance may be limited by the emergence of low-quality audits.

**Keywords:** Auditing; Mandates; Employees; Wages; Quality; Market Structure

**JEL Classification:** G18; G38; J23; J24; J31; J42; K22; L10; L51; L84; M42; M48

---

\*We thank Simcha Barkai, Phil Berger (discussant), Henry Friedman, Brandon Gipper (discussant), Jon Glover, Carsten Homburg, Rafael Jimenez, Filippo Lancieri, Rongchen Li, Shunsuke Matsuno, Felix Montag, Maximilian Müller, Michael Overesch, Stephen Penman, Canice Prendergast, Aneesh Raghunandan (discussant), Li Yang, and Luigi Zingales; seminar participants at Columbia University, Yale University, Stanford University, University of Strathclyde, Boston College, University of Utah, University of Cologne, Humboldt University Berlin, and University of Mannheim; and conference participants at the 2022 Labor and Accounting Group Conference in St. Louis, the 2022 German Economists Abroad Conference, the 2022 Stigler Center Fellows Conference at the University of Chicago, the 2023 American Accounting Association FARS Midyear Meeting, and the 2023 European Accounting Association Annual Congress for helpful comments and suggestions. We acknowledge excellent research assistance by Karin Hobelsberger. All errors are our own.

<sup>†</sup>Columbia University, Graduate School of Business - [mb4468@gsb.columbia.edu](mailto:mb4468@gsb.columbia.edu)

<sup>‡</sup>Columbia University, Graduate School of Business - [ale25@gsb.columbia.edu](mailto:ale25@gsb.columbia.edu)

<sup>§</sup>University of Mannheim - [vetter@uni-mannheim.de](mailto:vetter@uni-mannheim.de)

# 1 Introduction

Mandates to obtain audits from private, third-party auditors are ubiquitous. They are a cornerstone of financial and environmental regulations and commonplace in consumer markets (e.g., [Duflo et al., 2013a](#)). The mandates aim to enforce compliance with regulations and standards (e.g., for financial accounting or food safety) such that those can take effect. The effectiveness of audit mandates themselves, however, has repeatedly been called into question. High-profile audit failures and scandals raise concerns about the independence of auditors hired by auditees (e.g., [Ronen, 2010](#)).<sup>1</sup> At the same time, research struggles to document clear benefits of audit mandates for auditees or the markets they operate in.<sup>2</sup> Accordingly, it remains uncertain whether and how the mandates work and who they benefit. This uncertainty, in no small part, is aided by the opacity of audit firms and auditors, the potential beneficiaries of audit mandates.

To better understand the working of audit mandates, we examine how the mandates shape the market for audits. In our examination, we focus on mandates applying to the market for audits of firms' financial statements, one of the oldest and most prominent audit markets (e.g., [Jensen and Meckling, 1976](#); [Watts and Zimmerman, 1983](#)). Specifically, we examine the European Union's (EU) audit mandates that require larger firms—both publicly listed and private ones—to obtain financial-statement audits. The size-based audit mandates are expansive, affecting several hundred thousand firms. They aim to ensure that firms that are of public interest due to the size of their business disclose credible financial statements to allow for monitoring of their corporate actions and financial health ([European Commission, 2022](#)). In this context, we explore how the mandates affect the key players of the audit market: *firms* purchasing audits (i.e., customers), *audit firms* offering audits (i.e., producers),

---

<sup>1</sup>Corporate frauds often remain undeterred or undetected by audits ([Dyck et al., 2010](#)). While prominent examples include audited public firms such as Enron and Wirecard, the same issue pertains to frauds of audited private firms (e.g., [Eaglesham and Jones, 2021](#); [Gemmell, 2022](#)).

<sup>2</sup>For evidence on environmental audit mandates, see, for example, [Duflo et al. \(2013a\)](#) and [Kontokosta et al. \(2020\)](#). For evidence on financial audit mandates, see, for example, [Kausar et al. \(2016\)](#), [Breuer \(2021\)](#), and [Bourveau et al. \(2021\)](#). For reviews of the audit literature, see [DeFond and Zhang \(2014\)](#) and [Vanstraelen and Schelleman \(2017\)](#).

and *auditors* auditing firms on behalf of audit firms (i.e., employees).

We attempt to shed light on the working of audit mandates by using variation in countries' audit thresholds and novel data on firms, audit firms, and auditors. We measure the scope of audit mandates via the share of firms above a country's audit thresholds. Differences and changes in European countries' audit thresholds create plausibly exogenous variation in this share. In addition, this share even varies across countries with the same thresholds or, likewise, across regions within a given country, due to differences in industrial structure and firm-size distributions. We complement this regulatory variation in the scope of audit mandates with data on the key players in the audit market. We obtain comprehensive data on firms' audit choices from annual snapshots of firms' auditors in Bureau van Dijk's *Amadeus* database; financial information on audit firms from a manual search of audit firms' financial statements in Bureau van Dijk's *Orbis* (historical) database; and data on auditors' employment histories and wages from confidential access to administrative records in Germany provided by the IAB's *Linked-Employer-Employee* database.

We begin our empirical examination by documenting the impact of audit mandates on firms and their stakeholders. We find that the mandates substantially increase firms' propensity to obtain an audit. Firms just above the German audit thresholds, for example, exhibit a 63 percentage points higher audit rate than firms just below. We also observe that audit mandates imposed on some firms appear to crowd out voluntary audit rates among other firms. This observation is consistent with audit mandates increasing the cost of auditing (e.g., by increasing the demand for scarce audit resource; [Duguay et al., 2020](#)) or decreasing its benefits (e.g., by reducing the signal value of audits; [Kausar et al., 2016](#)), thereby imposing a negative externality on voluntarily audited firms. In terms of consequences, we find some, albeit weak evidence that audit mandates increase the quality of (otherwise unaudited) firms' accounting reports, but no evidence that broader economic or societal improvements result from the audit mandates.

We next examine the impact of audit mandates on audit firms. We find that the mandates

substantially increase the average number of clients served by a given audit firm. At the same time, they decrease the average size of a given audit firm's clients. Consistent with our prior results, these findings show that audit mandates substantially increase the demand for audits, especially among smaller firms. The increasing demand from smaller firms reflects both, the fact that these are the marginal firms affected by the variation in the size thresholds of the mandates, and that these firms exhibit lower voluntary disclosure incentives than larger firms (e.g., with greater agency issues; [Lennox and Pittman, 2011](#)). With a view to audit firms' input factors and cost drivers, we observe that audit mandates substantially increase a given audit firm's total and tangible capital, number of employees, and employee costs.

Finally, we study the impact of audit mandates on the labor market for auditors. We find that a greater share of firms subject to audit mandates in a given region increases the number of employees working at audit firms in that region. While some of these additional employees are non-audit staff (e.g., administrators), the majority are auditors. We find that several of these auditors hail from other regions and non-audit industries (e.g., corporate jobs). Collectively, the findings are consistent with audit mandates increasing audit demand and the size of the audit profession, in line with our earlier results. With a view to auditor wages, we find that a greater share of firms subject to audit mandates in a given region *reduces* auditors' average wages substantially. This result runs counter to the expectation that, in a simple supply-demand model of the audit market, a shift in audit demand should translate into more auditors *and* higher auditor wages.

We propose an extended model of the audit market with differentiated audit qualities to interpret our collective findings. The model rationalizes the *reduced* auditor wages as a result of a compositional shift from high- toward low-quality audits. It highlights that audit mandates force those firms that privately do not view an audit as net beneficial to buy an audit. To minimize costs, those firms will tend to choose a low-quality option, if forced to buy an audit. As a result, audit mandates primarily increase the demand for low-quality audits offered by low-quality audit firms and auditors.

In supplemental tests, we find evidence consistent with the predictions of our extended model. We find that, while audit mandates increase audit firms' number of clients, the average size of audit firms and market-share concentration in the audit market decreases. The decrease is due to many small audit firms entering the audit market in response to the mandates. The small audit firms likely cater to the low-quality audit demand, as audit-firm size is a robust indicator of audit quality (e.g. [DeAngelo, 1981](#); [DeFond and Zhang, 2014](#); [Jiang et al., 2019](#)). We also find that the increase in the number of auditors in a given region in response to audit mandates is primarily driven by less experienced auditors with lower outside options. Notably, this finding does not reflect a short-run scarcity of experienced auditors. It obtains both in the short and long run. Accordingly, it plausibly reflects the increased demand for low-quality audits. As auditors are the key input in the audit process, low-quality auditors can be expected to translate into low-quality audits (e.g., [Francis, 2011](#); [Lee et al., 2021](#)).<sup>3</sup> We note that our quality interpretation does not necessarily suggest that audit mandates are not needed. Instead, it suggests that audit mandates need to be complemented by quality controls (e.g., oversight) to ensure that mandates unfold their desired effects. A less benign interpretation is that audit mandates primarily create demand for low-complexity audits. With more complex firms standing to benefit more from audits and the absence of aggregate improvements, this interpretation would suggest that audit mandates are not needed.

Collectively, our findings suggest that audit mandates increase the size of the audit market and profession by creating additional demand for audits. This demand emerges from firms that do not want to obtain audits voluntarily. In a differentiated audit market (e.g., [Duffo et al., 2013b](#); [Gerakos and Syverson, 2015](#)), their demand is served by small audit firms and inexperienced auditors offering a low-cost option to comply on paper, but not necessarily in substance. This insight provides a potential explanation for why audit mandates may

---

<sup>3</sup>An alternative interpretation could be that audit mandates increase demand for low-complexity audits. We compare and contrast the quality vs. complexity interpretations in Section ??.

produce disappointing results.<sup>4</sup>

Our paper contributes to the literature on certification and verification mechanisms (e.g., [Dranove and Jin, 2010](#)).<sup>5</sup> Third-party audits are one of the most, if not the most popular mechanism to verify information and ensure compliance with regulations and standards.<sup>6</sup> Prior literature casts doubt on the effectiveness of third-party audits on the grounds of potential independence issues arising because firms pay their auditors. Our paper shows that, even if independence were not an issue, we should not necessarily expect audit mandates to result in *substantive* compliance with regulations and standards as the mandates primarily create demand for low-quality audits, rubber stamping compliance. More broadly, our paper suggests that providing firms with the option to select their compliance mechanisms can undermine the effectiveness of regulations and standards.

Our paper also speaks to the literature on the economics and politics of regulation (e.g., [Stigler, 1971](#); [Kahn, 1988](#); [Rose, 2014](#)). It shows that mandates, by creating additional demand, allow the audit market and profession to grow its size. This growth is attributable to the profession’s ability to convince regulators, instead of firms, that more auditing is needed. The audit profession’s success with regulators likely reflects that the profession is a well-organized interest group which promises to provide a politically convenient good: trust and transparency.<sup>7</sup> Notably though, the mandates impact on the growth of the profession is muted by the fact that mandatory audits crowd out some voluntary audits. In addition, the growth is concentrated in the low-quality segment. As a result, the increased size of

---

<sup>4</sup>It is consistent with the conjecture in [Cook et al. \(2020\)](#) that an unintended consequence of audit mandates could be that “non-discerning auditors emerge to serve clients with low endogenous demand for auditing” (p. 4). It also aligns with evidence in [Lennox and Pittman \(2011\)](#) that involuntarily audited firms tend to choose non-Big 4 auditors and pay lower fees.

<sup>5</sup>Certification or verification of information can help sustain markets. If market participants are asymmetrically informed, markets can fail ([Akerlof, 1970](#)). This failure can be averted through information disclosure ([Ross, 1979](#)). The disclosure needs to be credible though ([Viscusi, 1978](#)). Its credibility can be assured through certification or verification ([Mookherjee and Png, 1989](#); [Stahl and Strausz, 2017](#)).

<sup>6</sup>The literature examines various aspects of the auditing market ([Benston, 1985](#)), including audit quality (e.g., [DeFond and Zhang, 2014](#)), competition (e.g., [Gerakos and Syverson, 2015](#); [Friedman and Mahieux, 2021](#)), pricing (e.g., [Simunic, 1980](#)), litigation (e.g., [Dye, 1993](#)), and licensing (e.g., [Cascino et al., 2021](#)).

<sup>7</sup>For anecdotal evidence supporting the lobbying prowess of the audit profession, see, for example, [Wiesen \(1978\)](#) for an account of the audit profession’s influence on the lawmaking of the Securities Acts in the U.S. and [Bartz et al. \(2021\)](#) for a description of audit firms’ lobbying after the recent Wirecard scandal in Germany.



the profession may come at the cost of a decreased standing, discouraging employees with high skill and integrity to enter the profession. Such adverse selection could ultimately prove detrimental to a profession that relies heavily on its members to uphold professional standards and ethics.

Lastly, our paper provides timely lessons for current policy deliberations regarding the disclosure and verification of environmental, social, and governance (ESG) metrics. ESG metrics are viewed as pivotal for enabling private-market and regulatory efforts to address environmental and societal issues (e.g., through proper measurement of pollution; [Greenstone et al., 2023](#)). The reliability of firms' reported ESG metrics is often called into question though (see "greenwashing" debate; [Constable, 2020](#); [Harris, 2022](#)). To address the reliability issue, regulators are deliberating audit mandates, and financial audit firms are rushing into the ESG space, offering themselves up as experts in information verification ([O'Dwyer and Edgecliffe-Johnson, 2021](#); [Maurer, 2022](#)).<sup>8</sup>

Our evidence casts doubt on the promise of audit mandates for ESG reporting. While our evidence is derived from a financial-reporting context, we contend that the basic economic insights carry over to the context of ESG reporting ([Christensen et al., 2021](#)). We surmise that the issues with audit mandates in the ESG context may be even more consequential. In our context of financial reporting, it is unclear whether there are substantial externalities that firms neglect in their voluntary reporting decisions (e.g., [Greenstone et al., 2006](#); [Breuer, 2021](#)). Hence, poor enforcement of financial-reporting regulation resulting from firms' choice of low-quality audits may not be detrimental to society. To the contrary, it may even be a way to limit the economic losses of excessive regulation. In the context of ESG reporting, by contrast, externalities of firms' reporting may be substantial, justifying the regulation and standardization of ESG reporting. In this case, poor enforcement of ESG reporting regulation due to regulators' reliance on ineffective verification mechanisms, such as audit

---

<sup>8</sup>S.P. Kothari, the former Chief Economist and Director of the Division of Economic and Risk Analysis at the U.S. Securities and Exchange Commission, "half-jokingly describes the global push as a 'full-employment act for accountants and consultants'" in a recent article in *The Economist* ([Ryan, 2022](#)).

mandates which allow firms to choose their third-party auditors, could be quite costly.

## 2 Institutions: Audit Markets and Mandates

Third-party audits of firms' financial accounts emerged several centuries ago.<sup>9</sup> [Watts and Zimmerman \(1983\)](#), for example, document that English merchant guilds relied on audits as early as 1200. By verifying management's account of its use of shareholders' resources, third-party audits serve as a core mechanism to address agency issues arising from the separation of ownership and control of firms' resources. Consequently, audits have been pivotal for the creation and success of large scale business endeavors (e.g., [Fama and Jensen, 1983](#)).

The development of the audit market and profession has been shaped by economic forces (e.g., the increasing scale of business) but also regulatory interventions. A first notable audit mandate was introduced in England through the Joint Stock Companies Act of 1844, which mandated audits for joint-stock companies.<sup>10</sup> In the United States (U.S.), audits were mandated for publicly-listed companies in 1933/4 through the passage of the Securities Acts. Those mandates were commonly introduced in response to corporate scandals and frauds.<sup>11</sup> They have "greatly enhanced the status of professional auditors as well as the growth of that profession" ([Stettler, 1977](#)), "created a need for ... independent auditors" ([Senate Staff, 1976](#)), and provided "immense" benefits to markets and the economy ([Doty, 2014](#)), according to popular audit textbooks, Senate staff reports, and the former chairman of the Public Company Accounting Oversight Board.

In the EU, the Accounting Directives require that financial accounts of limited-liability firms be audited since the 1980s. This requirement, applying to both private and publicly-

---

<sup>9</sup>The origins of accounting trace back to at least 10,000 BC (e.g., [Waymire and Basu, 2008](#)). According to the economic historian Jacob [Soll \(2014\)](#), "*Over and over, good accounting practices have produced the levels of trust necessary to found stable governments and vital capitalist societies, and poor accounting and its attendant lack of accountability have led to financial chaos, economic crimes, civil unrest, and worse.*"

<sup>10</sup>The mandate was removed in 1856 (due to concerns about the independence and competence of auditors) and reinstated in 1900 ([Hopwood and Vieten, 1999](#); [Competition Commission, 2012](#)).

<sup>11</sup>Economic theory suggests that audit mandates can, for example, be justified if audits provide an externality (e.g., trust in markets) or improve firms' real decisions (e.g., [Jiang et al., 2023](#)). For a discussion of regulatory rationales, see, e.g., [Minnis and Shroff \(2017\)](#).

listed firms, is more expansive than the mandates in the U.S. This more expansive requirement reflects differences in legal and institutional traditions (e.g., [McLeay, 1999](#); [La Porta et al., 2000](#); [La Porta et al., 2008](#)). Compared to the U.S. with its large public-capital market, the emphasis of Europe’s accounting regulation lies more on the protection of a broad set of stakeholders (e.g., customers, suppliers, and employees) than merely on the protection of shareholders (e.g., [Eilifsen and Willekens, 2007](#)).<sup>12</sup> Similarly expansive accounting regulations can be found in Australia, India, and several South American and African countries.

The Accounting Directives allow for size-based exemptions from audit mandates. The rationale for these exemptions is twofold. For one, the EU wants to protect the public by monitoring firms of public interest; which tend to be larger firms (e.g., with many employees). For another, the EU expects that smaller firms are particularly burdened by the audit mandates due to fixed costs of audits. As a result, the EU allows member states to exempt private firms with firm sizes below two out of three thresholds, relating to firms’ total assets, sales, and employees, from the audit mandates.

The EU member states have implemented different exemption thresholds across countries and over time (e.g., [Bernard et al., 2018](#); [Breuer, 2021](#)). The different implementations across countries reflect their distinct traditions. In some Nordic countries, for example, audit mandates used to apply to all firms, partly as a way to enforce tax compliance (given the close alignment of financial and tax accounting). Other countries (e.g., Germany), by contrast, have chosen to implement the maximum exemption thresholds allowed under the EU’s Accounting Directives. The EU sets the maximum thresholds to prevent countries from exempting all their firms from audit mandates, in an effort to ensure a (harmonized) minimum level of audit mandates across Europe. Over time, the member states’ exemption thresholds have changed due to periodic updates of the thresholds (e.g., to account for inflation) or major shifts in audit regulations. Norway, for example, implemented the audit exemptions in 2011 for the first time and the U.K. increased its exemption thresholds notably

---

<sup>12</sup>U.S. regulators are currently deliberating regulating private firms’ financial accounting and auditing as a result of the growing importance of private capital and recent private-firm scandals (e.g. [Kiernan, 2022](#)).

around 2004. Those changes provide major shifts in the share of firms subject to audit mandates (Table A1).

### 3 Theory: A Simple Model of the Audit Market

The EU’s size-based audit mandates can affect firms, audit firms, and auditors in various ways. Based on a basic supply-demand logic, we would expect that audit mandates, by forcing firms to buy audits, increase the demand for audits. As audits are provided by auditors working at audit firms, we would expect this demand to translate into more auditors working at audit firms. We would also expect this demand to translate into higher auditor wages, which are necessary to attract more employees into the audit profession.

To fix ideas, we present a simple model of the audit market that jointly considers the three players: firms, audit firms, and auditors. The model allows tailoring the above supply-demand logic to the particularities of the EU’s size-based mandates and forming more detailed and specific expectations.

#### 3.1 Firms’ Audit Demand

Firms, indexed by  $i$ , differ in their size ( $s_i$ ). There are many more small firms than large firms. Hence, we model the frequency of firms along the size dimension as following a Pareto distribution ( $f(s_i) \sim Pareto(\alpha)$ ). Larger firms are more complex to audit, but also benefit more from audits (e.g., due to greater agency issues).

Firms of a given size choose to obtain an audit if their utility of the audit exceeds the audit cost:

$$u_i = (b - p)s_i - f \tag{1}$$

where  $b$  is the marginal benefit of an audit for a firm of size  $s_i$ ;  $p$  is the marginal cost of an audit (e.g., scaling with the audit hours); and  $f$  is the fixed cost of an audit (e.g., due to

technology investments and setup costs). For simplicity, we abstract from other idiosyncratic factors determining firms' audit demand.<sup>13</sup>

Firms of size  $s^*$  are indifferent between buying or foregoing an audit:

$$u_i = 0 \tag{2}$$

$$\Rightarrow s^* = \frac{f}{b-p} \tag{3}$$

Accordingly, all firms above this size cutoff buy audits voluntarily, whereas smaller firms forego an audit.

The total demand for audits (in units of audit complexity) is thus given by the sum of the frequency weighted size (or complexity) of all firms choosing an audit:

$$Q^D = \int_{s^*}^{\infty} s_i f(s_i) d_i \tag{4}$$

### 3.2 Audit Firms' Audit Production

Audit firms produce audits by combining labor ( $L$ ) with technology and systems in place at the audit firms:

$$Q^S = AL^\rho \tag{5}$$

For simplicity, we focus on the labor input and take the technology and systems as given (e.g., embodied in the productivity parameter  $A$ ).<sup>14</sup> We assume constant returns to labor ( $\rho = 1$ ), implying that audit firms, for double the amount of audits, require double the amount of auditors. Notably, we treat audit firms as monolithic. (We provide an extension in Section 6.) There could be one or multiple firms serving firms' total audit demand.

---

<sup>13</sup>By abstracting from other factors, we can solve our model in closed form and provide a stark illustration of its main predictions. For robustness, we numerically solve a version of our model that includes idiosyncratic audit-utility shocks. This model yields the same qualitative predictions as our simple model.

<sup>14</sup>Ronnen (1996) provides a two-stage model with investments in technology in the first stage.

Audit firms charge firms a fixed cost ( $f$ ) to cover setup and technology investments and an average marginal cost ( $p$ ), which corresponds to the total wage bill of the audit firm divided by the total audit services supplied:

$$p = \frac{wL}{Q^S} \quad (6)$$

where  $w$  denotes the wage of auditors.

### 3.3 Auditors' Labor Supply

Auditors, indexed by  $j$ , supply their labor in a local audit market if their local wage ( $w$ ) exceeds their outside option ( $\bar{w}d_j$ ). The outside option is a function of the distance ( $d_j$ ) of the auditor from the local market:

$$u_j = w - \bar{w}d_j \quad (7)$$

This setup implies that auditors are not in fixed supply, but can be attracted from further away or outside occupations (e.g., corporate / internal-audit jobs).

Auditors are located along a unit distance line, with zero denoting the location of the local audit market. For simplicity, we assume that the auditors are uniformly distributed along the line. They are indifferent between supplying their labor in the local market or elsewhere if they are at distance  $d_j^*$ :

$$u_j = 0 \quad (8)$$

$$\Rightarrow d_j^* = w/\bar{w} \quad (9)$$

The total supply of local auditor labor accordingly amounts to the sum of all auditors located between the audit market and the distance cutoff:

$$L = \int_0^{d_j^*} d_j \quad (10)$$

### 3.4 Voluntary Audit Market Equilibrium

Absent size-based audit mandates, a voluntary equilibrium obtains in the audit market. In this equilibrium firms choose whether to obtain audits solely based on their utility derived from audits. In equilibrium, the total audit quality demanded by firms and supplied by audit firms and auditors need to coincide:

$$Q^D \stackrel{!}{=} Q^S \tag{11}$$

This equilibrium condition pins down auditors' equilibrium wage ( $w^*$ ). (For a derivation of the equilibrium, please refer to the [Model Appendix](#).)

To illustrate the voluntary market equilibrium, we use a concrete numerical example.<sup>15</sup> For this example, Panel A of Figure 1 plots the firm-size distribution (in light blue), firms' audit utility (in grey), and firms' audit choices (in dark blue). Firms choose an audit if their utility derived from auditing is positive. Accordingly, all firms larger than the cutoff  $s^*$ , where the utility crosses zero, choose to buy an audit.

Panel B of Figure 1 plots the corresponding equilibrium in the market for auditors. The downward sloping demand curve (in dark blue) reflects that greater wages, which translate into marginal audit costs, decrease firms' audit demand. The upward sloping supply curve (in grey) reflects that greater wages attract more auditors to the local audit market. The black dashed lines indicate the wage and auditor-labor supply in the voluntary audit market equilibrium (i.e., the intersection of supply and demand).

### 3.5 Mandatory Audit Market Equilibrium

In the presence of size-based audit mandates, firms above the regulatory threshold ( $T$ ) must obtain an audit irrespective of their utility. This requirement affects the audit market if it is binding; that is, if the threshold is lower than the size (cutoff) at which firms choose to

---

<sup>15</sup>The numerical values chosen for the parameters are reported in the caption of Figure 1.

obtain audits voluntarily:  $T < s^*$ . Unlike in the voluntary (benchmark) equilibrium then, the size-cutoff above which firms buy an audit is an exogenous parameter, not an endogenous outcome anymore. Still, even in the mandatory equilibrium, total audit quality demanded (voluntarily and/or mandatorily) by firms and supplied by audit firms and auditors need to coincide.

To illustrate the impact of size-based audit mandates implied by our model, we introduce a binding threshold into our previous numerical example. Panel C of Figure 1 plots the firm-size distribution (in light blue), firms' audit utility (in grey), and firms' audit choices again. This time though, all firms above the regulatory threshold (shown as the red dashed line) must obtain an audit. Accordingly, compared to the voluntary equilibrium, more firms are obtaining an audit. Panel D of Figure 1 shows that this outward shift in the demand for audits increases the equilibrium number of auditors working in the local audit market. To attract those workers, the equilibrium wage needs to increase too. The red dashed lines indicate the new mandatory equilibrium in the market for auditors.

The main prediction that audit mandates increase the amount and wages of auditors comports with the expectation one would form based on a basic supply-demand logic. The model, however, also provides further, more specific insights into the expected impact of the EU's size-based audit mandates on the audit market. First, it suggests that, while voluntarily audited firms and their stakeholders benefit from audits, this may not be the case for mandatorily audited firms and their stakeholders. This insight can be seen in Panel C of Figure 1 by the fact that the mandate forces firms with negative audit utility to obtain audits. Second, our model suggests that the average size of audit firms' audit clients decreases in response to size-based mandates. This insight can be seen in Panel C of Figure 1 by the fact that the mandate forces primarily smaller firms to obtain audits. This feature arises for two reasons: smaller firms are the marginal firms affected by variation in the size-based threshold *and* smaller firms have lower auditing propensities than larger firms. Lastly, our model suggests that audit mandates crowd-out some voluntary audit demand. This insight



can be seen in Panel D of Figure 1 by the fact that the slope of the audit utility is flattened in the mandatory equilibrium as compared to the voluntary equilibrium. This flattening occurs because, due to greater demand for auditors, auditor wages and, thus, audit prices increase, reducing the marginal value of an audit for firms. As a result of this pecuniary externality, the range of firms that voluntarily obtains an audit shrinks, as can be seen by the increased voluntary audit size cutoff (dashed black line) and the share of firms obtaining voluntary audits (dark blue area) in Panel C of Figure 1.

In terms of welfare, our model predicts that the mandates first and foremost result in a wealth transfer from firms to auditors. Figure 2 shows that, without the mandates, firms' surplus is made up of areas  $A$  and  $B$ , whereas auditors' surplus corresponds to the area  $C$ . With the mandates, firms' surplus decreases by area  $B$  because all audited firms have to pay a higher auditor wage. Their surplus further decreases by areas  $D$  and  $E$  because several firms are forced to buy an audit at a price that they would not buy at voluntarily. Most of these surplus losses are transferred to auditors. Auditors gain the areas  $B$  and  $D$  as they can charge higher wages and still face higher audit demand due to the mandate. The only area they do not gain is  $E$ , which represents a deadweight loss from forced transactions between firms and auditors. This welfare analysis presumes that firms' private demand for audits coincides with society's audit demand. If there are externalities of the underlying regulation, audit mandates may not decrease or could even enhance total welfare. The primary effect of the mandates, however, would likely still be a wealth transfer from firms to auditors (as shown in Figure A1 in the [Internet Appendix](#)).

## 4 Empirical Strategy

### 4.1 Data

We create and combine various datasets to explore, guided by our model, the impact of audit mandates on the key players of the audit market. We collect information on European

size-based audit mandates for 24 countries for years 2000 to 2019. We use the thresholds reported in Breuer (2021) and update them using the most recent information provided by countries’ regulators (Table A1).

We obtain information on European firms’ audit choices from annual snapshots of Bureau van Dijk’s *Amadeus* database, for the years 2003 to 2019. The snapshots provide information on whether firms obtained an audit; and, if so, which audit firm provided the audit. They allow us to examine firms’ history of audit choices, not just their most recent audit choice reported in the *Amadeus* database. We supplement this information with data on firms’ size (e.g., total assets, sales, and employees) and financials (e.g., leverage) obtained from Bureau van Dijk’s *Orbis* (historical) database, for the years 2003 to 2019, and data on firms’ accounting and audit quality (e.g., qualified audit opinions and restatements) obtained through full-text searches on *LexisNexis* of the *Bundesanzeiger* (German Federal Gazette).

We obtain information on European audit firms’ client portfolio from the annual *Amadeus* snapshots. We clean and harmonize the audit firm names within and across years using a combination of manual checking and machine-based matching. We supplement this information with data on audit firms’ size (e.g., total assets and employees), tangible capital (e.g., fixed assets), and wage bill (e.g., cost of employees) obtained through manual (name-based) searches in Bureau van Dijk’s *Orbis* (historical) database, for the years 2003 to 2019. We limit our searches to the largest 100 audit firms in each country.<sup>16</sup>

Lastly, we obtain information on German auditors from the IAB’s *Linked-Employer-Employee* database (*LIAB*) for the years 2008 to 2019. The sample starts in 2008 because audit firms and auditors are only identifiable in the database using granular industry and occupation codes, which are available after 2008.<sup>17</sup> The *LIAB* contains administrative records

---

<sup>16</sup>This selection means we only observe the largest audit firms. These audit firms are the most important ones, especially given the typically high concentration in audit markets. They are also the ones that are most likely to be required to report their financial statements. Hence, the focus on larger audit firms is unavoidable. Still, this sample-selection bias needs to be taken into account when interpreting (aggregate/average) results using audit firms’ financial information as outcomes.

<sup>17</sup>Industries are assigned via the Klassifikation der Wirtschaftszweige (WZ08), which is based on the NACE Rev. 2 classification. Occupations are assigned via the Klassifikation der Berufe (KldB).

on employment spells, linked with employer records at the establishment level. It is constructed via a stratified random sample from a database comprising employment biographies for all German employees, the *Integrated Employment Biographies (IEB)*. Once an establishment is chosen, all employees within that establishment subject to social security contributions are included in the sample.<sup>18</sup> The administrative employee records contain data on daily wages and demographic information, along with granular industry, occupation, and regional classification codes.<sup>19</sup>

## 4.2 Designs

We exploit the size-based audit mandates in Europe to identify the impact of the mandates on the key players in the audit market. To examine the impact on firms, we compare firms just below the audit thresholds with those just above, using a variant of the regression discontinuity design (Lee and Lemieux, 2010) that accommodates multiple assignment variables and thresholds:

$$y_{i,t} = \alpha + \beta AboveThresholds_{i,t-1} + \gamma Size_{i,t-1} + \epsilon_{i,t} \quad (12)$$

where  $y_{i,t}$  is an outcome (e.g., an audit indicator) of firm  $i$  in year  $t$ ;  $AboveThresholds_{i,t-1}$  is an indicator for firms exceeding two out of three audit thresholds in the previous year; and  $Size_{i,t-1}$  is a vector of controls for all three regulatory size dimensions (entered as logarithms): total assets, sales, and employees in the previous year. The size controls are

---

<sup>18</sup>We use the longitudinal version of the *LIAB*, which contains the complete employment biographies of the sampled employees. The data is sourced from the integrated notification procedure for health, pension and unemployment insurance in Germany. Under this procedure, employers are required to submit records for all employees subject to social security contributions.

<sup>19</sup>We clean and harmonize the data following standard procedures. We deflate all wages using the 2015 CPI. Given the collection of wage information via social security records, the daily wages are truncated at the social security contribution limit. We address this truncation by imputing wages for employees earning above the contribution limit, using data on annual contribution limits provided by the Research Data Center of the IAB (FDZ) and the procedure suggested in Dustmann et al. (2009) and Gartner (2005). We use the 5-digit WZ08 code in the *LIAB* to assign establishments (which we refer to as firms) to industries, and assign employees to occupations based on 5-digit KldB occupation codes. Lastly, we assign each employee to a county using the 5-digit Kreisschlüssel code, which corresponds to the European NUTS3 level code. These county codes are available in both the *LIAB* and the *Orbis* data, allowing us to link the data sources on the county level.

centered at the respective threshold values such that  $\beta$  captures the difference between firms just above the thresholds and those just below. The basic idea behind this design is that, conditional on the *known* assignment variables (i.e., firm size), firms around the thresholds only differ in the audit mandates they face—those above are mandated, those below are not. Accordingly, any differences between firms just above and those just below the thresholds can plausibly be attributed to the impact of the audit mandates on the firms.<sup>20</sup>

We complement the firm-level design with a market-level design. The market-level design exploits variation in the intensity with which a given market is affected by the audit mandates:

$$y_{c,t} = \alpha_c + \alpha_t + \beta \text{AboveThresholds}_{c,t-1} + \epsilon_{c,t} \quad (13)$$

where  $y_{c,t}$  is an outcome (e.g., audit rates) of country or county  $c$  in year  $t$ ;  $\alpha_c$  and  $\alpha_t$  are country or county and year fixed effects, respectively; and  $\text{AboveThresholds}_{c,t-1}$  is the share of firms exceeding two out of three audit thresholds in the given country or county in the previous year. This share exhibits rich variation. It varies across countries and over time as a result of differences and changes in countries' audit thresholds. It also varies across countries, and even across counties in a given country, as a result of differences in the industrial structure and size distribution of the local firms. A county dominated by capital-intensive industries producing tradable goods (e.g., steel production in Germany's Ruhr area), for example, will exhibit a greater share of firms subject to audit mandates than a county with predominantly smaller firms producing nontradable goods (e.g., restaurants and tourist attractions in Germany's Northern islands).

The market-level design exploits differential changes in the share of firms subject to audit mandates across countries or counties and over time. It is akin to a continuous-treatment difference-in-differences design (e.g., [Callaway et al., 2021](#)). The key identifying assumption is a version of the familiar parallel trends assumption. It assumes that countries or counties

---

<sup>20</sup>Unlike a traditional regression discontinuity design with only one assignment variable, we do not explicitly restrict our sample to firms just around the thresholds. Instead, we try to explicitly control for differences in the various assignment variables (e.g., [Papay et al., 2011](#); [Breuer et al., 2018](#)).

with a greater increase in the share of firms subject to audit mandates over time would have experienced similar trends as other countries or counties, if it were not for the audit mandates.

The key benefit of the market-level design is that we can use it for firms but also audit firms and auditors. Unlike firms, audit firms and auditors are not directly affected by audit mandates. Instead, they are only indirectly affected by the demand created for their services through mandates applying to firms. Accordingly, the market-level measure of the intensity of audit mandates in a given local audit market is the relevant measure of treatment intensity for our exploration of the impact of mandates on audit firms and auditors. The market-level measure is also particularly useful for identifying the effects on audit firms and auditors as it provides rich variation that is plausibly exogenous to audit firms and auditors. The measure, for example, varies due to differences in the size of industrial firms in a given region. This variation would not necessarily be considered exogenous to local industrial firms (e.g., [Breuer, 2022](#)). In regions with larger firms, for example, there would be more economic activity and more firms subject to audit mandates. The greater share of audits, however, can hardly be expected to be the cause of the economic activity in the market. Rather, the share is driven by the activity (e.g., greater firm sizes). Notably, such omitted variable and reverse causality concerns are less pertinent when it comes to local audit firms and auditors. Their economic activity and size is *not* driving the share of firms subject to audit mandates. Accordingly, variation in local audit mandates due to variation in the size of firms (operating in industries other than the audit industry) is more plausibly exogenous to the local audit market. In the [Internet Appendix](#), we assess the robustness of our inferences to using various simulated instruments and Bartik instruments (Tables [A3](#) to [A5](#)), which focus on more limited but potentially cleaner subparts of the treatment variation (e.g., only on threshold variation) (e.g., [Currie and Gruber, 1996](#); [Goldsmith-Pinkham et al., 2020](#)).

To examine the impact of audit mandates on audit firms, we use the the share of firms subject to audit mandates as a market-level treatment. We use this market-level treatment

in both audit-firm and country-level specifications. The audit-firm-level specifications, with audit-firm fixed effects, allow us to examine the average changes experienced by a given audit firm in response to greater audit mandates. The country-level specifications allow us to examine the average or aggregate changes of the entire audit market over time. Together, these specifications help shed light on various margins—within audit-firm changes, entry and exit, and cross-firm reallocation—through which the mandates affect the audit-firm market (e.g., in the spirit of [Foster et al., 2008](#); [Melitz and Polanec, 2015](#)).

To examine the impact of audit mandates on auditors, we also use the share of firms subject to audit mandates as a market-level treatment. For our auditor analysis, we measure this share at the level of German counties. Given the granularity of our labor data, we exploit the local share of firms subject to audit mandates in the following specification:

$$\begin{aligned}
y_{o,k,c,t} = & \alpha_c + \alpha_t + \beta_1 \mathbb{1}_{AuditOcc} \times \mathbb{1}_{AuditInd} \times AboveThresholds_{c,t-1} & (14) \\
& + \beta_2 \mathbb{1}_{AuditOcc} \times AboveThresholds_{c,t-1} \\
& + \beta_3 \mathbb{1}_{AuditInd} \times AboveThresholds_{c,t-1} \\
& + \beta_4 \mathbb{1}_{AuditOcc} \times \mathbb{1}_{AuditInd} + \beta_5 \mathbb{1}_{AuditOcc} + \beta_6 \mathbb{1}_{AuditInd} \\
& + \beta_7 AboveThresholds_{c,t-1} + \epsilon_{o,k,c,t}
\end{aligned}$$

where  $y_{o,k,c,t}$  is an outcome (e.g., average wages) for employee occupation  $o$  working in employer industry  $k$  in county  $c$  in year  $t$ ;  $\alpha_c$  and  $\alpha_t$  are county and year fixed effects, respectively;  $\mathbb{1}_{AuditOcc}$  is an indicator for employees in the audit occupation (i.e., auditors);  $\mathbb{1}_{AuditInd}$  is an indicator for employers in the audit industry (i.e., audit firms); and  $AboveThresholds_{c,t-1}$  is the share of firms exceeding two out of three audit thresholds in the given county in the previous year.

The basic idea behind the above design is to provide a granular picture of how auditors and non-audit employees at audit firms are affected by the audit mandates relative to other occupations and/or employer industries. The coefficient on the triple interaction ( $\beta_1$ )

captures the impact of the mandates on auditors working at audit firms, the key group of interest, relative to auditors at non-audit firms and non-audit employees at audit firms. The coefficient on the interaction of the audit-occupation indicator and the market-level treatment ( $\beta_2$ ) captures the impact of audit mandates on auditors that do not work at audit firms (e.g., corporate / internal auditors). And the coefficient on the interaction of the audit-industry indicator and the market-level treatment ( $\beta_3$ ) captures the impact of audit mandates on employees working at audit firms that are not auditors (e.g., non-audit administrative staff). The key identifying assumption of this design is a version of parallel trends, as described for the market-level design before. We report the full specification, outlined above, as well as specifications with finer fixed effects (e.g., at the occupation-industry level) to gauge the robustness of our inferences. In supplemental tests, we also run this specification at the employee level (instead of at the occupation-industry-county-level), to examine within-employee changes and examine cross-sectional variation in employee characteristics.

Table 1 presents summary statistics for the distinct samples and designs used in our analyses. It shows that, on average, around 26-28 percent of our sample firms are subject to audit mandates, and that there is rich variation in audit mandates across firms, counties, and, especially, countries. (For additional information on variable definitions, aggregation levels, and data sources, refer to Table A2.)

## 5 Results

### 5.1 Impact on Firms

We begin our empirical examination with an assessment of the impact of audit mandates on firms' audit demand. Figure 3 plots the total number of firms and the number of audited firms along the firm size dimension, approximated using firms' total assets. Consistent with our model, the figure shows that there are many small firms and fewer large firms. It also shows that the share of audited firms increases notably with firm size, in line with our

model.<sup>21</sup> To examine the impact of the size-based audit mandate on firms' audit propensity, we next zoom into the region around the exemption thresholds.

Figure 4 plots the share of audited firms above and below the exemption thresholds in Germany. To determine firms' distance to the thresholds, we need to account for the fact that the mandates apply to firms exceeding two out of three size thresholds. Accordingly, we approximate a firm's distance from the thresholds via the second largest distance among the three distances (i.e., distance to total assets, sales, and employees thresholds). This distance is the marginal one, which determines how close a firm is to being subject to the audit mandate.

Figure 4 reveals a stark discontinuity around the thresholds. Firms just above the thresholds exhibit an about 50 percentage points greater propensity to be audited than firms just below the thresholds. This stark difference indicates that the German audit mandates are binding, creating substantial demand for audits. This result is particularly notable given that the German thresholds tend to be among the highest exemption thresholds (i.e., least expansive mandates). Accordingly, other European countries' audit mandates can be expected to provide at least as much of a mandated demand for audits. Another notable pattern in Figure 4 is that larger firms, irrespective of the audit mandates, exhibit a higher propensity to obtain audits, as evidenced by the general increase in the propensity across the firm-size dimension. This pattern suggests that firms' propensity to obtain voluntary audits increases in firm size, in line with our simple model and prior literature.<sup>22</sup> The last notable pattern in Figure 4 is that not all firms above the thresholds appear to obtain an audit. While this pattern may hint at imperfect compliance, it most likely reflects the fact that there is some measurement error in our distance measure and firm-level treatment assignment. Most notably, whether a firm is subject to the German audit mandates not only depends on firms' size in the last year, but also their size in the year before that. For simplicity, we abstract

---

<sup>21</sup>Unlike in our model, there are also some smaller firms that obtain audits. Their audit demand reflects factors other than size. Our model abstracts from those other factors for simplicity.

<sup>22</sup>See, for example, [Chaney et al. \(2004\)](#), [Lennox and Pittman \(2011\)](#), and [Dedman et al. \(2014\)](#).



from this complication in our tests. Accordingly, our estimates likely provide lower bounds of the actual impact of the audit mandates.

We sharpen and extend the graphical examination of the impact of audit mandates on firms' audit demand in Table 2. In column 1, we report results from a firm-level regression of firms' audit choice on an indicator for firms above the thresholds and size controls. Consistent with the graphical evidence, the regression reveals a stark increase in audit demand as result of the audit mandates by about 63 percentage points. Compared to the graphical evidence, the regression-based estimate is likely more accurate as it allows us to more flexibly and simultaneously account for the three size dimensions.

In column 2, we extend the firm-level results in the German setting to the county level. We report the results from a county-level regression of the share of audited firms in a county on the share of firms above the thresholds in that county, and fixed effects for counties and years. In this county-level analysis, we again find evidence that audit mandates strongly increase firms' audit demand. The size of the county-level impact, however, is only half as large as the size of the firm-level impact. There are at least two plausible explanations for this pattern. For one, the county-level design exploits changes over time (in a difference-in-differences design), whereas the firm-level design exploits cross-sectional variation. By focusing on changes, the measurement error in our treatment variable, stemming from our simplified classification rule (i.e., neglecting past year's size dimensions), is likely magnified; hence, biasing the county-level results downward. For another, the county-level design may incorporate some spillovers. Our model, for example, suggests that audit mandates can crowd-out some voluntary audit demand. As a result, the county-level results should be expected to be lower than the firm-level results. In line with this reasoning and our model, we find, in column 3, that audit mandates imposed on firms in neighboring counties decrease the share of audited firms in the focal county.

In the last column, we examine the impact of audit mandates on country-level audit demand in Europe. We again find that audit mandates strongly increase firms' audit de-

mand. The size of the country-level impact is slightly smaller than the county-level impact. As before, the attenuation likely reflects both, increased measurement error and increased crowding-out of voluntary audits at the country level compared to the county or firm level. Overall though, the country-level results in the European sample are highly consistent with our results in the German setting. This consistency supports the generalizability of our German audit results to the broader European level (and vice versa).

After establishing that audit mandates increase firms' audit demand, we next explore the consequences of audit mandates for firms and their stakeholders. Those consequences are key for understanding the desirability of audit mandates. Given our study's narrower focus on the impact of the mandates on the audit market (esp. the labor market of auditors), however, those consequences are generally outside of our study's scope. We, thus, only briefly summarize the findings of our consequences exploration here and refer interested readers to the [Internet Appendix](#) for more information.

We find some, albeit weak evidence that the audit mandates improve the average quality of firms' accounting reports. Forcing firms to obtain an audit, for example, appears to result in more qualified audit opinions, fewer restatements, lower divergence of accounting reports from Benford's law ([Amiram et al., 2015](#); [Badertscher et al., 2023](#)), and a timelier filing for bankruptcy as indicated by greater net assets of bankrupt firms (Figure [A2](#) and Table [A6](#)). Those accounting improvements, however, do not appear to translate into broader economic or societal benefits. We, for example, fail to find significantly positive effects on firms' financing, countries' productivity, output, and tax collection, or citizens' well-being (Tables [A7](#) and [A8](#)). Those outcomes intentionally span a wide range of potential benefits and beneficiaries of audit mandates, as properly enforced corporate reporting could have wide-spread implications (e.g., [Leuz and Wysocki, 2016](#); [Minnis and Shroff, 2017](#)). Our failure to find significant improvements across various outcomes confirms and extends the "disappointing" results reported in the literature.

Collectively, our results on firms' audit choices and consequences are consistent with our

model’s assumptions and predictions. They suggest that larger firms tend to obtain audits voluntarily, and that smaller firms are most strongly affected by the audit mandates. They also suggest that audit mandates may improve firms’ reporting but not necessarily their economic position or overall social welfare. Those results are in line with our model which suggests that the main beneficiary of audit mandates may be the audit profession. We explore this potential beneficiary next.

## 5.2 Impact on Audit Firms

We turn to an examination of the impact of audit mandates on audit firms. In Table 3, we examine the impact of audit mandates on audit firms’ client portfolio. In column 1, we observe that audit mandates increase the number of clients served by a given audit firm. The coefficient magnitude implies that a 10 percentage points increase in the share of firms subject to audit mandates increases the number of clients by 2.5 percent.<sup>23</sup> At the same time, in column 2, we observe that audit mandates decrease the average client size of a given audit firm. The coefficient magnitude implies that a 10 percentage points increase in the share of firms subject to audit mandates decreases the average client size by 6 percent. These results are highly consistent with the predictions of our model. They suggest that audit mandates, by forcing some firms to buy audits, increase the number of clients served by audit firms. As the mandates primarily force the many smaller firms to obtain audits, the additional clients are substantially smaller than the usual clients of audit firms.

In Table 4, we examine the impact of audit mandates on audit firms’ size in terms of inputs. In the first two columns, we examine capital inputs. In column 1, we observe that audit mandates increase the total assets of a given audit firm. The coefficient magnitude implies that a 10 percentage points increase in the share of firms subject to audit mandates increases total assets by 3.7 percent. Similarly, in column 2, we observe that audit mandates

---

<sup>23</sup>We use a 10 percentage points increase in the share of firms subject to audit mandates to quantify the effect size given that it more closely resembles the typical variation observed in the data (compared to a 1 unit or 100 percentage points increase). We convert the coefficient estimates of the log-linear regression specifications to percentage changes using the following transformation:  $(e^{\beta\Delta X} - 1) \times 100$ , where  $\Delta X = 0.1$ .

increase the fixed assets (e.g., computing equipment, offices, and training centers) of a given audit firm. The coefficient magnitude implies that a 10 percentage points increase in the share of firms subject to audit mandates increases fixed assets by as much as 7.7 percent.

In the last two columns of Table 4, we examine the impact of audit mandates on labor inputs. In column 3, we observe that audit mandates increase the number of employees of a given audit firm. The coefficient magnitude implies that a 10 percentage points increase in the share of firms subject to audit mandates results in a 3.1 percent increase in the number of employees working for a given audit firm. This increase is similar to the increase in audit firms' clients.<sup>24</sup> Similarly, in column 4, we observe that audit mandates increase the employee cost of audit firms. The coefficient magnitude implies that the costs increase by 2.3 percent in response to a 10 percentage points increase in firms subject to audit mandates.

Collectively, our results on audit firms corroborates that audit mandates increase the demand for and supply of audits. They also provide a first indication that audit mandates increase the demand for auditors, as predicted by our model. The audit firms' aggregate employment numbers, however, do not allow us to specifically examine auditors (as opposed to non-audit staff) and their wages. Accordingly, we next turn to detailed employer-employee matched data to home in on the labor market of auditors.

### 5.3 Impact on Auditors

In a last step, we examine the impact of audit mandates on the labor market of auditors. In Table 5, we first examine the impact of audit mandates on the number of auditors in a given local audit market in Germany. In column 1, we observe that audit mandates increase the number of employees working at audit firms (linear combination:  $\beta_1 + \beta_3$ ), consistent with our evidence using audit firms' total employees in the European setting. In terms of a breakdown between audit and non-audit staff working at audit firms, we observe that, while both their numbers increase, the increase (in absolute numbers) is pronounced

---

<sup>24</sup>The fact that the number of clients and employees of audit firms increase by about the same rate is in line with our simplifying assumption of a constant returns-to-scale production function of audits.

for auditors, albeit not statistically significantly so ( $\beta_1$ ). The coefficient magnitudes imply that a 10 percentage points increase in the share of firms subject to audit mandates in a given county increases the number of non-audit staff at audit firms by about 4 (relative to employees in non-audit industries), whereas it increases the number of auditors at audit firms by an *additional* 10 (i.e., 14 altogether). The increase of employees at audit firms and the incremental increase of auditors (compared to non-audit staff) at audit firms is robust to the inclusion of successively finer fixed effects, as shown in columns 2 to 4. The incremental increase of auditors at audit firms even turns statistically, not just economically, significant in the more stringent specifications (which increase test power by soaking up residual variation in the employment outcomes; [Breuer and deHaan, 2023](#)).

In percentage terms, the results in Table 5 imply a large increase in the number of auditors. To quantify the impact of audit mandates in terms of percentage changes, we re-run the specification using the logarithm rather than the absolute number of employees as the outcome variable (Table A9). The estimates imply that a 10 percentage points increase in the share of firms subject to audit mandates in a given county increases the number of auditors working at audit firms by about 40 percent relative to non-audit staff at audit firms and auditors in other industries.<sup>25</sup> This magnitude even increases to more than 100 percent when calculating the combined effect on auditors at audit firms relative to other occupations and industries, instead of relative to non-audit staff and other auditors. These large magnitudes need to be interpreted with a grain of salt. They in part arise because the typical variation in the share of firms subject to audit mandates in Germany is about 3 percentage points only. Accordingly, by using a 10 percentage points change, our quantification extrapolates the results beyond the observed variation. They likely also overstate the impact on a given county due to spillovers across counties. An increase in one county likely results in a decrease

---

<sup>25</sup>The incremental effect of audit mandates on auditors at audit firms is not statistically different from the effect on non-audit staff at auditors in the log-linear specifications. This result suggests that the ratio of audit staff to non-audit staff required for audits does not change significantly, at least statistically. The incremental increase of the absolute number of audit compared to non-audit staff in Table 5 accordingly implies that, for a given audit, audit firms need about 3 to 4 ( $\approx 122/36$ ) times as many auditors as non-audit staff.

in neighboring counties (as shown earlier). Hence, the difference-in-differences estimates can be inflated (Berg et al., 2021; Huber, 2023). Lastly, the percentage magnitudes are likely inflated due to the generally low number of auditors per county sampled by and included in the *LIAB* database. Despite these caveats regarding the magnitude of our estimates, we stress that the sign of our estimates is informative about the impact of audit mandates on auditors.

The results in Table 5 are consistent with audit mandates increasing the demand for audits, as predicted by our model. They also suggest that employees respond to this demand, starting to work as auditors at audit firms. Given that entry into the audit occupation / profession is complicated through educational and licensing requirements (e.g., Cascino et al., 2021; Barrios, 2022), this finding begs the question where the additional auditors are coming from. The results in Table 5 provide an indication for one origin. They show a consistently negative (albeit statistically insignificant) coefficient for auditors working at non-audit firms. This result suggests that, at least some of the new auditors working at audit firms are lured away from other industries (e.g., internal audit or corporate finance positions). In Table A10, we further find evidence consistent with audit mandates attracting auditors from neighboring counties.<sup>26</sup> Both margins, other industries and counties, accordingly contribute to the increase in the number of auditors. The remainder of the increase likely comes from an overall increase in the audit profession / occupation (at the expense of other occupations). Collectively, these findings are consistent with our model. They suggest that the supply of auditors is not fixed, but can be grown by attracting employees, along multiple margins, into the audit profession through higher wages.

We next examine the impact of audit mandates on auditors' wages. In Table 6, we find that, absent mandates, the audit occupation receives greater wages than other occupations, on average. The impact of the audit mandates on wages of the audit occupation, however, appears to be negative, relative to other occupations (linear combination:  $\beta_1 + \beta_2$ ). Notably,

---

<sup>26</sup>We observe that mandates in neighboring counties reduce the number of auditors in the focal county.

this negative effect appears to be driven by auditors working at audit firms ( $\beta_1$ ). Across all columns (1 to 4), we find consistent evidence of a negative impact on this group’s wages (relative to other groups). The coefficient estimates imply that wages of auditors working at audit firms decrease by between 31 to 46 percent in response to a 10 percentage points increase in the share of firms subject to audit mandates. Notably, this large decrease for auditors at audit firms is relative to non-audit staff at audit firms and auditors at non-audit firms. Given that non-audit staff experiences a wage increase, the relative decline of audit staff is magnified by the comparison to non-audit staff. The wage increase of non-audit staff (in two out of three specifications; albeit only significantly so in column 3) is consistent with more demand for services of audit firms resulting in greater employment at audit firms, attracted through higher wages.

When compared to other occupations and industries, our estimates suggest that auditors working at audit firms experience wage decreases in the range between 8 to 39 percent in response to a 10 percentage points increase in the share of firms subject to audit mandates. These magnitudes are smaller than those obtained comparing auditors with non-audit staff at audit firms. Still, these percentage changes are quite large. As discussed before, they are likely inflated due to a combination of extrapolated treatment variation, cross-county spillovers, and the low number of sampled observations. Nevertheless, the consistently negative sign of our estimates strongly suggests that average wages of auditors working at audit firms decrease in response to audit mandates. In robustness tests, we corroborate the wage decrease using audit firms’ average employee wages in the European setting.<sup>27</sup> This wage decrease stands in stark contrast to the prediction of our model and its basic supply-demand logic. Taken at face value, it suggests that more auditors can be attracted by lower wages.

---

<sup>27</sup>In Table A11, we find evidence consistent with audit mandates decreasing the average wages of audit-firm employees in Europe. The magnitude of these estimates is substantially smaller than the magnitudes obtained in the *LIAB* data. This difference in magnitudes likely reflects that the *LIAB* estimates are upward biased. However, it also reflects that the European estimates are downward biased. They comingling the wages effects experienced by non-audit and audit staff. According to our estimates in Table 6, those two groups experience opposing wage effects.

## 6 Extended Theory: A Differentiated Audit Market

Our results align well with many predictions of our simple model of the audit market, but contradict a key prediction: auditor wages should increase in response to audit mandates to attract more auditors according to our model. In the data, however, we observe that average auditor wages decline in response to audit mandates. This puzzling result suggests that our model is missing a key feature of the audit market. We contend that this feature is differentiation in the audit market (e.g., [Duflo et al., 2013b](#)).

Our model implicitly assumes that there is one homogeneous audit. The institutional details of the audit market and prior literature provide evidence of differences in audit qualities across audit firms and even across segments (e.g., private vs. public firm audits) within the same audit firms (e.g., [Chaney et al., 2004](#); [Sundgren and Svanström, 2013](#)). The size of audit firms, for example, is frequently viewed as a quality measure, with the largest audit firms, often labeled the Big 4 (EY, Deloitte, PwC, and KPMG), supposedly providing greater audit quality (e.g. [DeAngelo, 1981](#); [DeFond and Zhang, 2014](#)). Figure 5 documents that there are substantial differences in size across audit firms in the German audit market, with the Big 4 audit firms dominating along the dimensions of number of clients and client size. This rich variation in audit-firm size and characteristics provides prima facie evidence that differentiation may be a notable feature of audit markets that needs to be taken into account in understanding the impact of audit mandates.

### 6.1 Extended Model Setup

To allow for quality differentiation, we augment our model by introducing a second audit option. The two options differ in terms of quality ( $q$ ). The high-quality option ( $q = h$ ) is provided by audit firms employing high-quality auditors, whereas the low-quality option ( $q = l$ ) is provided by audit firms employing low-quality auditors (e.g., [Acemoglu and Autor, 2011](#)). The high-quality audit firms specialize in auditing larger, more complex firms. To



this end, they invest more heavily in technologies and systems, resulting in greater fixed costs than those of low-quality audit firms ( $f_h > f_l$ ) (e.g., Sutton, 1991; Sirois et al., 2016). In addition, for high-quality audit firms, it is harder to attract high-quality auditors than it is for low-quality audit firms to find low-quality auditors, given that high-quality auditors have better outside options than low-quality auditors ( $\bar{w}_h > \bar{w}_l$ ). The better auditors in combination with better technology and systems, however, allow high-quality audit firms to add more value to firms (per unit of complexity) than the value provided by low-quality audit firms ( $b_h > b_l$ ) (e.g., Bartel et al., 2007).

## 6.2 Voluntary Equilibrium in Differentiated Audit Market

Given this augmented setup, there are two size-cutoffs in the voluntary equilibrium.<sup>28</sup> A cutoff for firms choosing the high-quality audit and a cutoff for firms choosing the low-quality audit. Panel A of Figure 6 illustrates the two cutoffs. We observe that, given the lower fixed costs, low-quality audits are more attractive to smaller firms. For larger firms, however, the greater (marginal) value of high-quality audits renders high-quality audits more attractive, despite the greater fixed cost. Panels B and C of Figure 6 plot the corresponding supply and demand curves for the two labor market segments: high-quality and low-quality auditors. It shows a stark difference in the equilibrium wages across the two segments. The wage of high-quality auditors is substantially larger than the wage of low-quality auditors ( $w_h^* > w_l^*$ ).

## 6.3 Mandatory Equilibrium in Differentiated Audit Market

In the presence of size-based audit mandates, we observe that a large share of firms is effectively forced to obtain audits. Panel D of Figure 6 illustrates that, for those firms, low-quality audits are the best option, given that they must get an audit. Accordingly, Panel

---

<sup>28</sup>We focus on the relevant case where the regulatory threshold is lower than the cutoff for voluntary low-quality audits; and the cutoff for voluntary low-quality audits is lower than the cutoff for high-quality audits:  $T < s_l^* < s_h^*$ .

F of Figure 6 shows that there is a sizeable outward shift in the demand for low-quality auditors. This shift is accompanied by an increase in the wage. The wage increase, however, is fairly moderate given the low outside options (or high supply elasticity) of low-quality auditors. The figure also shows that there is a smaller outward shift in the demand for high-quality auditors (Panel E). This shift occurs because the mandate, by increasing the cost of low-quality audits (through greater demand and wages), leads a few firms to switch from low- to high-quality audits. This effect is reflected in the flattening of the low-quality audit-utility slope and the increase in the high-quality audit range in Panel D of Figure 6. Notably, the increase in high-quality audit demand also implies an increase in the equilibrium wages of high-quality auditors. Still, the *average* wage in the audit market decreases in the mandatory equilibrium relative to the voluntary equilibrium ( $\frac{w_h^* L_h + w_l^* L_l}{L_h + L_l} > \frac{w_{h,T}^* L_{h,T} + w_{l,T}^* L_{l,T}}{L_{h,T} + L_{l,T}}$ ). The decrease occurs because of a compositional shift. While the mandates increase wages for both low- and high-quality auditors, they attract substantially more low-quality auditors into the audit market ( $L_{h,T} - L_h < L_{l,T} - L_l$ ), as the mandates first and foremost create demand for low-quality audits. As a result, the average wage in the market decreases, as low-quality auditors' wages are substantially lower than those of high-quality auditors.<sup>29</sup>

Our model of a differentiated audit market, accordingly, can rationalize a decrease in average auditor wages. It suggests a compositional shift toward low-quality audits, performed by low-quality audit firms and auditors, can result in the documented decline. Our model also provides two additional testable implications, which allow examining the fit between our model's explanation and the data. First, it implies that, within a given quality segment (i.e., holding fixed the segment or employee), audit mandates unambiguously increase auditor wages. Second, it implies that the bulk of the new audit demand created by audit mandates is served by low-quality audit firms and low-quality auditors.

Notably, in terms of welfare, the differentiated audit-market model leaves even less scope for total welfare improvements than our undifferentiated audit-market model. In the differ-

---

<sup>29</sup>For early work on skill differentials and compositional shifts, see, for example, [Katz and Murphy \(1992\)](#) and [Lemieux \(2006\)](#).

entiated audit market, even if there is a potential welfare gain from stricter enforcement of underlying regulations through audits, audit mandates are unlikely to achieve this stricter enforcement. They rather create low-quality audits, transferring wealth to auditors without ultimately helping to unfold the potentially desirable societal effects of the underlying regulations.

## 7 Supplemental Results

In supplemental tests, we examine the two additional predictions implied by our extended model and explore alternative interpretations and explanations.

### 7.1 Auditors' Wages

We first examine whether audit mandates increase auditor wages, when holding auditor quality fixed. To this end, we exploit the richness of our linked employer-employee data. Unlike before, we now run regressions at the employee (instead of the county-occupation-industry) level (Table 7). In column 1, we essentially replicate our prior wage result, using county and year fixed effects only. In the next columns, we successively introduce finer fixed effects to focus on changes within the same category of auditor quality. In column 2, we find that the negative wage effect substantially attenuates when holding fixed the employer, consistent with quality sorting across audit firms. In column 3, the wage effect turns slightly positive, albeit statistically insignificantly so, when additionally holding fixed the employee. In column 4, the now positive wage effect becomes even larger, though still statistically insignificant, when additionally holding fixed the employer-employee match. The patterns of the wage effects across the different specifications are consistent with our extended model. They suggest that the large negative wage effect on average auditor wages in a given county reflect a shift in the composition of auditors toward low-quality auditors. Once we account for this shift, by focusing on the same auditor, audit mandates appear to, if anything, increase

auditors' wages, consistent with the basic supply-demand logic. Notably, the within-auditor change though is substantially smaller than the average change at the county. This difference in magnitudes is also consistent with our extended model and supports the notation that the large negative wage effect first and foremost reflects notable compositional changes.

## 7.2 Audit Firms' Size and Auditors' Experience

We next examine whether audit mandates increase the number of low-quality audit firms. To this end, we revisit the impact of audit mandates on audit firms' size. Audit-firm size is a common measure of audit quality; the idea being that larger audit firms not only have more technologies and systems in place but also are less dependent on any given client (e.g., [DeAngelo, 1981](#); [DeFond and Zhang, 2014](#)). In [Table 8](#), we find that audit mandates do not appear to increase the aggregate size of audit firms (column 1) and appear to, if anything, decrease the average size of audit firms, measured in terms of total assets, in a given country.<sup>30</sup> Notably, these results stand in contrast to the earlier result that mandates significantly increase a given audit firm's size. As with the auditors' wages, this discrepancy again hints at a compositional shift. While a given audit firm may grow as the result of the mandates, the average size of audit firms in the country likely decreases due to entry of many smaller audit firms serving the low-quality demand. Consistent with this interpretation, we find, in [column 3](#), that audit mandates substantially decrease the average size of audit firms, when focusing on the cross-sectional variation in audit firms instead of the within-audit firm variation. In [Table 9](#), we further document that audit mandates lead to substantial entry of new audit firms and reduced audit-market concentration. Collectively, these results suggest that audit mandates create demand for low-quality audits that is served by smaller (plausibly low-quality) audit firms, consistent with the predictions of our extended model.

---

<sup>30</sup>Our measurement of aggregate outcomes is skewed toward larger audit firms due to their disclosure requirements and our sample selection. Accordingly, we cannot rule out that there is an aggregate increase in the (total) size of audit firms in response to the mandates, when including smaller audit firms (for which we lack information). Still, even absent the measurement issues, aggregate effects are first and foremost driven by the impact of audit mandates on larger audit firms. Accordingly, the influence of smaller audit firms on the aggregate (as compared to the average) size of audit firms is likely limited.

Lastly, we examine whether audit mandates increase the number of low-quality auditors. To this end, we explore whether primarily low-quality auditors choose to work at audit firms in response to audit mandates. We proxy for auditor quality using measures of their experience (i.e., age and prior audit-firm tenure). In Table 10, we find that especially less experienced auditors appear to respond to audit mandates by joining audit firms. In line with our prior wage results, this cross-sectional result suggests that audit mandates attract primarily low-quality auditors to audit firms. This cross-sectional variation in the quality of auditors and audit firms appears to be key to understanding the impact of audit mandates on audit markets. In a quality differentiated audit market, audit mandates appears to create demand for low-quality audits served by seemingly low-quality audit firms and auditors.

### 7.3 Quality vs. Complexity

Through the lens of our model, we interpret our findings as consistent with audit mandates creating demand for low-quality audits. An alternative interpretation (or labeling) for our collective results could be that audit mandates create demand for low-complexity audits. Both aspects—quality and complexity—are closely related. Indeed, in our model, both aspects are at play. We refer to the inherent difficulty of and need for audits of firms as “complexity” and refer to the assurance benefit produced by audit firms and auditors (per unit of complexity) as “quality.” Thus, larger, more complex firms (e.g., with more external stakeholders) find higher quality audits more appealing than smaller, less complex firms. Importantly, this sorting does not mean that lower quality audits are “bad.” It simply reflects that for smaller, less complex firms, low-quality, or even no audits may suffice.

To support our quality interpretation, we explore differences in the audit-firm choices of voluntarily and mandatorily audited firms of similar complexity. To this end, we examine the audit quality (proxied by Big 4 audits) chosen by firms of similar size, that are either just below or just above the mandates’ thresholds. Figure 7 shows that, despite being of similar size (in terms of total assets, sales, and employees), mandated firms, just above the thresh-

olds, exhibit a substantially lower propensity to choose high-quality audits than voluntarily audited firms, just below the thresholds. Notably, in this comparison, the mandated firms, if anything, are slightly larger than the voluntarily audited firms, making this result, which supports our quality interpretation, even starker.

Besides quality differences in similarly sized firms' audit choices, we provide two additional pieces of evidence to support our quality interpretation. For one, we document that mandatorily audited firms just above the audit thresholds exhibit slightly higher internal complexity (e.g., in terms of the number of industries they operate in), but significantly lower external complexity (e.g., in terms of number of owners) than voluntarily audited firms just below the thresholds (Figure A3). This pattern supports the notion that mandated firms choose low-quality audits because they face limited demand for high-quality *external* assurance (e.g., from stakeholders relying on firms' reports; Breuer et al., 2023), not merely because their limited *internal* complexity makes them easier to audit. For another, we document that auditors' current wages closely align with auditors' future wage potential (i.e., their innate ability or outside option), and that auditors with low wage potential tend to work at small audit firms (Figure A4). Those patterns support the notion that the wage of auditors and the size of audit firms, both of which decline as a result of audit mandates, are credible proxies of audit quality (in line with DeAngelo, 1981; Lee et al., 2021).

Despite the empirical support for our quality interpretation, we acknowledge that both the quality and complexity interpretation fit our data. Notably, while both fit the data, they suggest slightly different regulatory implications. The quality interpretation would suggest that the absence of aggregate improvements resulting from audit mandates *could* be due to firms choosing low-quality compliance. It, hence, does not necessarily imply that audit mandates for financial reporting are not needed. It may merely suggest that audit mandates may need to be complemented by quality controls (e.g., certification, licensing, or oversight) to ensure that the mandates unfold their desired economic or societal effects. In contrast, the complexity interpretation would suggest that, given the absence of aggregate improvements,

audit mandates for financial reporting are not needed (i.e., because they do not provide positive externalities and/or because the complexity of the mandatorily audited firms is so low that audits are not needed to assure outsiders). Accordingly, the complexity interpretation would be even less benign and more forceful than our preferred quality interpretation.

## 7.4 Alternative Explanations

Our extended model suggests that more auditors and lower auditor wages can jointly be explained by increased demand for low-quality auditing in response to audit mandates.

An alternative explanation for our labor-market findings (*more auditors, lower wages*) could be that audit mandates only temporarily results in lower auditor wages, because the supply of auditors is limited by educational and licensing requirements, in the short run. Hence, new auditors are primarily recent graduates who are new to the industry (i.e., entry-level auditors) and, hence, earn lower wages.

We assess the validity of this alternative explanation by focusing on long-run variation in the share of firms subject to audit mandates. To this end, we exchange the fine county fixed effects with coarser state fixed effects in our labor-market specifications. The resulting regressions primarily focus on the rich variation in audit mandates across counties rather than the more limited changes within counties. Compared to the within-county design, the cross-sectional design, hence, captures more long-run differences than short-run adjustments. Still, we find that the cross-sectional design yields results highly consistent with those previously reported for the within-county design (Table A12). This pattern is inconsistent with the alternative explanation based on short-run adjustment friction.

Another alternative explanation for our labor-market findings could be that audit mandates predominantly increase the need for entry/lower-level auditors due to hierarchical audit-team structures. Given that an audit typically requires only one audit partner (senior) but several entry- and mid-level auditors (juniors), more audits due to audit mandates may disproportionately increase the need for lower-level auditors with lower wages.

We contend that the institutional details in our setting and our collective evidence refute this alternative explanation. The mandates create demand for many relatively small-scale audits which are served by new, small audit firms, which employ auditors with low outside options. The emergence of those small audit firms is consistent with our explanation based on demand for low-quality audits, but appears at odds with the alternative explanation based on increasing scale economies and audit-team hierarchies within existing audit firms.

## 8 Conclusion

We examine how audit mandates shape the market for audits. We focus on mandates in the EU that require larger firms, above certain size thresholds, to obtain a third-party audit of their financial statements. Using novel data on the key players of this audit market, we explore how the mandates affect firms, audit firms, and auditors.

We show three main results. First, audit mandates increase firms' audit rates. This increase is more pronounced among smaller firms, right at the audit thresholds; and less pronounced at the market level, due to some firms' mandatory audits crowding out other firms' voluntary audits. Second, audit mandates increase the size of a given audit firm in terms of the number of clients, capital inputs (e.g., offices and technology), and labor inputs (e.g., auditors and non-audit staff). The average size of a given audit firm's clients decreases substantially though. Likewise, the average size of audit firms in the market declines due to entry of new, smaller audit firms. Third, audit mandates increase the number of auditors, but *decrease* their average wages. The average wage decline is driven by entry of new, low-wage auditors. This compositional shift swamps any increase of a given auditor's wage.

Collectively, our results suggest that audit mandates create demand for low-quality audits. The mandates force those firms that do not voluntarily obtain audits to buy audits (e.g., smaller firms). In a differentiated audit market, those firms can minimize the cost of compliance with the audit mandates by choosing low-quality audits performed by small



audit firms and inexperienced auditors.

Our results cast doubt on the effectiveness of audit mandates for ensuring compliance with regulations and standards (e.g., financial accounting or environmental standards). They highlight that, in differentiated audit markets, where firms can choose their preferred compliance mechanism, we should not necessarily expect mandatory audits to lead to substantive compliance. This lesson is particularly important and timely given recent debates about greenwashing and the verification of ESG information.

Our results also provide an indication for who benefits from audit mandates. Consistent with prior literature, we find little benefits for firms subject to mandatory audits or their stakeholders. Instead, our results show that the audit mandates, by forcing firms to buy audits irrespective of their value, increase the size of the audit market and profession. This growth, however, is partly offset by the fact that some firms' voluntary audits are crowded out by other firms' mandatory audits. In addition, it is primarily driven by more low-quality audits provided by low-quality audit firms and auditors. While the increased size of the profession may come with greater economic importance and political influence in the short run. In the long run, the shift toward low-quality audits may erode the public's trust in and standing of the profession.

In closing, we stress that our results first and foremost apply to size-based mandates for audits of firms' financial statements. We note though that financial-statement audits are the archetypal setting of third-party audits and size-based mandates are a common regulatory feature. Moreover, we surmise that the broader insights (e.g., smaller firms are primarily affected by the mandate) should apply even if audit mandates are imposed to enforce other regulations and standards (e.g., environmental standards) or based on other regulatory categories (e.g., firms' legal form or listing status instead of size).

## References

- Acemoglu, Daron, and David Autor, 2011, Chapter 12 - Skills, tasks and technologies: Implications for employment and earnings, volume 4 of *Handbook of Labor Economics*, 1043–1171 (Elsevier).
- Akerlof, George A., 1970, The market for “lemons”: Quality uncertainty and the market mechanism, *The Quarterly Journal of Economics* 84, 488–500.
- Amiram, Dan, Zahn Bozanic, and Ethan Rouen, 2015, Financial statement errors: Evidence from the distributional properties of financial statement numbers, *Review of Accounting Studies* 20, 1540–1593.
- Badertscher, Brad A., Jaewoo Kim, William R. Kinney, and Edward Owens, 2023, Assurance level choice, CPA fees, and financial reporting benefits: Inferences from U.S. private firms, *Journal of Accounting and Economics* 75, 101551.
- Barrios, John M., 2022, Occupational licensing and accountant quality: Evidence from the 150-hour rule, *Journal of Accounting Research* 60, 3–43.
- Bartel, Ann, Casey Ichniowski, and Kathryn Shaw, 2007, How does information technology affect productivity? Plant-level comparisons of product innovation, process improvement, and worker skills, *The Quarterly Journal of Economics* 122, 1721–1758.
- Bartz, Tim, Martin Hesse, and Gerald Traufetter, 2021, So will sich EY nach dem Wirecard-Desaster vor dem Abgrund retten [That’s how EY wants to save itself after the Wirecard disaster], *Spiegel* ([link](#)).
- Benston, George J., 1985, The market for public accounting services: Demand, supply and regulation, *Journal of Accounting and Public Policy* 4, 33–79.
- Berg, Tobias, Markus Reisinger, and Daniel Streitz, 2021, Spillover effects in empirical corporate finance, *Journal of Financial Economics* 142, 1109–1127.
- Bernard, Darren, David Burgstahler, and Devrimi Kaya, 2018, Size management by European private firms to minimize proprietary costs of disclosure, *Journal of Accounting and Economics* 66, 94–122.
- Borusyak, Kirill, and Peter Hull, 2021, Non-random exposure to exogenous shocks: Theory and applications, Working Paper 27845, National Bureau of Economic Research.
- Bourveau, Thomas, Matthias Breuer, Jeroen Koenraadt, and Robert C. Stoumbos, 2021, Public company auditing around the Securities Exchange Act, *Working Paper* ([SSRN link](#)).
- Breuer, Matthias, 2021, How does financial-reporting regulation affect industry-wide resource allocation?, *Journal of Accounting Research* 59, 59–110.
- Breuer, Matthias, 2022, Bartik instruments: An applied introduction, *Journal of Financial Reporting* 7, 49–67.

- Breuer, Matthias, and Ed deHaan, 2023, Using and interpreting fixed effects models, *Working Paper* ([SSRN link](#)).
- Breuer, Matthias, Katharina Hombach, and Maximilian A Müller, 2018, How does financial reporting regulation affect firms' banking?, *The Review of Financial Studies* 31, 1265–1297.
- Breuer, Matthias, Katharina Hombach, and Maximilian A. Müller, 2023, The economics of firms' public disclosure: Theory and evidence, *Working Paper* ([SSRN link](#)).
- Burgstahler, David C., Luzi Hail, and Christian Leuz, 2006, The importance of reporting incentives: Earnings management in European private and public firms, *The Accounting Review* 81, 983–1016.
- Callaway, Brantly, Andrew Goodman-Bacon, and Pedro H. C. Sant'Anna, 2021, Difference-in-differences with a continuous treatment, *Working Paper* ([arXiv link](#)).
- Cascino, Stefano, Ane Tamayo, and Felix Vetter, 2021, Labor market effects of spatial licensing requirements: Evidence from CPA mobility, *Journal of Accounting Research* 59, 111–161.
- Chaney, Paul K., Debra C. Jeter, and Lakshmanan Shivakumar, 2004, Self-selection of auditors and audit pricing in private firms, *The Accounting Review* 79, 51–72.
- Christensen, Hans B., Luzi Hail, and Christian Leuz, 2021, Mandatory CSR and sustainability reporting: Economic analysis and literature review, *Review of Accounting Studies* 26, 1176–1248.
- Cicala, Steve, David Hémons, and Morten G. Olsen, 2022, Adverse selection as a policy instrument: Unraveling climate change, Working Paper 30283, National Bureau of Economic Research.
- Competition Commission, 2012, Development of the statutory financial audit, *UK Competition Commission Report* ([link](#)).
- Constable, Simon, 2020, What is greenwashing? Here is what investors need to know, *Wall Street Journal* ([link](#)).
- Cook, Jonathan, Zachary T. Kowaleski, Michael Minnis, Andrew Sutherland, and Karla M. Zehms, 2020, Auditors are known by the companies they keep, *Journal of Accounting and Economics* 70, 101314.
- Currie, Janet, and Jonathan Gruber, 1996, Saving babies: The efficacy and cost of recent changes in the medicaid eligibility of pregnant women, *Journal of Political Economy* 104, 1263–1296.
- DeAngelo, Linda Elizabeth, 1981, Auditor size and audit quality, *Journal of Accounting and Economics* 3, 183–199.

- Dedman, Elisabeth, Asad Kausar, and Clive Lennox, 2014, The demand for audit in private firms: Recent large-sample evidence from the UK, *European Accounting Review* 23, 1–23.
- DeFond, Mark, and Jieying Zhang, 2014, A review of archival auditing research, *Journal of Accounting and Economics* 58, 275–326, 2013 Conference Issue.
- Doty, James R., 2014, The role of audit in economic growth, *Public Company Accounting Oversight Board* ([link](#)).
- Dranove, David, and Ginger Zhe Jin, 2010, Quality disclosure and certification: Theory and practice, *Journal of Economic Literature* 48, 935–63.
- Dufo, Esther, Michael Greenstone, Rohini Pande, and Nicholas Ryan, 2013a, Truth-telling by third-party auditors and the response of polluting firms: Experimental evidence from India, *The Quarterly Journal of Economics* 128, 1499–1545.
- Dufo, Esther, Michael Greenstone, Rohini Pande, and Nicholas Ryan, 2013b, What does reputation buy? Differentiation in a market for third-party auditors, *American Economic Review* 103, 314–19.
- Duguay, Raphael, Michael Minnis, and Andrew Sutherland, 2020, Regulatory spillovers in common audit markets, *Management Science* 66, 3389–3411.
- Dustmann, Christian, Johannes Ludsteck, and Uta Schönberg, 2009, Revisiting the German wage structure, *The Quarterly Journal of Economics* 124, 843–881.
- Dyck, Alexander, Adair Morse, and Luigi Zingales, 2010, Who blows the whistle on corporate fraud?, *The Journal of Finance* 65, 2213–2253.
- Dye, Ronald A., 1993, Auditing standards, legal liability, and auditor wealth, *Journal of Political Economy* 101, 887–914.
- Eaglesham, Jean, and Coulter Jones, 2021, Weak oversight plagues audits of billions in private assets, *Wall Street Journal* ([link](#)).
- Eilifsen, Aasmund, and Marleen Willekens, 2007, *In the name of trust: Some thoughts about trust, audit quality and audit regulation in Europe*, Auditing, Trust and Governance (Routledge).
- European Commission, 2022, Financial reporting: EU rules on financial information disclosed by companies, *European Commission* ([link](#)).
- Fama, Eugene F., and Michael C. Jensen, 1983, Separation of ownership and control, *The Journal of Law and Economics* 26, 301–325.
- Foster, Lucia, John Haltiwanger, and Chad Syverson, 2008, Reallocation, firm turnover, and efficiency: Selection on productivity or profitability?, *American Economic Review* 98, 394–425.

- Francis, Jere R., 2011, A framework for understanding and researching audit quality, *AUDITING: A Journal of Practice & Theory* 30, 125–152.
- Friedman, Henry L., and Lucas Mahieux, 2021, How is the audit market affected by characteristics of the nonaudit services market?, *Journal of Accounting Research* 59, 959–1020.
- Gartner, Hermann, 2005, The imputation of wages above the contribution limit with the German IAB employment sample, *Institut für Arbeitsmarkt- und Berufsforschung (IAB), Nürnberg [Institute for Employment Research, Nuremberg, Germany], FDZ Methodenreport 2*.
- Gemmell, Katharine, 2022, Top audit firms in crosshairs as U.K. watchdog beefs up powers, *Bloomberg* ([link](#)).
- Gerakos, Joseph, and Chad Syverson, 2015, Competition in the audit market: Policy implications, *Journal of Accounting Research* 53, 725–775.
- Goldsmith-Pinkham, Paul, Isaac Sorkin, and Henry Swift, 2020, Bartik instruments: What, when, why, and how, *American Economic Review* 110, 2586–2624.
- Greenstone, Michael, Christian Leuz, and Patricia Breuer, 2023, Mandatory disclosure would reveal corporate carbon damages, *Science* 381, 837–840.
- Greenstone, Michael, Paul Oyer, and Annette Vissing-Jorgensen, 2006, Mandated disclosure, stock returns, and the 1964 Securities Acts amendments, *The Quarterly Journal of Economics* 121, 399–460.
- Harris, Mark, 2022, ESG should be boiled down to one simple measure: Emissions, *The Economist* ([link](#)).
- Hopwood, Anthony, and Holgar Vieten, 1999, *United Kingdom, Accounting Regulation in Europe* (Palgrave Macmillan).
- Huber, Kilian, 2023, Estimating general equilibrium spillovers of large-scale shocks, *The Review of Financial Studies* 36, 1548–1584.
- Jensen, Michael C., and William H. Meckling, 1976, Theory of the firm: Managerial behavior, agency costs and ownership structure, *Journal of Financial Economics* 3, 305–360.
- Jiang, John (Xuefeng), Isabel Yanyan Wang, and K. Philip Wang, 2019, Big N auditors and audit quality: New evidence from quasi-experiments, *The Accounting Review* 94, 205–227.
- Jiang, Xu, Baohua Xin, and Yan Xiong, 2023, The value of mandatory certification: A real effects perspective, *Journal of Accounting Research* 61, 377–413.
- Kahn, Alfred E, 1988, *The economics of regulation: Principles and institutions*, volume 1 (MIT press).
- Katz, Lawrence F., and Kevin M. Murphy, 1992, Changes in relative wages, 1963-1987: Supply and demand factors, *The Quarterly Journal of Economics* 107, 35–78.

- Kausar, Asad, Nemit Shroff, and Hal White, 2016, Real effects of the audit choice, *Journal of Accounting and Economics* 62, 157–181.
- Kiernan, Paul, 2022, SEC pushes for more transparency from private companies, *Wall Street Journal* ([link](#)).
- Kontokosta, Constantine E., Danielle Spiegel-Feld, and Sokratis Papadopoulos, 2020, Mandatory building energy audits alone are insufficient to meet climate goals, *Nature Energy* 5, 282–283.
- La Porta, Rafael, Florencio Lopez de Silanes, Andrei Shleifer, and Robert Vishny, 2000, Investor protection and corporate governance, *Journal of Financial Economics* 58, 3–27, Special Issue on International Corporate Governance.
- La Porta, Rafael, Florencio Lopez-de Silanes, and Andrei Shleifer, 2008, The economic consequences of legal origins, *Journal of Economic Literature* 46, 285–332.
- Lee, David S., and Thomas Lemieux, 2010, Regression discontinuity designs in economics, *Journal of Economic Literature* 48, 281–355.
- Lee, Gladys, Vic Naiker, and Christopher R. Stewart, 2021, Audit office labor market proximity and audit quality, *The Accounting Review* 97, 317–347.
- Lemieux, Thomas, 2006, Increasing residual wage inequality: Composition effects, noisy data, or rising demand for skill?, *American Economic Review* 96, 461–498.
- Lennox, Clive S, and Jeffrey A Pittman, 2011, Voluntary audits versus mandatory audits, *The Accounting Review* 86, 1655–1678.
- Leuz, Christian, Dhananjay Nanda, and Peter D Wysocki, 2003, Earnings management and investor protection: An international comparison, *Journal of Financial Economics* 69, 505–527.
- Leuz, Christian, and Peter D. Wysocki, 2016, The economics of disclosure and financial reporting regulation: Evidence and suggestions for future research, *Journal of Accounting Research* 54, 525–622.
- Maurer, Mark, 2022, Audit and consulting firms at odds over who should verify climate data, *Wall Street Journal* ([link](#)).
- McLeay, Stuart, 1999, *Accounting Regulation in Europe*, volume 1 (Palgrave Macmillan London).
- Melitz, Marc J., and Sašo Polanec, 2015, Dynamic Olley-Pakes productivity decomposition with entry and exit, *The RAND Journal of Economics* 46, 362–375.
- Minnis, Michael, and Nemit Shroff, 2017, Why regulate private firm disclosure and auditing?, *Accounting and Business Research* 47, 473–502.

- Mookherjee, Dilip, and Ivan Png, 1989, Optimal auditing, insurance, and redistribution, *The Quarterly Journal of Economics* 104, 399–415.
- O’Dwyer, Michael, and Andrew Edgecliffe-Johnson, 2021, Big four accounting firms rush to join the ESG bandwagon, *Financial Times* ([link](#)).
- Papay, John P., John B. Willett, and Richard J. Murnane, 2011, Extending the regression-discontinuity approach to multiple assignment variables, *Journal of Econometrics* 161, 203–207.
- Ronen, Joshua, 2010, Corporate audits and how to fix them, *Journal of Economic Perspectives* 24, 189–210.
- Ronnen, Uri, 1996, The effects of mandated versus voluntary auditing policy on the quality of auditing, *Journal of Accounting, Auditing & Finance* 11, 393–419.
- Rose, N.L., 2014, *Economic Regulation and Its Reform: What Have We Learned?*, National Bureau of Economic Research Conference Report (University of Chicago Press).
- Ross, Stephen, 1979, Disclosure regulation in financial markets: Implications of modern finance theory and signaling theory, in F. R. Edwards, ed., *Issues in Financial Regulation* (McGraw-Hill).
- Ryan, Pete, 2022, Missionary creep: New disclosure rules aim to better measure climate risks. Is that even possible?, *The Economist* ([link](#)).
- Senate Staff, 1976, The accounting establishment: A staff study 1, Staff of Senate Subcommittee on Reports, Accounting, and Management of the Committee on Government Operations, 94th Cong., 2d Sess., U.S. Government Printing Office.
- Simons, Dirk, and Nicole Zein, 2016, Audit market segmentation – The impact of mid-tier firms on competition, *European Accounting Review* 25, 131–154.
- Simunic, Dan A., 1980, The pricing of audit services: Theory and evidence, *Journal of Accounting Research* 18, 161–190.
- Sirois, Louis-Philippe, Sophie Marmousez, and Dan A. Simunic, 2016, Auditor size and audit quality revisited: The importance of audit technology, *Accounting Auditing Control* 22, 111–144.
- Soll, Jacob, 2014, *The Reckoning: Financial Accountability and the Rise and Fall of Nations* (Basic Books).
- Stahl, Konrad, and Roland Strausz, 2017, Certification and market transparency, *The Review of Economic Studies* 84, 1842–1868.
- Stettler, Howard F., 1977, *Auditing Principles 20-21* (Prentice-Hall).
- Stigler, George J., 1971, The theory of economic regulation, *The Bell Journal of Economics and Management Science* 2, 3–21.

- Sundgren, Stefan, and Tobias Svanström, 2013, Audit office size, audit quality and audit pricing: Evidence from small- and medium-sized enterprises, *Accounting and Business Research* 43, 31–55.
- Sutton, John, 1991, *Sunk costs and market structure: Price competition, advertising, and the evolution of concentration* (MIT Press).
- Vanstraelen, Ann, and Caren Schelleman, 2017, Auditing private companies: What do we know?, *Accounting and Business Research* 47, 565–584.
- Viscusi, W. Kip, 1978, A note on “lemons” markets with quality certification, *The Bell Journal of Economics* 9, 277–279.
- Watts, Ross L., and Jerold L. Zimmerman, 1983, Agency problems, auditing, and the theory of the firm: Some evidence, *The Journal of Law and Economics* 26, 613–633.
- Waymire, Gregory B., and Sudipta Basu, 2008, Accounting is an evolved economic institution, *Foundations and Trends in Accounting* 2, 1–174.
- Wiesen, J., 1978, The Securities Acts and independent auditors: What did Congress intend?, A Research Study Prepared for the Commission on Auditors’ Responsibilities.



## Model Appendix

We consider a parsimonious model of firms' audit demand, audit firms' audit production, and auditors' labor supply. In this appendix, we derive the voluntary and mandatory equilibria of the model with two qualities of labor ("high" vs. "low" quality), discussed in Section 6. The derivation of the corresponding equilibria of the simpler model with one homogeneous quality of labor, discussed in Section 3, follows analogously.

### Auditors' Labor Supply

There are auditors of two qualities ( $q \in \{h, l\}$  with  $q = h$  denoting high quality and  $q = l$  denoting low quality) that supply their labor in a local audit market if their local wage exceeds their outside option. The outside option is a function of the distance of the auditors from the local market:

$$u_{q,j} = w_q - \bar{w}_q d_{q,j} \quad (15)$$

Auditors ( $j$ ) are uniformly distributed along a unit distance line. They are indifferent between supplying their labor in the local market or elsewhere if they are at distance  $d_{1,j}^*$ :

$$w_q - \bar{w}_q d_{q,j} = 0 \quad (16)$$

$$\Rightarrow d_{q,j}^* = w_q / \bar{w}_q \quad (17)$$

Local auditor labor supply accordingly amounts to:

$$L_q = \int_0^{d_{q,j}^*} d_{q,j} = w_q / \bar{w}_q \quad (18)$$

### Audit Firms' Audit Production

Audit firms produce audits (i.e., supply total audit quality) combining labor (of either quality) ( $L_q$ ) with technology and systems in place at the audit firms:

$$Q_q^S = A_q L_q^\rho \quad (19)$$

For parsimony, we focus on the labor input and take the technology / systems as given. High-quality labor is more productive with high-tech systems, resulting in higher productivity:  $A_h \geq A_l$ . High-tech systems (e.g., for large-scale audits), however, impose greater fixed costs ( $f_h > f_l$ ) that are passed on to firms (i.e., audit clients).

Besides the fixed cost, audit firms charge firms ( $i$ ) an average marginal cost, which corresponds to the total wage bill of the audit firm divided by the total audit quality supplied:

$$p_q = \frac{w_q L_q}{Q_q^S} = \frac{w_q}{A_q} \left( \frac{w_q}{\bar{w}_q} \right)^{1-\rho} \quad (20)$$

## Firms' Audit Demand

Firms ( $i$ ) differ in their size ( $s_i$ ). Their frequency along the size dimension follows a Pareto distribution ( $f(s_i) \sim \text{Pareto}(\alpha)$ ). Larger firms are more complex to audit, but also benefit more from audits; especially from high-quality audits ( $b_h > b_l$ ). Firms of a given size choose to obtain an audit if their utility of the audit exceeds the audit cost. If firms choose to obtain an audit, they can choose between the two audit qualities (high vs. low):

$$u_{q,i} = (b_q - p_q)s_i - f_q \quad (21)$$

$$= \left( b_q - \frac{w_q}{A_q} \left( \frac{w_q}{\bar{w}_q} \right)^{1-\rho} \right) s_i - f_q \quad (22)$$

Firms of size  $s_h^*$  are indifferent between the two types of audits:

$$u_{h,i} = u_{l,i} \quad (23)$$

$$\Rightarrow \left( b_h - \frac{w_h}{A_h} \left( \frac{w_h}{\bar{w}_h} \right)^{1-\rho} \right) s_h^* - f_h = \left( b_l - \frac{w_l}{A_l} \left( \frac{w_l}{\bar{w}_l} \right)^{1-\rho} \right) s_h^* - f_l \quad (24)$$

$$\Rightarrow s_h^* = \frac{f_h - f_l}{(b_h - b_l) - \left( \frac{w_h}{A_h} \left( \frac{w_h}{\bar{w}_h} \right)^{1-\rho} - \frac{w_l}{A_l} \left( \frac{w_l}{\bar{w}_l} \right)^{1-\rho} \right)} \quad (25)$$

Firms of size  $s_l^*$  are indifferent between low-type audits and no audits:

$$u_{l,i} = 0 \quad (26)$$

$$\Rightarrow \left( b_l - \frac{w_l}{A_l} \left( \frac{w_l}{\bar{w}_l} \right)^{1-\rho} \right) s_l^* - f_l = 0 \quad (27)$$

$$\Rightarrow s_l^* = \frac{f_l}{b_l - \frac{w_l}{A_l} \left( \frac{w_l}{\bar{w}_l} \right)^{1-\rho}} \quad (28)$$

The total demand for high-type audits is given by:

$$Q_h^D = \int_{s_h^*}^{\infty} s_i f(s_i) d_i \quad (29)$$

$$= s_h^{*(1-\alpha)} \left( \frac{\alpha}{\alpha - 1} \right) \quad (30)$$

for  $\alpha \neq 1$  using the expression for the mean of a truncated Pareto distribution (and rescaling by the cumulative distribution function).

The total demand for low-type audits is given by:

$$Q_l^D = \int_{s_l^*}^{\bar{s}^*} s_i f(s_i) d_i \quad (31)$$

$$= \frac{s_l^{*\alpha}}{1 - \left( \frac{s_l^*}{s_h^*} \right)^\alpha} \left( \frac{\alpha}{\alpha - 1} \right) \left( \frac{1}{s_l^{*\alpha-1}} - \frac{1}{s_h^{*\alpha-1}} \right) \left( \frac{1}{s_l^{*\alpha}} - \frac{1}{s_h^{*\alpha}} \right) \quad (32)$$

for  $\alpha \neq 1$  using the expression for the mean of a bounded Pareto distribution (and rescaling

by the cumulative distribution function).

We limit our investigation to cases where the largest firms prefer high-quality audits (because high-quality audit firms specialize in auditing complex firms) over low-quality audits; and marginal firms deciding between an audit or no audit prefer the low-quality audits (over high-type audits):  $s_h^* > s_l^*$ .

## Voluntary Audit Market Equilibrium

Absent a regulatory threshold, firms choose whether to obtain audits based on their utility. In equilibrium, the total audit quality demanded by firms and supplied by audit firms and auditors need to coincide for both audit qualities.

For high-quality audits, the equilibrium condition is:

$$Q_h^D \stackrel{!}{=} Q_h^S \quad (33)$$

$$\Rightarrow s_h^{*(1-\alpha)} \left( \frac{\alpha}{\alpha-1} \right) = A_h \left( \frac{w_h}{\bar{w}_h} \right)^\rho \quad (34)$$

For low-quality audits, the equilibrium condition is:

$$Q_l^D \stackrel{!}{=} Q_l^S \quad (35)$$

$$\Rightarrow \frac{s_l^{*\alpha}}{1 - \left( \frac{s_l^*}{s_h^*} \right)^\alpha} \left( \frac{\alpha}{\alpha-1} \right) \left( \frac{1}{s_l^{*\alpha-1}} - \frac{1}{s_h^{*\alpha-1}} \right) \left( \frac{1}{s_l^{*\alpha}} - \frac{1}{s_h^{*\alpha}} \right) = A_l \left( \frac{w_l}{\bar{w}_l} \right)^\rho \quad (36)$$

After making the simplifying assumptions of  $\rho = 1$  (constant returns to scale) and  $\alpha = 2$ , the first condition implies the following expression for the high-quality wage ( $w_h$ ):

$$w_h = \frac{2A_h \bar{w}_h (w_l + A_l b_h - A_l b_l)}{A_l (A_h^2 f_h - A_h^2 f_l + 2\bar{w}_h)} \quad (37)$$

Likewise, the second condition implies the following expression for the high-quality wage ( $w_h$ ):

$$w_h = \frac{A_h (-A_l^2 f_h f_l w_l + A_l^2 f_l^2 w_l - 2f_h \bar{w}_l w_l - 2A_l f_l \bar{w}_l b_h + 2A_l f_h \bar{w}_l b_l)}{2A_l f_l \bar{w}_l} \quad (38)$$

Equating the two expression and solving for the low-quality wage gives the equilibrium wage for low-quality auditors ( $w_l^*$ ):

$$w_l^* = \frac{\left( A_h b_h - \frac{2A_h \bar{w}_h b_h}{A_h^2 f_l - A_h^2 f_l + 2\bar{w}_h} - \frac{A_h f_h b_l}{f_l} + \frac{2A_h \bar{w}_h b_l}{A_h^2 f_h - A_h^2 f_l + 2\bar{w}_h} \right)}{\left( -\frac{A_h f_h}{A_l f_l} + \frac{2A_h \bar{w}_h}{A_l (A_h^2 f_h - A_h^2 f_l + 2\bar{w}_h)} - \frac{A_h A_l f_h}{2\bar{w}_l} + \frac{A_h A_l f_l}{2\bar{w}_l} \right)} \quad (39)$$

Equipped with the equilibrium wage for low-quality auditors, we can solve for the equi-

librium wage for the high-quality auditors ( $w_h^*$ ):

$$w_h^* = \frac{2A_h\bar{w}_h(w_l^* + A_l b_h - A_l b_l)}{A_l(A_h^2 f_h - A_h^2 f_l + 2\bar{w}_h)} \quad (40)$$

## Mandatory Audit Market Equilibrium

In the presence of a size-based audit mandate, firms above the regulatory threshold ( $T$ ) must obtain an audit irrespective of their utility. Unlike in the voluntary (benchmark) equilibrium, the (low / marginal type) audit threshold / cutoff is thus an exogenous parameter, not an endogenous outcome in the mandatory equilibrium. Still, even the mandatory equilibrium requires that total audit quality demanded (voluntarily and mandatorily) by firms and supplied by audit firms and auditors need to coincide for both audit qualities. We restrict our attention to the case where the mandate is binding:  $T < s_l^*$ .

For high-quality audits, the equilibrium condition is as before:

$$Q_h^D \stackrel{!}{=} Q_h^S \quad (41)$$

$$\Rightarrow s_h^{*(1-\alpha)} \left( \frac{\alpha}{\alpha-1} \right) = A_h \left( \frac{w_h}{\bar{w}_h} \right)^\rho \quad (42)$$

For low-quality audits, the new equilibrium condition is:

$$Q_l^D \stackrel{!}{=} Q_l^S \quad (43)$$

$$\Rightarrow \frac{T^\alpha}{1 - \left(\frac{T}{s_h^*}\right)^\alpha} \left( \frac{\alpha}{\alpha-1} \right) \left( \frac{1}{T^{\alpha-1}} - \frac{1}{s_h^{*\alpha-1}} \right) \left( \frac{1}{T^\alpha} - \frac{1}{s_h^{*\alpha}} \right) = A_l \left( \frac{w_l}{\bar{w}_l} \right)^\rho \quad (44)$$

After again making the simplifying assumptions of  $\rho = 1$  (constant returns to scale) and  $\alpha = 2$ , the first condition still implies the following expression for the high-quality wage ( $w_h$ ), as before:

$$w_h = \frac{2A_h\bar{w}_h(w_l + A_l b_h - A_l b_l)}{A_l(A_h^2 f_h - A_h^2 f_l + 2\bar{w}_h)} \quad (45)$$

The altered second condition now implies the following expression for the high-quality wage ( $w_h$ ):

$$w_h = \frac{A_h(-2A_l f_h \bar{w}_l + 2A_l f_l \bar{w}_l + A_l^2 f_h T \bar{w}_l - A_l^2 f_l T w_l + 2\bar{w}_l T w_l + 2A_l \bar{w}_l T b_h - 2A_l \bar{w}_l T b_l)}{2A_l \bar{w}_l T} \quad (46)$$

Equating the two expression and solving for the low-quality wage gives the equilibrium wage for low-quality auditors ( $w_{l,T}^*$ ):

$$w_{l,T}^* = \frac{\left( -\frac{A_h f_h}{T} + \frac{A_h f_l}{T} + A_h b_h - \frac{2A_h \bar{w}_h b_h}{A_h^2 f_h - A_h^2 f_l + 2\bar{w}_h} - A_h b_l + \frac{2A_h \bar{w}_h b_l}{A_h^2 f_h - A_h^2 f_l + 2\bar{w}_h} \right)}{\left( -\frac{A_h}{A_l} + \frac{2A_h \bar{w}_h}{A_l(A_h^2 f_h - A_h^2 f_l + 2\bar{w}_h)} - \frac{A_h A_l f_h}{2\bar{w}_l} + \frac{A_h A_l f_l}{2\bar{w}_l} \right)} \quad (47)$$

Equipped with the equilibrium wage for low-quality auditors, we can solve for the equilibrium wage for the high-quality auditors ( $w_{h,T}^*$ ):

$$w_{h,T}^* = \frac{2A_h\bar{w}_h(w_{l,T}^* + A_l b_h - A_l b_l)}{A_l(A_h^2 f_h - A_h^2 f_l + 2\bar{w}_h)} \quad (48)$$

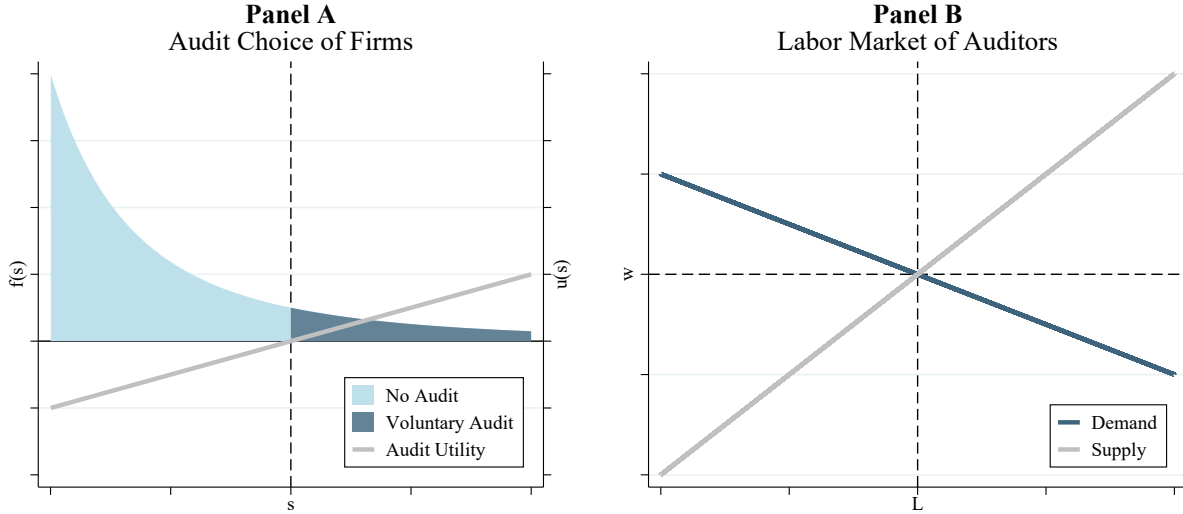
## Extensions

[Ronne](#) (1996) and [Simons and Zein](#) (2016) provide models of quality choices that provide similar intuition. They explicitly consider audit firms' quality choices. When endogenizing audit firms' quality choices, audit mandates, by increasing the demand for low-quality audits would expand the audit-quality disparity even further by incentivizing audit firms to differentiate their quality offerings even more.

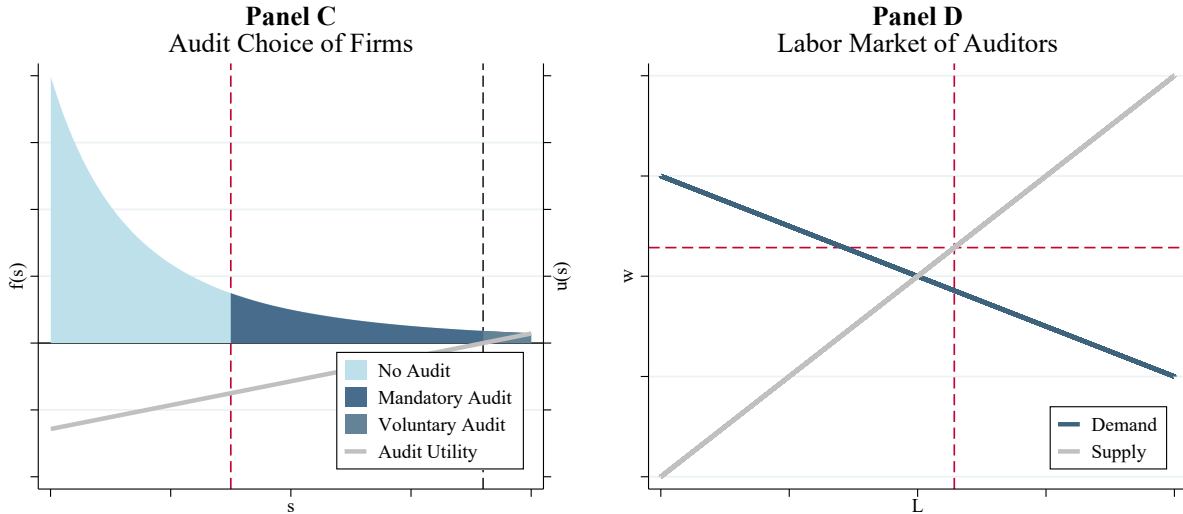
Our model is more specific to the mandate in our setting and the labor implications. The differentiated audit firms (with distinct quality of labor) can be viewed as the outcome of the first-stage quality decision and technology investment. Given our primary focus on the auditor-labor market, we abstract from audit firms' explicit technology and price choices. [Ronne](#) (1996) and [Simons and Zein](#) (2016) provide references for the pricing choices and profit implications of the mandate.

Figure 1: A Simple Audit Market Model

Audit Market *without* Mandate

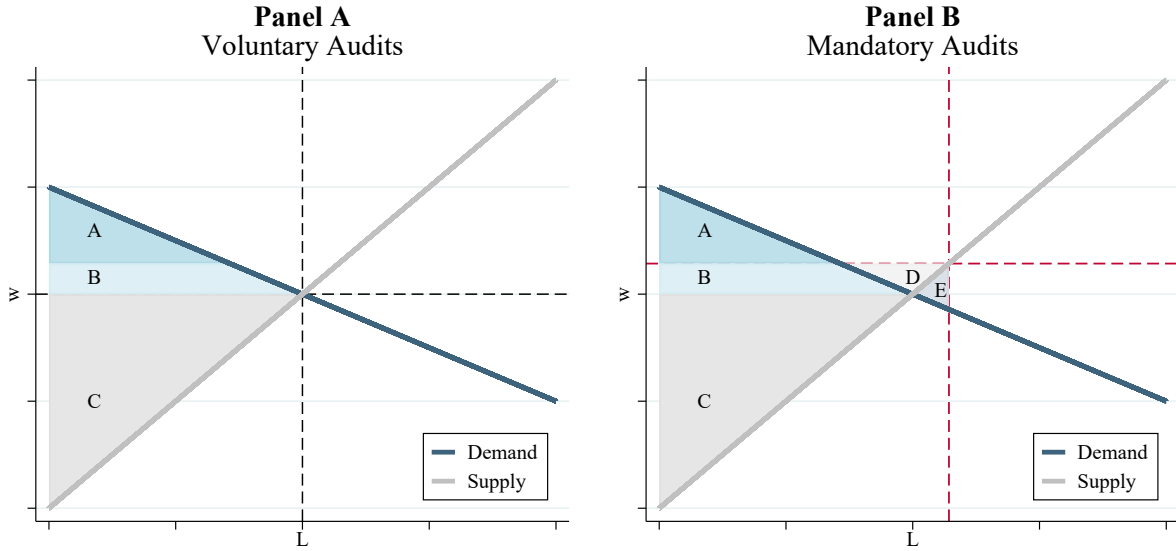


Audit Market *with* Mandate



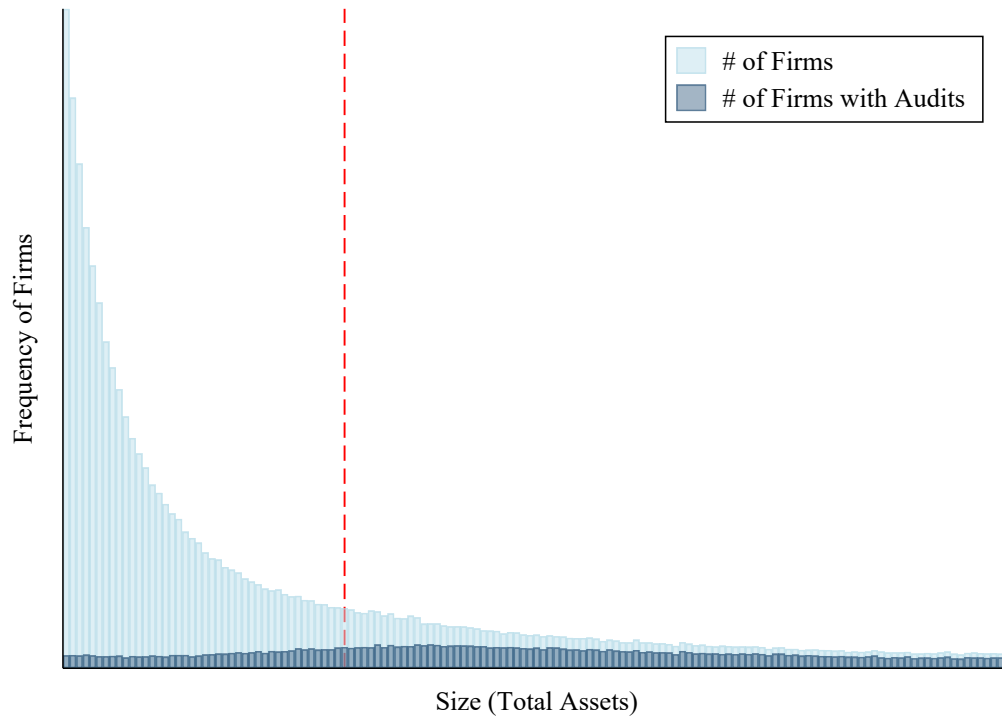
**Notes:** This figure shows the main components of our model of the audit market (Section 3). It is based on the following parameterization:  $\alpha = 2$ ,  $\rho = 1$ ,  $b = 1.5$ ,  $f = 1$ ,  $A = 1$ , and  $\bar{w} = 1$ . Panel A shows firms' audit choices and Panel B shows the labor market for auditors, both in the absence of an audit mandate. In Panel A, the firm-size distribution is plotted in light blue in the background. In the foreground, the grey line in represents the audit-utility function of firms. The dashed black line represents the size cutoff above which firms voluntarily buy an audit. The dark blue-shaded region represents the region of the firm-size distribution where firms voluntarily obtain an audit. In Panel B, the dark blue line represents the demand curve for auditors, while the grey line represents the supply curve of auditors. The intersection of these lines is the labor market equilibrium for auditors. The vertical dashed line shows the equilibrium number of auditors, whereas the horizontal dashed line shows the equilibrium wage for auditors. Panels C and D show firms' audit choices and the labor market for auditors in the presence of an audit mandate. In Panel C, the dashed black line represents the point at which firms buy audits voluntarily, while the dashed red line represents the firm-size threshold at which audits are mandated. The dark-blue shaded region of the firm-size distribution to the right of the dotted black line represents firms that voluntarily purchase audits. The navy region to the left of the black line, but to the right of the red line represents firms that buy audits mandatorily. Panel D shows the demand and supply curves of the labor market for auditors. The intersection of the dashed red lines represents the new labor market equilibrium for auditors given the audit mandate.

Figure 2: A Simple Audit Market Model: Welfare



**Notes:** This figure shows the welfare (or surplus) implications resulting from our model of the audit market (Section 3). Panel A shows the equilibrium in the labor market for auditors in the absence of an audit mandate. The areas *A* and *B* represent the consumer surplus of firms buying audits. The area *C* represents the producer surplus of auditors producing audits. Panel B shows the equilibrium in the labor market for auditors in the presence of an audit mandate. As in Figure 1, the intersection of the dashed red lines represents the mandatory equilibrium. In the mandatory equilibrium, area *A* represents the consumer surplus of firms that voluntarily buy audits. The areas *D* and *E* represent the loss of consumer surplus incurred by firms that mandatorily buy audits. The areas *B* and *C* represent the producer surplus of auditors obtained from producing audits for firms that voluntarily buy audits. Area *D* represents producer surplus of auditors obtained from producing audits for firms that mandatorily buy audits. Compared to the voluntary equilibrium, thus, the consumer surplus decreases by areas *B*, *D*, and *E*. The producer surplus, by contrast, increases by areas *B* and *D*. Those areas represent transfers from firms, due to the mandate. Area *E* is a deadweight (surplus) loss, imposed on firms, but not reaped by auditors (due to marginal auditors' high production costs). This simple welfare analysis neglects any social value of audits, which may exceed the firms' private value. We provide an extension that explicitly considers the social value of audits in Figure A1.

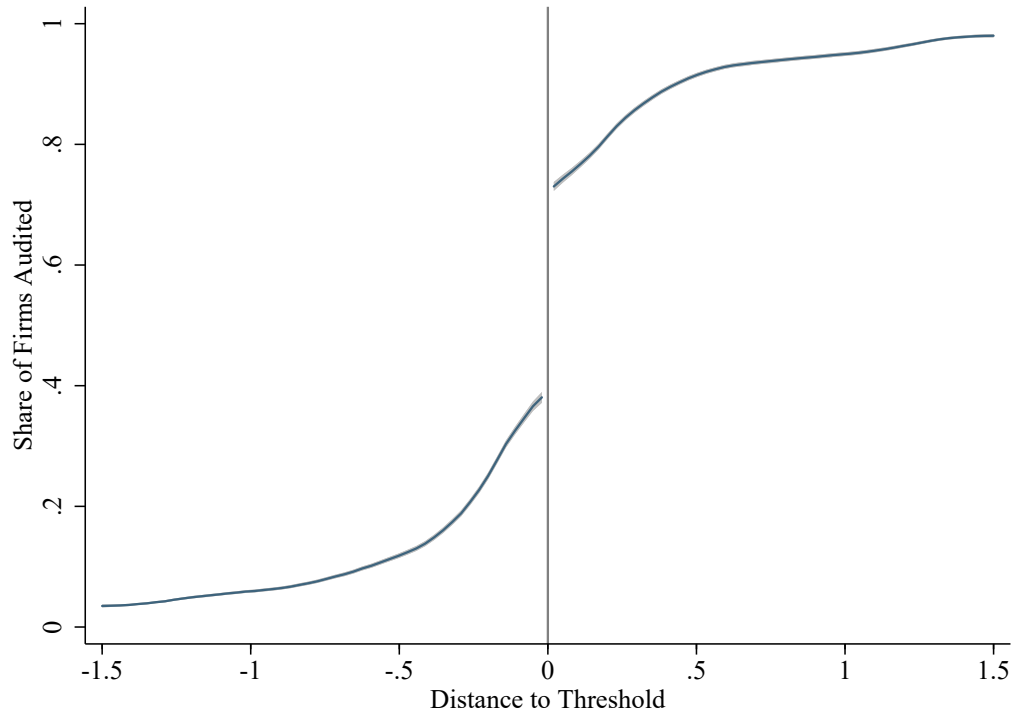
**Figure 3: Firms' Size and Audit Rates**



**Notes:** This figure shows the empirical firm-size distribution (in light blue) and the number of firms within each of those bins that has an audit (in dark blue) for firms with non-missing size (total asset) data in Germany from 2000 onward. Firm size (proxied by total assets) is plotted on the horizontal axis, while the frequency (count) of firms within each bin is plotted on the vertical axis. The red-dashed line represents the regulatory threshold for total assets for Germany from 2008 to 2013.

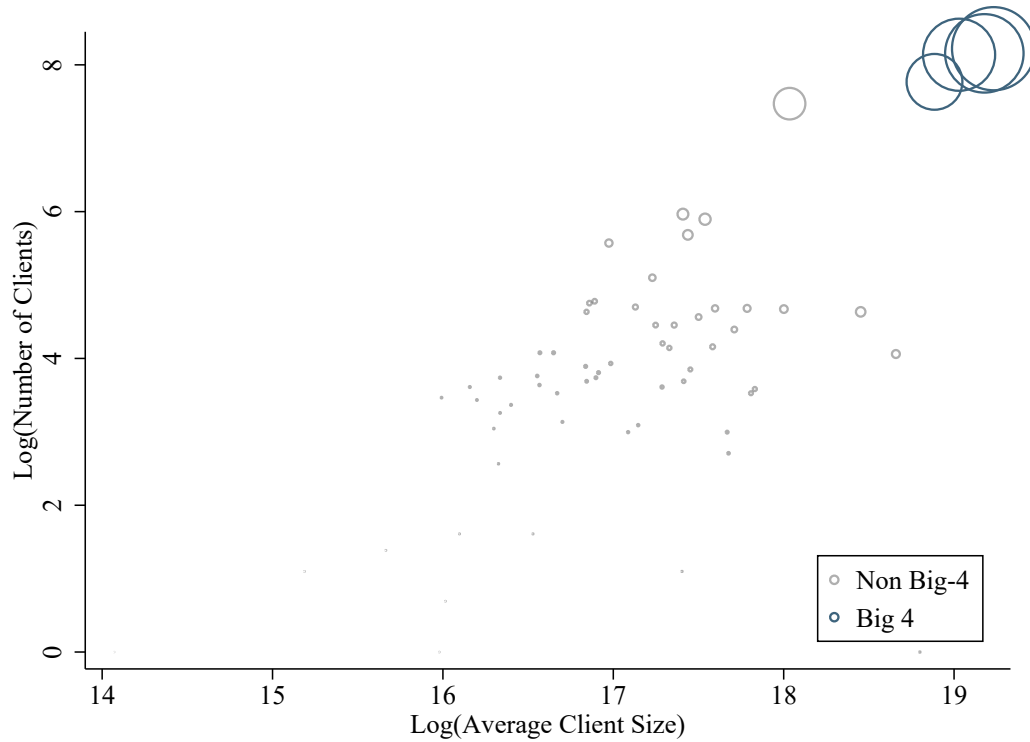


**Figure 4: Audit Mandates and Firms' Audit Choice**



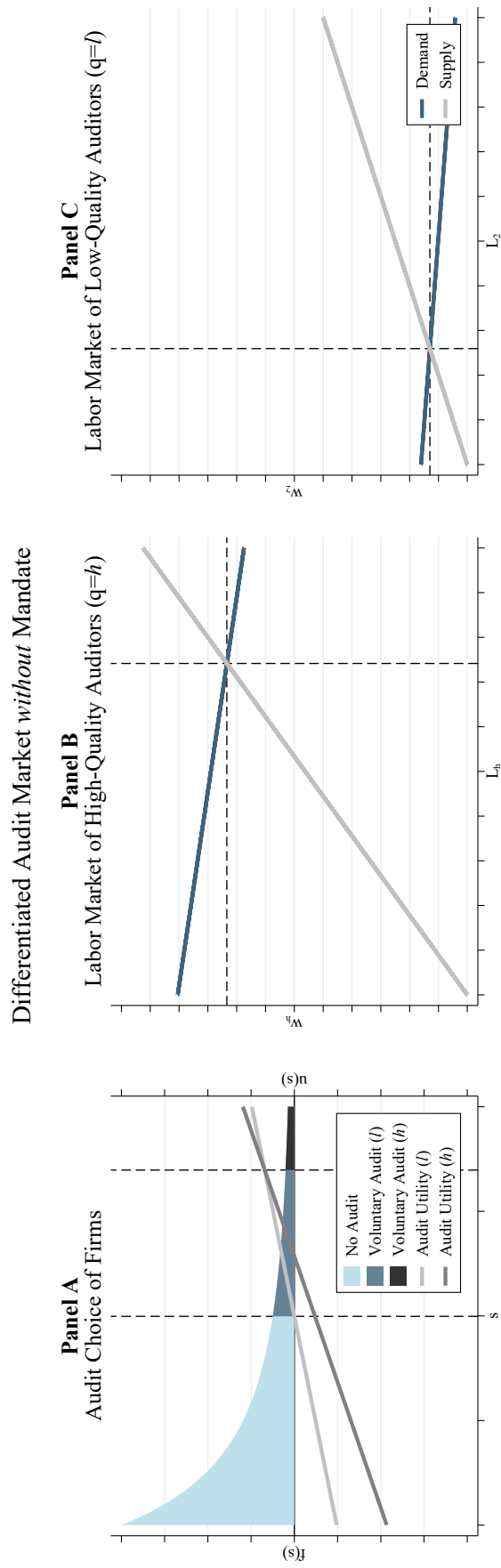
**Notes:** This figure shows local averages of firms' propensity to obtain an audit around the audit thresholds for German firms with non-missing size data from 2008 onward. The distance to the threshold, plotted on the  $x$ -axis, represents an approximation of firms' propensity to be subject to audit mandates. Following [Breuer et al. \(2018\)](#), our approximation uses the second-highest size dimension (relative to the respective regulatory threshold), because this second dimension determines whether a firm is likely to be subject to audit mandates given the multivariate (two-out-of-three thresholds) assignment rule. The figure plots local averages, obtained via kernel-weighted local polynomial regressions, separately for firms above and below the relevant threshold. The grey area represents 95% confidence intervals.

Figure 5: Audit Market Structure

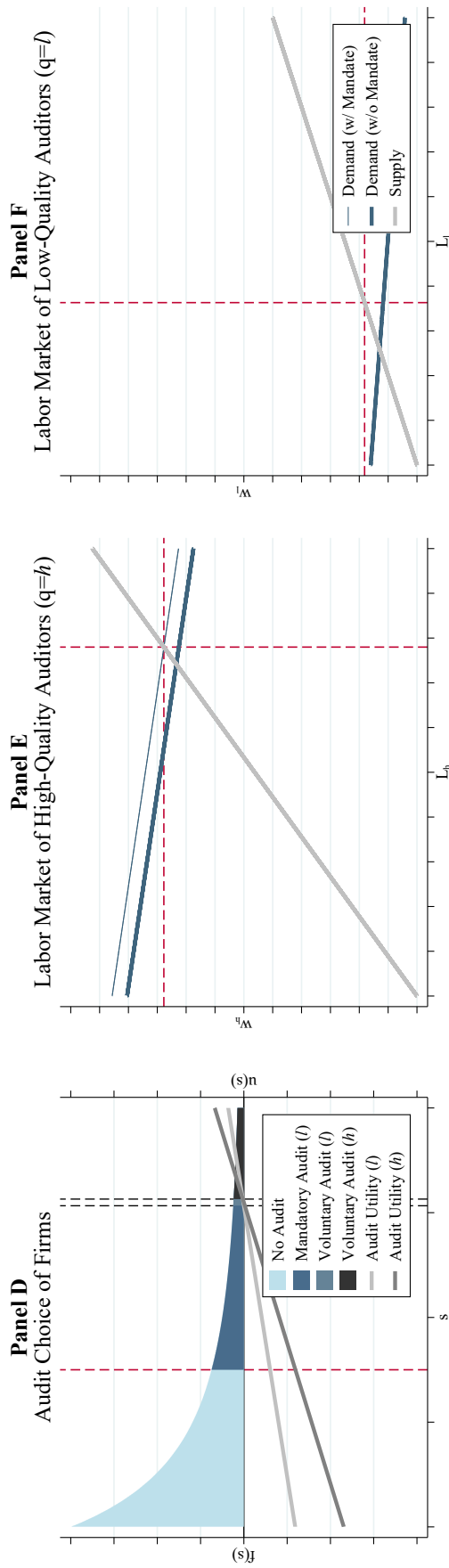


**Notes:** This figure plots the heterogeneity in audit firms' portfolios for the Top 100 audit firms in Germany in 2010. The navy circles represent each of the Big 4 accounting firms (i.e. KPMG, Deloitte, EY, and PwC), while the grey circles represent all other accounting firms. The horizontal axis plots the logged average client size, which is the logged average total assets across all clients in the portfolio of that audit firm in 2010. The vertical axis plots the logged number of clients in that audit firm's portfolio in 2010. The size of the circles represent the relative market share of the audit firms, defined by the sum of the total assets of all clients in their portfolio, compared to the total assets of all audit clients across the sample in 2010.

Figure 6: A Differentiated Audit Market Model

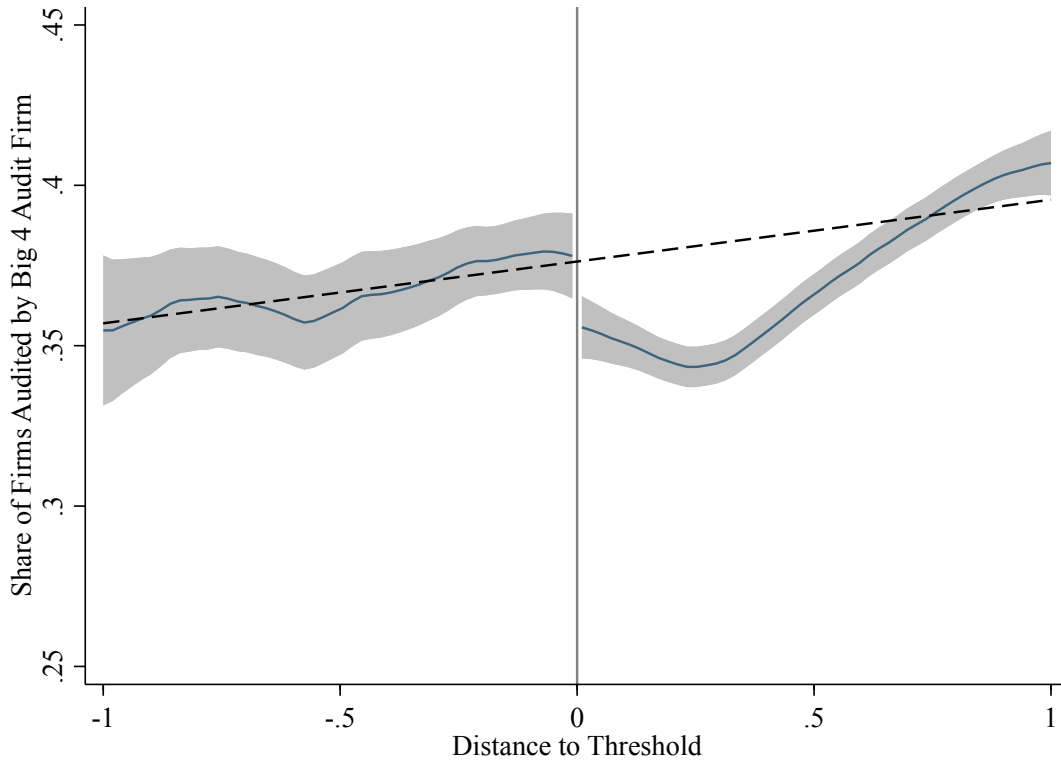


### Differentiated Audit Market *with* Mandate



**Notes:** This figure shows the main components of our model of a differentiated audit market (Section 6). It is based on the following parameterization:  $\alpha = 2$ ,  $\rho = 1$ ,  $b_h = 2.5$ ,  $b_l = 0.75$ ,  $f_h = 1.9$ ,  $f_l = 0.98$ ,  $A_h = 1$ ,  $A_l = 1$ ,  $\bar{w}_h = 2.25$ , and  $\bar{w}_l = 1$ . Panel A shows firms' audit choices, Panel B shows the labor market for high-quality auditors, and Panel C shows the labor market for low-quality auditors in the absence of an audit mandate. In Panel A, the firm-size distribution is plotted in light blue in the background. In the foreground, the light grey line represents firms' utility from low-quality audits. The dark grey line represents firms' utility from high-quality audits. The left black dashed line represents the size cutoff above which firms buy low-quality audits. The right black dashed line represents the size cutoff above which firms buy high-quality audits. The black shaded region represents the firms that voluntarily obtain a high-quality audit. The dark-blue shaded region represents the firms that voluntarily obtain a low-quality audit. In Panels B and C, the solid blue line represents the demand curve for high- and low-quality auditors, respectively. The solid grey line represents the supply curve of high- and low-quality auditors, respectively. Panels D, E and F show firms' audit choice and the labor markets for high- and low-quality auditors in the presence of an audit mandate. In Panel C, the black shaded region represents firms that voluntarily obtain a high-quality audit. The dark-blue shaded region represents firms that voluntarily obtain a low-quality audit. The navy shaded region represents firms that buy audits mandatorily. The dashed red line represents the size threshold of the mandate. In Panels E and F, the solid thick blue lines represent the demand curves for high-skilled and low-skilled auditors, respectively, absent the mandate (i.e., as in Panels B and C). The solid thin blue line in Panel E represents the demand for high-quality auditors in the presence of the mandate. The high-quality demand curve shifts out given that the two types of auditors are substitutes; and the mandate raises the wage for low-quality auditors. This interaction between the two labor markets explains why the mandate affects both markets, not just the low-quality market. The solid grey lines in Panels E and F represent the supply curves of high- and low-quality auditors, respectively. The intersection of the dashed red lines represent the equilibrium in the labor markets for high- and low-quality auditors in the presence of a mandate. For a welfare (or surplus) analysis, the demand curves absent a mandate constitute the relevant benchmark to determine the change in firms' (consumer) surplus. Firms' losses in the low-quality market are partially ameliorated by firms' ability to substitute away into the high-quality market. As result, both markets are affected by the mandate and exhibit welfare transfers and deadweight losses compared to the benchmark case without a mandate.

**Figure 7:** Audit Mandates and Firms' Auditor Choices



**Notes:** This figure shows local averages of firms' propensity to obtain an audit from a Big 4 audit firm around the audit thresholds for audited German firms with non-missing size data. The Big 4 audit firms consist of KPMG, Deloitte, EY, and PwC, the largest and world-wide leading audit firms. Audits provided by Big 4 audit firms are indicative of high-quality auditing (e.g., [DeFond and Zhang, 2014](#); [Jiang et al., 2019](#)). The distance to the threshold, plotted on the  $x$ -axis, represents an approximation of firms' propensity to be subject to audit mandates. Following [Breuer et al. \(2018\)](#), our approximation uses the second-highest size dimension (relative to the respective regulatory threshold), because this second dimension determines whether a firm is likely to be subject to audit mandates given the multivariate (two-out-of-three thresholds) assignment rule. The figure plots local averages, obtained via kernel-weighted local polynomial regressions, separately for firms above and below the relevant threshold. The grey area represents the corresponding 95% confidence intervals. The dashed black line represents a simple linear (regression) fit using all firms, irrespective of whether they are below or above the threshold. It shows that the actual audit choices of firms' just above the threshold deviate significantly from the choices expected based on the relation between firm-size and audit-firm choice observed for other firms (e.g., voluntarily audited firms just below the threshold).

Table 1: Summary Statistics

Panel A: Industrial Firms

	Setting	Aggregation Level	Obs.	Mean	Std. Dev	p10	p25	p50	p75	p90
Audit	Germany	Firm-Level	1,002,964	0.25	0.43	0.00	0.00	0.00	1.00	1.00
Above Thresholds	Germany	Firm-Level	1,036,170	0.28	0.45	0.00	0.00	0.00	1.00	1.00
Audit	Germany	County-Level Average	5,614	0.08	0.03	0.04	0.06	0.08	0.10	0.12
Above Thresholds	Germany	County-Level Average	5,614	0.12	0.03	0.09	0.10	0.12	0.14	0.16
Peers Above Thresholds	Germany	County-Level Average	5,614	0.13	0.01	0.12	0.13	0.13	0.14	0.15
Audit	Europe	Country-Level Average	363	0.18	0.23	0.00	0.02	0.07	0.28	0.49
Above Thresholds	Europe	Country-Level Average	480	0.26	0.30	0.03	0.06	0.13	0.36	0.99
Total Assets (in thousands Euro)	Germany	Firm-Level	1,036,170	29,318.54	106,901.92	107.39	393.46	1,316.47	8,905.03	52,799.60
Sales (in millions Euro)	Germany	Firm-Level	1,036,170	31.80	105.09	0.24	0.83	2.36	12.62	64.91
Employees	Germany	Firm-Level	1,036,170	247.24	4293.96	2.00	6.00	17.00	61.00	270.00
Relative Total Assets (Log)	Germany	Firm-Level	1,036,011	-1.05	2.44	-3.86	-2.66	-1.46	0.55	2.34
Relative Sales (Log)	Germany	Firm-Level	1,035,960	-1.23	2.26	-3.76	-2.59	-1.57	0.21	1.87
Relative Employees (Log)	Germany	Firm-Level	1,036,170	-0.76	1.72	-2.81	-1.97	-1.02	0.22	1.69

Panel B: Audit Firms

	Setting	Aggregation Level	Obs.	Mean	Std. Dev	p10	p25	p50	p75	p90
Audit	Europe	Country-Level Average	363	0.18	0.23	0.00	0.02	0.07	0.28	0.49
Above Thresholds	Europe	Country-Level Average	480	0.26	0.30	0.03	0.06	0.13	0.36	0.99
No. of Audit Firms	Europe	Country Total	363	5,758.12	9,263.72	140.00	503.00	1,453.00	5,622.00	25,028.00
Audit Firm HHI	Europe	Country Sum	359	0.03	0.08	0.00	0.01	0.02	0.03	0.06
No. of Clients	Europe	Audit-Firm	1,852,076	17.22	348.36	1.00	1.00	2.00	6.00	25.00
Client Size (in thousands of Euros)	Europe	Audit-Firm	1,840,569	8,044.81	19,340.71	70.85	361.43	1,977.62	6,956.65	17,882.40
Total Assets (in thousands of Euros)	Europe	Audit Firm	9,199	25,629.84	131,184.45	162.00	524.00	1,395.00	6,858.32	38,568.11
Fixed Assets (in thousands of Euros)	Europe	Audit Firm	9,188	6,069.12	37,271.12	1.59	30.56	195.22	1,204.50	6,543.00
No. of Employees	Europe	Audit Firm	6,121	381.70	1,520.32	4.00	10.00	26.00	150.00	700.00
Employee Cost (in millions of Euros)	Europe	Audit Firm	7,179	24.52	122.54	0.15	0.41	1.12	5.36	31.59

**Panel C: Auditors**

	Setting	Aggregation Level	Obs.	Mean	Std. Dev	p10	p25	p50	p75	p90
Audit	Germany	County-Level Average	5,614	0.08	0.03	0.04	0.06	0.08	0.10	0.12
Above Thresholds	Germany	County-Level Average	5,614	0.12	0.03	0.09	0.10	0.12	0.14	0.16
Peers Above Thresholds	Germany	County-Level Average	5,614	0.13	0.01	0.12	0.13	0.13	0.14	0.15
Log(Wage)	Germany	Employee-Level	15,221,976	4.27	0.99	2.75	3.87	4.45	4.87	5.21
Log(Wage)	Germany	Occupation-Industry Level	3,385,820	4.01	0.94	2.61	3.57	4.23	4.66	5.03
# of Employees	Germany	Occupation-Industry Level	3,394,933	4.51	50.53	1.00	1.00	1.00	2.00	6.00
Audit Industry	Germany	Employee-Level	15,310,357	0.001	0.03	0.00	0.00	0.00	0.00	0.00
Audit Occupation	Germany	Employee-Level	15,310,357	0.001	0.03	0.00	0.00	0.00	0.00	0.00
Age	Germany	Employee-Level	15,310,357	40.19	12.98	23.00	29.00	40.00	51.00	58.00
Acct Firm Experience	Germany	Employee-Level	15,310,357	0.07	0.65	0.00	0.00	0.00	0.00	0.00

**Notes:** This table reports the summary statistics for the variables used in the proceeding analysis. We employ different designs involving three key parties: (industrial firms, audit firms and auditors. In each panel, the “Setting” refers to whether the variable is used in our analysis of the German audit market, or the European audit market. The level of aggregation refers to the level at which the variable has been aggregated. In general, we employ several levels of aggregation; the most disaggregated being the employee-level and firm-level, and the most aggregated being at the country-level. Panel A reports the summary statistics for the variables used in our analyses of industrial firms at the firm-level and county-level. Panel B reports the summary statistics used in our analyses of audit firms, at the country-level and audit-firm level. Finally, Panel C reports the summary statistics for the variables used in our main analyses of auditors at the county-level, the occupation-industry-county level and the employee-level. Detailed variable definitions are included in Table A.2.

**Table 2: Audit Mandates and Firms' Audit Choice**

Outcome Design	Audit RDD (1)	Audit County-Level (2)	Audit County-Level (3)	Audit Country-Level (4)
Above Thresholds	0.629*** (0.003)	0.312*** (0.032)	0.307*** (0.015)	0.197*** (0.053)
Peers Above Thresholds			-1.709* (0.960)	
Constant	0.126*** (0.001)	0.044** (0.004)	0.271** (0.127)	0.136*** (-0.011)
Distance Controls	Yes	N/A	N/A	N/A
Fixed Effects Structure	Industry, Year	County, Year	County, Year	Country, Year
Cluster	Firm	County	County	Country
Observations	1,002,159	5,614	5,614	337
$R^2$	0.716	0.846	0.846	0.779

**Notes:** This table reports the estimates from regressions of firms' audit choice on a variable capturing whether firms exceed at least two of the three regulatory thresholds at different aggregation levels. Column 1 reports the estimates from a firm-level RD Design for German firms, where *Above Thresholds* is an indicator that takes on a value of 1 if the firm exceeds at least two of the three regulatory thresholds, and 0 otherwise. This specification also includes distance controls, which include controls for the logged version of each of the three variables (total assets, total sales, employee count) determining whether firms exceed the regulatory threshold. Column 2 report the results from a regression of the proportion of firms with audits at the county-level in Germany on the proportion of firms in that county that exceed at least two of the three regulatory thresholds. Column 3 reports estimates at the same aggregation level, but also includes a spillover measure, *Peers Above Thresholds*, which is defined in Table A.2. Column 4 reports the estimates from a regression of the proportion of firms within a country with audits on the proportion of firms within that country that exceed at least two of the three regulatory thresholds. Fixed effects for industries and years are included in column 1, for counties and years in columns 2 and 3, and for countries and years in column 4. Standard errors, reported in parentheses, are clustered at the firm level in column 1, at the county level in columns 2 and 3, and at the country level in column 4. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% level, respectively.



**Table 3: Audit Mandates and Audit Firms' Client Portfolio**

	Log(No. Clients) (1)	Log(Client Size) (2)
Above Thresholds	0.251*** (0.022)	-0.584*** (0.018)
Fixed Effects Structure	Audit Firm, Year	Audit Firm, Year
Cluster	Audit Firm	Audit Firm
Observations	1,239,884	1,230,470
$R^2$	0.847	0.862

**Notes:** This table reports the estimates from regressions of audit firms' portfolio outcomes on *Above Thresholds*, a variable capturing the proportion of firms in a country that exceed at least two of three regulatory thresholds. The outcome in column 1 is the logged number of clients the audit firm has in their portfolio. The outcome in column 2 is the average size of the clients in the audit firms' portfolio, measured by the average total assets of the client firms. All specifications include fixed effects for audit firms and years. Standard errors, reported in parentheses, are clustered at the audit-firm level for all specifications. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Table 4: Audit Mandates and Audit Firms' Inputs

	Log(Total Assets) (1)	Log(Fixed Assets) (2)	Log(No. of Employees) (3)	Log(Cost of Employees) (4)
Above Thresholds	0.369*** (0.081)	0.745*** (0.150)	0.304*** (0.102)	0.231*** (0.067)
Fixed Effects Structure	Audit Firm, Year	Audit Firm, Year	Audit Firm, Year	Audit Firm, Year
Cluster	Audit Firm	Audit Firm	Audit Firm	Audit Firm
Observations	8,390	7,732	5,595	6,582
R <sup>2</sup>	0.896	0.857	0.954	0.946

**Notes:** This table reports the estimates from regressions of audit firms' capital and labor inputs on *Above Thresholds*, a variable capturing the proportion of firms in a country that exceed at least two of three regulatory thresholds. The outcome in column 1 is the logged total assets of the audit firm. The outcome in column 2 is the logged fixed assets of the audit firm. The outcome in column 3 is the logged number of employees of the audit firm. The outcome in column 4 is the logged labor expenses of the audit firm. Detailed variable definitions can be found in Table A.2. All specifications include fixed effects for audit firms and years. Standard errors, reported in parentheses, are clustered at the audit-firm level for all specifications. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% level, respectively.

**Table 5: Audit Mandates and Auditors' Quantity**

	# of Employees (1)	# of Employees (2)	# of Employees (3)	# of Employees (4)
Audit Occ × Audit Ind × Above Thresholds	99.606 (68.395)	90.589 (66.489)	194.718* (109.714)	405.667** (199.717)
Audit Occ × Above Thresholds	-13.686 (12.567)	-19.030 (14.710)	-40.641 (52.871)	
Audit Ind × Above Thresholds	36.302** (15.203)	40.352** (19.095)	55.272 (108.765)	
Above Thresholds	11.831 (7.881)	11.116* (6.589)	2.223 (3.105)	
Audit Occ × Audit Ind	-3.285 (8.319)			
Audit Occ	-2.489 (1.520)			
Audit Ind	-6.835*** (1.805)			
<b>Linear Combinations</b>				
Audit Occupation × Audit Industry Effect ( $\beta_1 + \beta_2 + \beta_3$ )	122.222* (73.95)	111.911 (70.14)	209.349* (127.80)	
Audit Occupation Effect ( $\beta_1 + \beta_2$ )	85.920 (62.477)	71.559 (57.455)	154.077 (95.901)	
Audit Industry Effect ( $\beta_1 + \beta_3$ )	135.909* (79.205)	130.941* (78.290)	249.990 (163.865)	
Fixed Effects Structure	County, Year	County, Year, Occ × Ind	Occ × Year, Ind × Year, Occ × Ind, County × Ind, County × Occ	Ind × Occ × Year, County × Occ × Year, County × Ind × Year
Cluster	County	County	County	County
Observations	2,317,137	2,305,517	2,279,172	1,371,959
$R^2$	0.012	0.087	0.357	0.398

**Notes:** This table reports the estimates from regressions of number of employees within a German county on *Above Thresholds*, a variable capturing the proportion of firms in a county that exceed at least two of three regulatory thresholds. Analyses in this table are conducted on the occupation-industry-county level. The coefficients reported for *Above Thresholds* captures the effect of audit mandates on non-auditors working at non-audit firms. The interaction between *Audit Ind* and *Above Thresholds* captures the incremental effect of the mandate on non-auditors employees working at audit firms. The interaction between *Audit Occ* and *Above Thresholds* captures the incremental effect of the mandate on auditors working at non-audit firms. The interaction between *Audit Occ*, *Audit Ind* and *Above Thresholds* captures the incremental effect of audit mandates on auditors working at audit firms. Linear combinations of the decomposed coefficients are also included to facilitate interpretations of the total incremental impact of the mandates on non-auditors in audit firms (i.e. Audit Industry Effect), auditors in non-audit firms (i.e. Audit Occupation Effect) and auditors in audit firms (i.e. Audit Occupation × Audit Industry Effect). Detailed variable definitions can be found in Table A.2. The columns differ in their fixed effects structures. Column 1 includes the least restrictive structure with fixed effects for counties and years. Column 2 additionally includes fixed effects for occupations × industries. Column 3 includes fixed effects for occupations × years, industries × years, occupations × industries, counties × industries, and counties × occupations. Column 4 includes fixed effects for industries × occupations × years, counties × occupations × years, and counties × industries × years. Standard errors, reported in parentheses, are clustered at the county level for all specifications. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% level, respectively.

**Table 6: Audit Mandates and Auditors' Wages**

	Log(Wages) (1)	Log(Wages) (2)	Log(Wages) (3)	Log(Wages) (4)
Audit Occ × Audit Ind × Above Thresholds	-5.490*** (1.619)	-4.055*** (1.368)	-3.802* (1.952)	-4.912** (2.456)
Audit Occ × Above Thresholds	-0.269 (0.709)	1.227** (0.536)	-0.600 (0.979)	
Audit Ind × Above Thresholds	1.707 (1.556)	-0.088 (1.195)	3.504** (1.690)	
Above Thresholds	0.287* (0.171)	0.038 (0.117)	0.070 (0.088)	
Audit Occ × Audit Ind	-0.035 (0.228)			
Audit Occ	1.188*** (0.097)			
Audit Ind	-0.159 (0.211)			
<b>Linear Combinations</b>				
Audit Occupation × Audit Industry Effect ( $\beta_1 + \beta_2 + \beta_3$ )	-4.051*** (0.755)	-2.916*** (0.742)	-0.897 (2.538)	
Audit Occupation Effect ( $\beta_1 + \beta_2$ )	-5.759*** (1.738)	-2.828** (1.348)	-4.401** (2.159)	
Audit Industry Effect ( $\beta_1 + \beta_3$ )	-3.783*** (0.878)	-4.143*** (0.836)	-0.297 (2.426)	
Fixed Effects Structure	County, Year	County, Year, Occ × Ind	Occ × Year, Ind × Year, Occ × Ind, County × Ind, County × Occ	Ind × Occ × Year, County × Occ × Year, County × Ind × Year
Cluster	County	County	County	County
Observations	2,309,859	2,298,230	2,271,792	1,365,872
$R^2$	0.059	0.572	0.734	0.804

**Notes:** This table reports the estimates from regressions of employees logged wages within a German county on *Above Thresholds*, a variable capturing the proportion of firms in a county that exceed at least two of three regulatory thresholds. Analyses in this table are conducted on the occupation-industry-county level. The coefficients reported for *Above Thresholds* captures the effect of audit mandates on non-auditors working at non-audit firms. The interaction between *Audit Ind* and *Above Thresholds* captures the incremental effect of the mandate on non-auditors employees working at audit firms. The interaction between *Audit Occ* and *Above Thresholds* captures the incremental effect of the mandate on auditors working in non-audit firms. The interaction between *Audit Occ*, *Audit Ind* and *Above Thresholds* captures the incremental effect of audit mandates on auditors working at audit firms. Linear combinations of the decomposed coefficients are also included to facilitate interpretations of the total incremental impact of the mandates on non-auditors at audit firms (i.e. Audit Industry Effect), auditors in non-audit firms (i.e. Audit Occupation Effect) and auditors in audit firms (i.e. Audit Occupation × Audit Industry Effect). Detailed variable definitions can be found in Table A.2. The columns differ in their fixed effects structures. Column 1 includes the least restrictive structure with fixed effects for counties and years. Column 2 additionally includes fixed effects for occupations × industries. Column 3 includes fixed effects for occupations × years, industries × years, occupations × industries, counties × industries, and counties × occupations. Column 4 includes fixed effects for industries × occupations × years, counties × occupations × years, and counties × industries × years. Standard errors, reported in parentheses, are clustered at the county level for all specifications. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% level, respectively.

**Table 7: Audit Mandates and Auditors' Wages (Revisited)**

	(1) Log(Wages)	(2) Log(Wages)	(3) Log(Wages)	(4) Log(Wages)
Audit Occ $\times$ Audit Ind $\times$ Above Thresholds	-3.238*** (1.143)	-1.580* (0.938)	0.213 (0.682)	1.114 (0.908)
Main Effects & Two-Way Interactions	Yes	Yes	Yes	Yes
Fixed Effects Structure	County, Year	Establishment, County, Year	Employee, Establishment, County Year	Employee $\times$ Establishment, County, Year
Cluster	County	County	County	County
Observations	12,864,938	12,650,635	12,595,702	11,434,187
$R^2$	0.145	0.581	0.866	0.920

**Notes:** This table reports the estimates from regressions of employees' logged wages on *Above Thresholds*, a variable capturing the proportion of firms in a county that exceed at least two of three regulatory thresholds. Analyses in this table are conducted on the employee level. In this table, only the incremental effect on auditors at audit firms (i.e. the interaction between *Above Thresholds*, *Audit Occ* and *Audit Ind*) is reported for parsimony, although all main effects and two-way interactions (as reported in Table V and Table VI are also included in the regression). Detailed variable definitions can be found in Table A.2. The columns differ in their fixed effects structures. Column 1 includes the least restrictive structure with fixed effects for counties and years. Column 2 additionally includes fixed effects for establishments. Column 3 additionally includes fixed effects for employees. Column 4 includes fixed effects for counties, years, and employees  $\times$  establishments. Standard errors, reported in parentheses, are clustered at the county level for all specifications. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% level, respectively.

**Table 8: Audit Mandates and Audit Firms' Size**

**Panel A: Total Assets**

Outcome Design	Log(Aggregate Total Assets) Country-Level Aggregate (1)	Log(Avg Total Assets) Country-Level Average (2)	Total Assets (Between Estimator) Between Estimator (3)
Above Thresholds	0.004 (0.005)	-0.293 (0.213)	-0.810** (0.398)
Fixed Effects Structure	Country, Year	Country, Year	N/A
Cluster Observations $R^2$	Country 369 0.952	Country 369 0.930	Audit Firm 8,408 0.006

**Panel B: Number of Employees**

Outcome Design	Log(Aggregate No. of Employees) Country-Level Aggregate (1)	Log(Avg No. of Employees) Country-Level Average (2)	Log(No. of Employees) Between Estimator (3)
Above Thresholds	0.028 (0.017)	0.091 (0.392)	-0.647* (0.338)
Fixed Effects Structure	Country, Year	Country, Year	N/A
Cluster Observations $R^2$	Country 347 0.819	Country 347 0.831	Audit Firm 5,628 0.006

**Notes:** This table reports the estimates from regressions of proxies for audit firm size (i.e. their capital and labor inputs) on *Above Thresholds*, a variable capturing the proportion of firms in a country that exceed at least two of three regulatory thresholds. Analyses in this table are conducted on the country level and the audit-firm level. Panel A reports the results using Total Assets as an outcome, while Panel B reports the result using the number of employees as an outcome. In both panels, column 1 reports the result from a regression of the the country-level aggregate (i.e. the total of the outcome at the country-level) on *Above Thresholds*. Column 2 reports the results from a regression of the country-level average of the outcome on *Above Thresholds*. Column 3 reports the results for audit-firm level analyses using a between estimator (rather than a fixed-effects model) to capture how audit mandates impact cross-sectional differences in outcomes between audit firms. Detailed variable definitions can be found in Table A.2. Columns 1 and 2 include fixed effects for countries and years. Column 3 uses a between estimator, so it does not include any fixed effects. Standard errors, reported in parentheses, are clustered at the country level in columns 1 and 2, and at the audit-firm level in column 3. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% level, respectively.

**Table 9: Audit Mandates and Audit Market Structure**

	Log(No. of Audit Firms) (1)	Log(HHI) (2)
Above Thresholds	0.717** (0.295)	-0.867* (0.438)
Fixed Effects Structure	Country Year	Country Year
Cluster	Country	Country
Observations	337	335
$R^2$	0.854	0.676

**Notes:** This table reports the estimates from regressions of measures of the audit market’s structure on *Above Thresholds*, a variable capturing the proportion of firms in a country that exceed at least two of three regulatory thresholds. Analyses in this table are conducted on the country level and the audit-firm level. Column 1 uses the logged (total) number of audit firms within a country as an outcome. Column 2 uses the logged Herfindahl–Hirschman Index (HHI) among audit firms as an outcome. Detailed variable definitions can be found in Table A.2. Both specifications include fixed effects for countries and years. Standard errors, reported in parentheses, are clustered at the country level. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% level, respectively.

**Table 10: Audit Mandates and Auditors' Experience**

	Audit Firm (1)	Audit Firm (2)
Above Thresholds	17.214** (8.275)	1.297 (0.796)
Experience	-0.102 (0.305)	0.073 (0.044)
Above Thresholds $\times$ Experience	-4.650** (2.229)	-1.057*** (0.302)
Experience Proxy	Log(Age)	Log(1 + Acct Firm Experience)
Fixed Effects Structure	County, Year	County, Year
Cluster	County	County
Observations	13,797	13,797
$R^2$	0.548	0.416

**Notes:** This table reports the estimates from regressions of *Audit Firm*, an indicator that takes on a value of 1 if an auditor works at an audit firm, and 0 otherwise on *Above Thresholds*, a variable capturing the proportion of firms in a German county that exceed at least two of three regulatory thresholds. Analyses in this table are conducted on the German county level. The sample in this analysis is restricted only to auditors in the *IAB* data. The variable *Experience* is a proxy for auditors' experience. Column 1 uses logged Age as a proxy for experience, while column 2 uses the logged number of (cumulative) years experience in an accounting-related position as an experience proxy. Detailed variable definitions can be found in Table A.2. Both specifications include fixed effects for counties and years. Standard errors, reported in parentheses, are clustered at the county level. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% level, respectively.



# Internet Appendix

(For Online Publication Only)

Audit Mandates, Audit Firms, and Auditors

*by* Matthias Breuer, Anthony Le and Felix Vetter

## Internet Appendix Sections

Section A1: Simulated and Bartik Instruments . . . . .	1
--	---

## Internet Appendix Figures and Tables

Figure A1: A Differentiated Audit Market Model: Social Welfare . . . . .	4
Figure A2: Audit Mandates and Firms' Accounting Quality . . . . .	5
Figure A3: Audit Mandates and Firms' Complexity . . . . .	6
Figure A4: Current Wages, Future Wages, and Audit Firm Size . . . . .	7
Figure A5: Variation of Bartik Instruments . . . . .	8
Table A.1: Regulatory Audit Thresholds . . . . .	9
Table A.2: Variable Definitions . . . . .	13
Table A3: Simulated Instrument and Audit Firms' Outcomes . . . . .	20
Table A4: Simulated Instrument and Audit Market Structure . . . . .	21
Table A5: Bartik Instruments and Auditors' Quantity and Wages . . . . .	22
Table A6: Audit Mandates and Firms' Accounting Quality . . . . .	23
Table A7: Audit Mandates and Countries' Economic Outcomes . . . . .	25
Table A8: Audit Mandates and Citizens' Well-Being . . . . .	26
Table A9: Audit Mandates and Auditors' Log Quantity . . . . .	27
Table A10: Audit Mandates and Auditors' Quantity and Wages with Spillovers . . . . .	28
Table A11: Audit Mandates and Auditors' Wages (Orbis) . . . . .	29
Table A12: Audit Mandates and Auditors' Wages (State FE) . . . . .	30

# A1 Simulated and Bartik Instruments

## A1.1 Bartik Instruments in German County Design

In our German county design, we construct and employ several Bartik (i.e., shift-share) instruments in our robustness tests of our county-level results on auditors (*# of Employees and Wages*).<sup>31</sup> The purpose of the instruments is to purge the treatment variation (i.e., the share of firms subject to audit mandates; *Above Thresholds*) from potentially endogenous sources of variation (e.g., changes in firm sizes). We note that, although we conduct further robustness tests using these Bartik instruments, omitted variable and reverse causality concerns are less pressing in our setting than they are in settings that focus on firms' outcomes (instead of audit firms and auditors' outcomes). Audit firms and auditors are only *indirectly* affected by such mandates (through the mandates' effects on firms' audit demand), and thus their economic activity and size should *not* be expected to endogenously drive the share of firms subject to audit mandates.

Our main treatment variable, *Above Thresholds*, varies at the county-year level. It can be decomposed into the interaction of the share of firms in a given county ( $c$ ) and year ( $t - 1$ ) operating in a given industry ( $k$ ),  $w_{c,k,t-1}$ , and the share of firms in a given county-industry-year exceeding the audit thresholds,  $\frac{1}{N_{c,k}} \sum_{j=1}^{N_{c,k}} \mathbb{1}\{s_{j,c,k,t-1} > \bar{s}_{t-1}\}$ .<sup>32</sup>

$$Above\ Thresholds = x_{c,t-1} = \sum_k \left[ w_{c,k,t-1} \times \frac{1}{N_{c,k}} \sum_{j=1}^{N_{c,k}} \mathbb{1}\{s_{j,c,k,t-1} > \bar{s}_{t-1}\} \right] \quad (49)$$

To construct our Bartik instrument, we make adjustments to either (or both) of the two components of our main treatment variable. Our first instrument, which employs a pre-determined industry firm share, can be expressed as follows:

$$Bartik\ IV\ (Pre - Det\ Share) = \sum_k \left[ w_{c,k,2008} \times \frac{1}{N_{c,k}} \sum_{j=1}^{N_{c,k}} \mathbb{1}\{s_{j,c,k,t-1} > \bar{s}_{t-1}\} \right] \quad (50)$$

This instrument holds the industry firm share weight (i.e.,  $w_{c,k}$ ) fixed at its 2008 level.<sup>33</sup> The resulting reduction in the treatment variation reduces endogeneity concerns relating to endogenous changes in counties' industrial structure over time. The remaining treatment variation only varies over time due to changes in the firm-size distribution and due to changes in the regulatory thresholds, *not* anymore due to changes in counties' industrial structures over time.

To construct our second instrument, we employ a representative firm-size distribution for

<sup>31</sup>We report the results of these robustness tests in Table A5

<sup>32</sup>This decomposition is an identity. It requires no additional assumptions - it simply breaks the treatment variation into further sub-parts on the industry-level

<sup>33</sup>The choice of the year for which to hold the share fixed makes little difference on the findings.

each industry (instead of using county-industry-specific distributions):

$$\text{Bartik IV (Rep. Firm Size Dist.)} = \sum_k \left[ w_{c,k,t-1} \times \frac{1}{N_k} \sum_{j=1}^{N_k} \mathbb{1}\{s_{j,k} > \bar{s}_{t-1}\} \right] \quad (51)$$

This instrument holds the firm-size distribution fixed for each industry across counties and time. To construct the fixed (or standardized) firm-size distributions, we pool all firms across counties and years to create one representative firm-size distribution for each industry,  $k$ . Notably, we still allow for the industry firm-share weight,  $w_{c,k,t-1}$  to vary over time for this instrument. Thus, the remaining treatment variation varies across time due to changes in counties’ industrial structures (i.e. through the industry-firm share weight) and changes in the regulatory thresholds over time. This reduced treatment variation alleviates concerns about confounding influences due to endogenous differences and changes in local firm-size distributions.

Finally, to construct our third instrument, we combine both of the above adjustments:

$$\text{Bartik IV (Combined)} = \sum_k \left[ w_{c,k,2008} \times \frac{1}{N_k} \sum_{j=1}^{N_k} \mathbb{1}\{s_{j,k} > \bar{s}_{t-1}\} \right] \quad (52)$$

This instrument uses both a pre-determined industry firm share and a representative firm-size distribution for each industry. The remaining treatment variation results from changes in the regulatory thresholds over time, and thus represents our “cleanest” treatment variation. Given that there were no major threshold changes in Germany during our sample period, this instrument exhibits very little variation.<sup>34</sup>

We note that, while the use of the above instruments reduces concerns about endogenous treatment variation, it also reduces potentially useful variation helpful for identify the effect of interest. As a result, the reduced treatment variation can possibly hurt test power (Goldsmith-Pinkham et al., 2020; Borusyak and Hull, 2021). We plot the variation for our main treatment variable, *Above Thresholds*, as well as the three Bartik instruments in Figure A5.

---

<sup>34</sup>The treatment variation in our European sample is much richer and exhibits greater variation across countries and years

## A1.2 Simulated Instrument in European Design

We also construct a Bartik-like simulated instrument for our European sample (Currie and Gruber, 1996; Goldsmith-Pinkham et al., 2020). The simulated instrument is constructed similarly to the Bartik instrument mentioned in the above section that uses a representative firm-size distribution. We first decompose our treatment variation into the interaction of the share of firms operating in a given country ( $c$ ), industry ( $k$ ), and year ( $t - 1$ ),  $w_{c,k,t-1}$ , and the share of firms exceeding a given country's audit thresholds in a given country, industry, and year,  $\frac{1}{N_{c,k}} \sum_{j=1}^{N_{c,k}} \mathbb{1}\{s_{j,c,k,t-1} > \bar{s}_{t-1}\}$ :

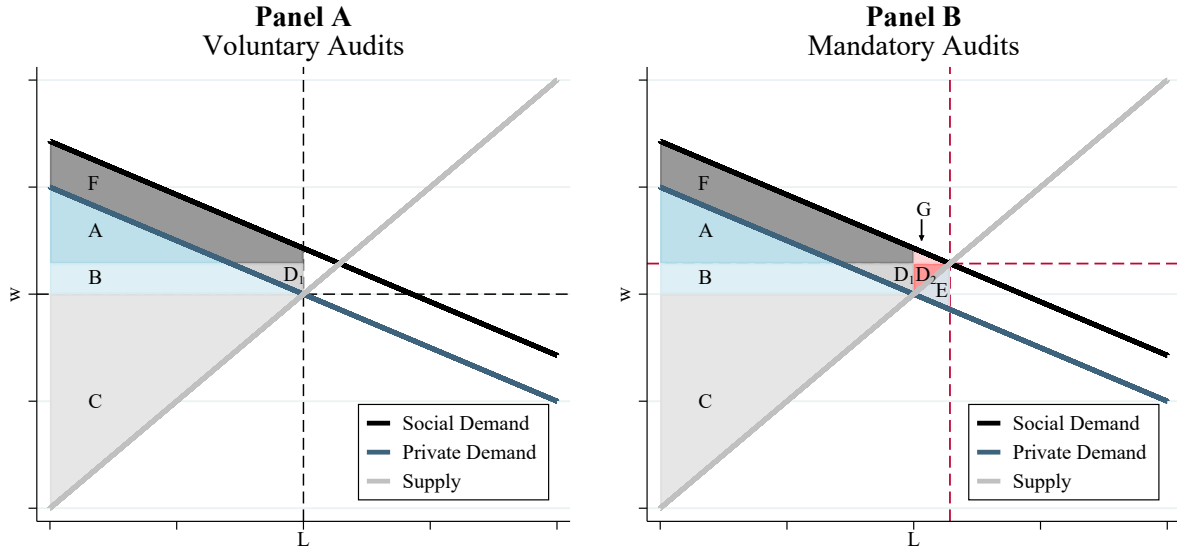
$$\textit{Above Thresholds} = x_{c,t-1} = \sum_k \left[ w_{c,k,t-1} \times \frac{1}{N_{c,k}} \sum_{j=1}^{N_{c,k}} \mathbb{1}\{s_{j,c,k,t-1} > \bar{s}_{t-1}\} \right] \quad (53)$$

To construct our simulated instrument, we pool all observations across all countries and years to create a representative firm-size distribution for each industry,  $k$ :

$$\textit{Standardized Scope} = \sum_k \left[ w_{c,k,t-1} \times \frac{1}{N_k} \sum_{j=1}^{N_k} \mathbb{1}\{s_{j,k} > \bar{s}_{t-1}\} \right] \quad (54)$$

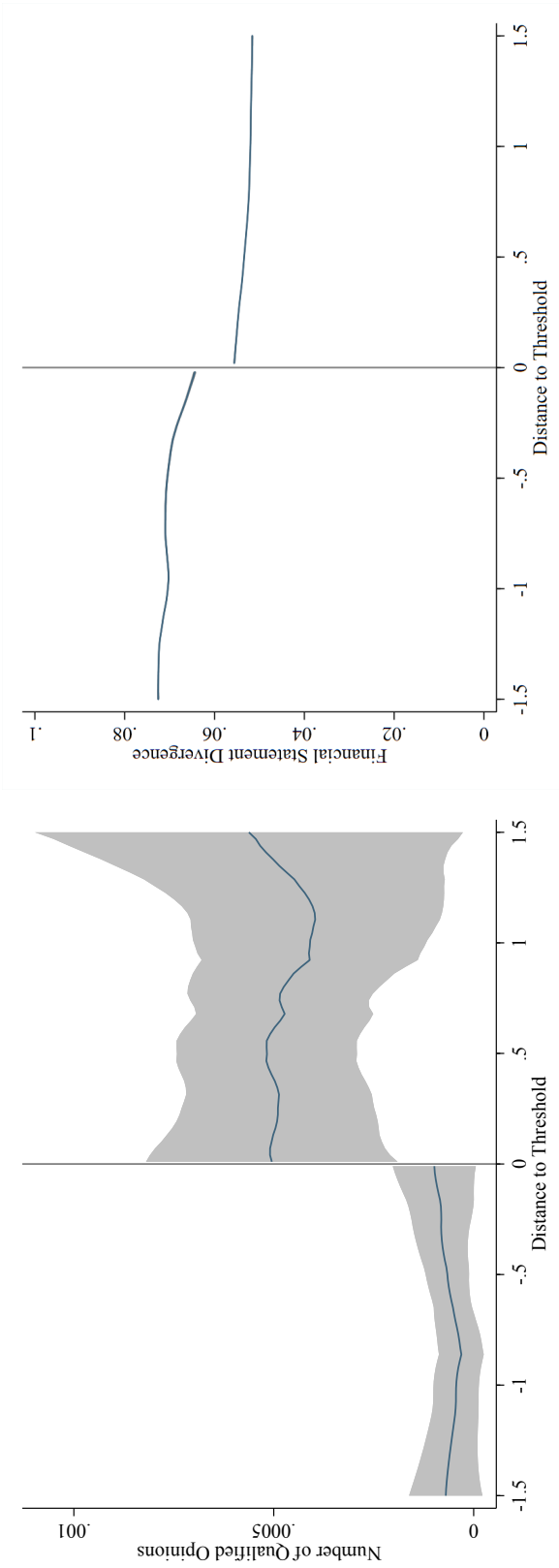
This instrument is constructed in the exact same way as the representative firm-size distributions for the German county design in Section A1.1. The key difference in this design is that observations are pooled across European *countries*, rather than across German *counties*.

Figure A1: A Differentiated Audit Market Model: Social Welfare



**Notes:** This figure shows the welfare (or surplus) implications resulting from our model of the audit market (Section 3). It extends our prior analysis (Figure 2) by including social demand for audits. In this extension, we assume that social and private demand for (or value of) audits are correlated, but differ in terms of levels. Firms do not internalize all benefits of the audit. Hence, the social demand curve exceeds the private demand curve. The social demand curve is shown in black. In Panel A, absent an audit mandate, firms' private choice provides society with surplus represented by regions  $F$  and  $D_1$ . In Panel B, given the audit mandate, the social surplus grows by area  $G$ , but, at the same time, shrinks by area  $D_1$ . Area  $D_1$  is transferred to auditors. In addition, auditors gain area  $D_2$ . Notably, total surplus (i.e., the sum of firm, social, and auditor surplus) remains unchanged compared to the voluntary equilibrium. This occurs because, while the mandate adds areas  $G$  and  $D_2$ , it also leads to a loss of  $E$  (borne by firms). In this stylized example (where private and social demand are perfectly correlated), those areas offset each other perfectly. Hence, the mandate still primarily leads to a transfer of surplus from firms to auditors. Accordingly, for audit mandates to add to total welfare, we would need that firms' private demand is little correlated (or even negatively correlated) with social demand. This condition appears unlikely to be met in the case of financial audits, given that larger, more complex firms, that are of public interest, tend to have pronounced incentives to obtain audits. The condition may be met in the case of environmental or ESG related audits. In those cases, however, we would still expect that an audit mandate primarily yields demand for low-quality audits, rather than assures the desired compliance. Accordingly, alternative compliance mechanism may be called for to make firms internalize the social costs and benefits of their actions (e.g., Cicala et al., 2022).

**Figure A2: Audit Mandates and Firms' Accounting Quality**

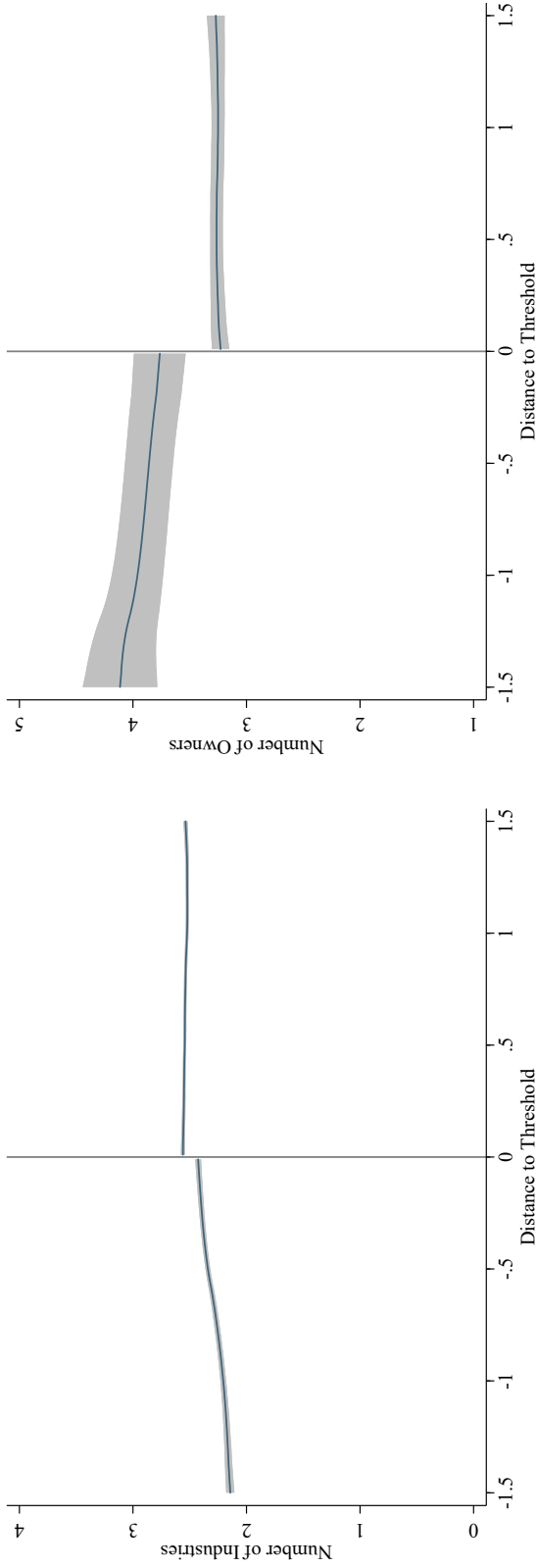


**Panel A: Number of Qualified Opinions**

**Panel B: Financial Statement Divergence Score**

**Notes:** This figure shows local averages of accounting quality measures around the audit thresholds for German firms with non-missing size data. Panel A plots the share of qualified audit opinions as a function of the distance to the audit thresholds. More qualified audit opinions are indicative of more audit effort and, thus, potentially higher accounting quality due to auditing. Panel B plots the average divergence of financial statement numbers from Benford's Law as a function of the distance to the audit thresholds. The divergence score is calculated as the mean absolute deviation of the distribution of firms' financial statement numbers from Benford's theoretical distribution. A higher divergence score is indicative of lower accounting quality. In both panels, the distance to the threshold, plotted on the  $x$ -axis, represents an approximation of firms' propensity to be subject to audit mandates. Following Breuer et al. (2018), our approximation uses the second-highest size dimension (relative to the respective regulatory threshold), because this second dimension determines whether a firm is likely to be subject to audit mandates given the multivariate (two-out-of-three thresholds) assignment rule. The figure plots local averages, obtained via kernel-weighted local polynomial regressions, separately for firms above and below the relevant threshold. The grey area represents 95% confidence intervals.

**Figure A3: Audit Mandates and Firms' Internal Complexity**



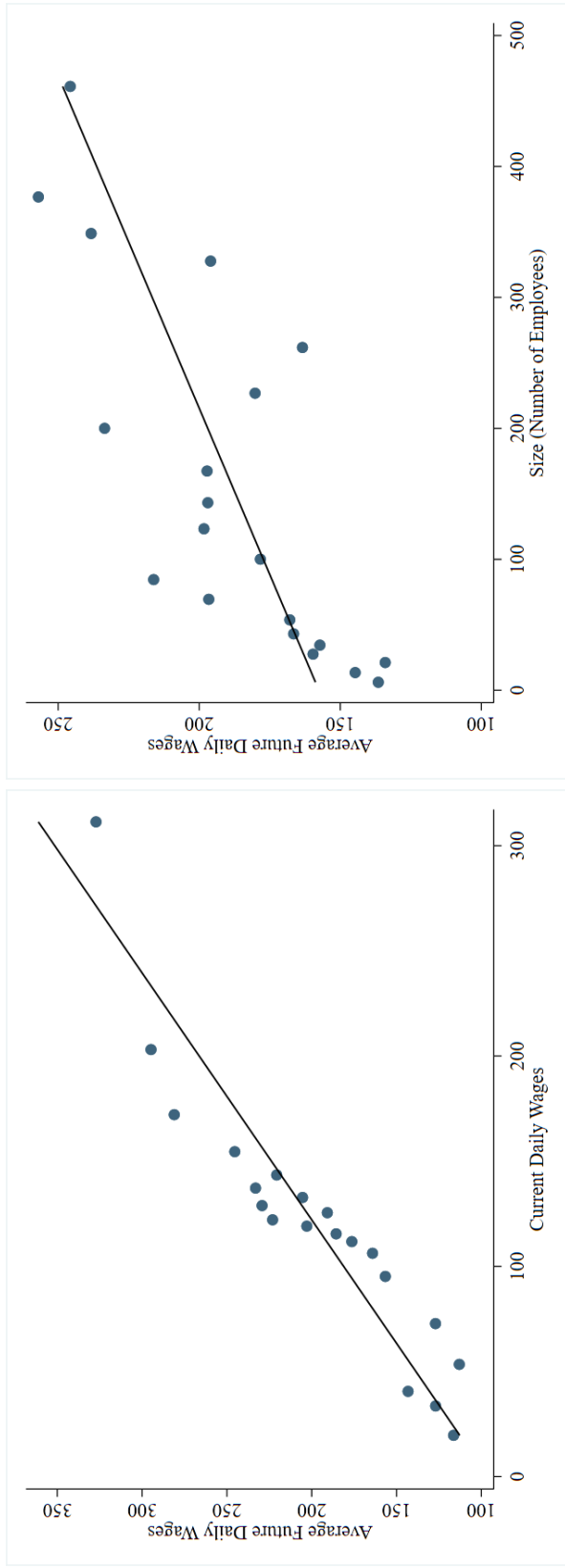
**Panel A: Number of Industries**

**Panel B: Number of Owners**

**Notes:** This figure shows local averages of internal and external complexity measures around the audit thresholds for audited German firms with non-missing size data. Panel A plots the average number of industries a firm operates in as a function of the distance to the audit thresholds. The number of industries captures the internal complexity of firms' operations and structures. Panel B plots the average number of owners as a function of the distance to the audit thresholds. The number of owners captures the external complexity of firms (e.g., the extent of agency costs and demand for audited financial reporting). In both panels, the distance to the threshold, plotted on the  $x$ -axis, represents an approximation of firms' propensity to be subject to audit mandates. Following [Breuer et al. \(2018\)](#), our approximation uses the second-highest size dimension (relative to the respective regulatory threshold), because this second dimension determines whether a firm is likely to be subject to audit mandates given the multivariate (two-out-of-three thresholds) assignment rule. The figure plots local averages, obtained via kernel-weighted local polynomial regressions, separately for firms above and below the relevant threshold. The grey area represents 95% confidence intervals.

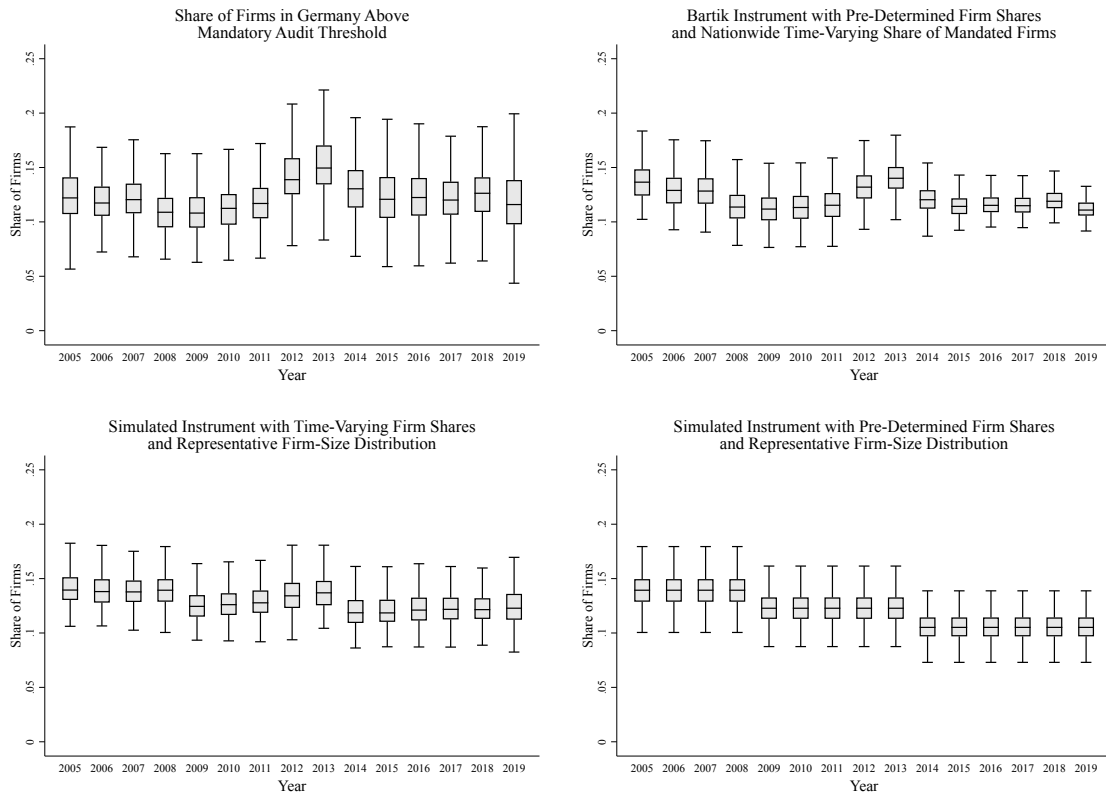


**Figure A4: Current Wages, Future Wages, and Audit Firm Size**



**Notes:** This figure shows binned scatterplots of auditors' current and future wages and their sorting across audit firms of different sizes. Panel A plots the average (future) wages received by auditors after leaving their audit firms for another employer against the auditors' current wages at the audit firm. Panel B plots the average future wages (as proxies of auditors' outside options) against the size of the audit firms that they currently work for.

## Figure A5: Variation of Bartik Instruments



**Notes:** This figure plots the degree of treatment variation for our main treatment variable in the German county design, *Above Thresholds*, and the three Bartik instruments we construct. We provide a box plot for each year. The line in the middle of the boxes represents the median, while the top and bottom edge of the box represent the 75th and 25th percentile of the variable. We exclude outside values from these plots. Each box and its associated whiskers represent the cross-sectional variation in treatment variation across counties in Germany.

**TABLE A.1**  
REGULATORY AUDIT THRESHOLDS

Country	Period	Currency	Total Assets	Sales	Employees
Austria	2000 - 2004	EUR	3,125,000	6,250,000	50
	2005 - 2007	EUR	3,650,000	-	50
	2008 - 2015	EUR	4,840,000	9,680,000	50
	2016 - 2019	EUR	5,000,000	10,000,000	50
Belgium	2000 - 2004	EUR	3,125,000	6,250,000	50
	2005 - 2015	EUR	3,650,000	7,300,000	50
	2016 - 2019	EUR	4,500,000	9,000,000	50
Bulgaria	2000 - 2001	BGN	300,000	600,000	30
	2002 - 2004	BGN	500,000	1,000,000	30
	2005 - 2006	BGN	1,000,000	2,000,000	50
	2007 - 2015	BGN	1,500,000	2,500,000	50
	2016 - 2019	BGN	2,000,000	4,000,000	50
Czech Republic	2000 - 2001	CZK	20,000,000	40,000,000	
	2002 - 2019	CZK	40,000,000	80,000,000	50
Denmark	2000 - 2005	DKK	0	0	0
	2006 - 2010	DKK	1,500,000	3,000,000	12
	2011- 2016	DKK	4,000,000	8,000,000	12
	2017 - 2019	DKK	6,000,000	12,000,000	50
Estonia	2000 - 2002	EEK	-	1,000,000	-
	2003 - 2004	EEK	3,000,000	6,000,000	5
	2005 - 2009	EEK	5,000,000	10,000,000	10
	2010 - 2015	EUR	1,000,000	2,000,000	30
	2016 - 2019	EUR	2,000,000	4,000,000	60
Finland	2000 - 2007	EUR	0	0	0
	2008 - 2019	EUR	100,000	200,000	3

France	2000 - 2001	FRF	10,000,000	20,000,000	50
	2002 - 2016	EUR	1,550,000	3,100,000	50
	2017 - 2019	EUR	4,000,000	8,000,000	50
Germany	2000 - 2001	DEM	6,720,000	13,440,000	50
	2002 - 2003	EUR	3,438,000	6,875,000	50
	2004 - 2007	EUR	4,015,000	8,030,000	50
	2008 - 2013	EUR	4,840,000	9,680,000	50
	2014 - 2019	EUR	6,000,000	12,000,000	50
Greece	2000 - 2001	GRD	500,000,000	1,000,000,000	50
	2002 - 2007	EUR	1,500,000	3,000,000	50
	2008 - 2015	EUR	2,500,000	5,000,000	50
	2016 - 2019	EUR	4,000,000	8,000,000	50
Ireland	2000 - 2004	IEP	1,500,000	250,000	50
	2005 - 2006	EUR	1,904,607	1,500,000	50
	2007 - 2012	EUR	3,650,000	7300000	50
	2013 - 2016	EUR	4,400,000	8,800,000	50
	2017 - 2019	EUR	6,000,000	12,000,000	50
Italy	2000 - 2001	ITL	4,700,000,000	9,500,000,000	50
	2002 - 2006	EUR	3,125,000	6,250,000	50
	2007 - 2009	EUR	3,650,000	7,300,000	50
	2010 - 2016	EUR	4,400,000	8,800,000	50
	2017 - 2019	EUR	4,000,000	4,000,000	50
Lithuania	2000 - 2003	LTL	0	0	0
	2004 - 2007	LTL	5,000,000	10,000,000	50
	2008 - 2014	EUR	6,000,000	12,000,000	50
	2015 - 2019	EUR	1,800,000	3,500,000	50
Luxembourg	2000 - 2010	EUR	3,125,000	6,250,000	50
	2011 - 2019	EUR	4,400,000	8,800,000	50

Netherlands	2000 - 2001	NLG	7,500,000	15,000,000	50
	2002 - 2003	EUR	3,500,000	7,000,000	50
	2004 - 2005	EUR	3,650,000	7,300,000	50
	2006 - 2015	EUR	4,400,000	8,800,000	50
	2016 - 2019	EUR	6,000,000	12,000,000	50
Norway	2000 - 2010	NOK	0	0	0
	2011 - 2019	NOK	20,000,000	-	10
Poland	2000 - 2019	EUR	2,500,000	5,000,000	50
Portugal	2000 - 2001	PTE	140,000,000	280,000,000	50
	2002 - 2019	EUR	1,500,000	3,000,000	50
Romania	2000 - 2004	EUR	0	0	0
	2005 - 2016	EUR	3650000	7300000	50
	2017 - 2019	EUR	3,500,000	7,000,000	50
Slovakia	2000 - 2008	SKK	20,000,000	40,000,000	20
	2009 - 2016	EUR	1,000,000	2,000,000	30
	2017 - 2019	EUR	2,000,000	4,000,000	30
Slovenia	2000 - 2001	SIT			
	2002 - 2004	SIT	500,000,000	1,000,000,000	50
	2005	EUR	850,000,000	1,700,000,000	50
	2006 - 2008	EUR	3,650,000	7,300,000	50
	2009 - 2015	EUR	4,400,000	8,800,000	50
	2016 - 2019	EUR	4,000,000	8,000,000	50
Spain	2000 - 2007	ESP	395,000,000	790,000,000	50
	2008 - 2019	EUR	2,850,000	5,700,000	50
Sweden	2000 - 2010	SEK	0	0	0
	2011 - 2019	SEK	1,500,000	3,000,000	3

	2000 - 2003	GBP	1,400,000	1,000,000	50
United Kingdom	2004 - 2007	GBP	2,800,000	5,600,000	50
	2008 - 2015	GBP	3,260,000	6,500,000	50
	2016 - 2019	GBP	5,100,000	10,200,000	50

---

**Notes:** This table lists the regulatory audit thresholds in each of the 24 European countries in our sample. It also lists the time period for which the exact threshold values were active, as well as the exact values for the total assets, total sales and employee count thresholds. Additionally, the table reports the currency in which the threshold is reported.

**TABLE A.2**  
**VARIABLE DEFINITIONS**

Variable	Setting	Aggregation Level	Variable Source	Definition
Audit	Germany	Firm	BvD Orbis	An indicator that takes on a value of 1 if a firm purchases an audit, and 0 otherwise.
Audit	Germany, Europe	County, Country	BvD Orbis	The share of firms that obtain and audit in that county/country.
Above Thresholds	Germany	Firm	BvD Orbis	An indicator that takes on a value of 1 if the firm exceeds at least two of the tree regulatory audit thresholds in that year (i.e. total assets, total sales, employee count as reported for Germany in Appendix Table A1)
Above Thresholds	Germany, Europe	County, Country	BvD Orbis	The share of firms within that county (country) exceeding at least two of three regulatory audit thresholds in that year (i.e. total assets, total sales, employee count as reported in Appendix Table A1)
Peers Above Thresholds	Germany	County	BvD Orbis	A weighted spillover measure capturing the scope of audit mandates for counties surrounding the focal county. Each surrounding county's audit scope (i.e. <i>Above Thresholds</i> ) is weighed by its distance from the focal county, as well as the ratio of its employment to total employment.
No. of Clients	Europe	Audit Firm	BvD Orbis	The total number of audit engagements the auditor has in their portfolio in that year.
Client Size	Europe	Audit Firm	BvD Orbis	The average size (i.e. total assets) across all firms within the audit firm's portfolio in that year.

Total Assets	Europe	Audit Firm, Country	BvD Orbis	Audit firms' (aggregate/average) total assets in that fiscal year, as reported on their balance sheet.
Fixed Assets	Europe	Audit Firm	BvD Orbis	The total fixed assets in that fiscal year, as reported on the firm's balance sheet. Fixed assets include long-term assets such as Property, Plant & Equipment, intangible assets, etc.
No. of Employees	Europe	Audit Firm, Country	BvD Orbis	Audit firms' (aggregate/average) number of employees in that fiscal year.
Cost of Employees	Europe	Audit Firm	BvD Orbis	The total labor expenses in that fiscal year, as reported on the firm's income statement.
# of Employees	Germany	Occupation-Industry- County	LIAB	The total number of employees in that county, within that occupation and within that industry in the given year.
Log(Wage)	Germany	Occupation-Industry- County	LIAB	The average daily (real) wage of employees across all employees in that county, within that occupation and within that industry in the given year.
Audit Ind	Germany	Employee	LIAB	An indicator that takes on a value of 1 if the employee belongs to the audit industry, which is identified via the 5-digit WZ08 code. In our main analysis, we identify the audit industry by using the industry code 69201 (Activities of qualified auditors, auditing firms).
Audit Occ	Germany	Employee	LIAB	An indicator that takes on a value of 1 if the employee belongs to the audit occupation, which is identified via the first four digits of the 5-digit KldB occupation codes. In our main analysis, we identify auditors using KldB codes 7224 (Occupations in auditing) and 7229 (Managers in accounting, controlling & auditing).



No. of Audit Firms	Europe	Country	BvD Orbis	The total number of audit firms in that country.
Log(HHI)	Europe	Country	BvD Orbis	The logged value of the Herfindahl-Hirschman Index (HHI). The HHI is the sum of the squared market shares of each audit firm within that country in that year.
Audit Firm	Germany	Employee	LIAB	An indicator that takes on a value of one if the employee works at an audit firm and zero otherwise.
Age	Germany	Employee	LIAB	The age of the employee.
Acct Firm Experience	Germany	Employee	LIAB	The cumulative number of years the employee had worked in an accounting firm.
Share of Firms Audited by Big 4 Audit Firm	Germany	Firm	BvD Orbis	The share of firms that are audited by KPMG, Deloitte, Ernst & Young, or PwC.)
Distance to Threshold	Germany	Firm	BvD Orbis	The distance between a firm's size and the second closest regulatory threshold. It is calculated as the second order statistic of the a firm's (logged) total assets relative to the total assets threshold, (logged) sales relative to the sales threshold, and the (logged) number of employees relative to the number of employee threshold.
Relative Total Assets	Germany	Firm	BvD Orbis	The logged ratio of the firm's total assets to the relevant regulatory threshold in that year: $\text{Log}(\text{Total Assets}/\text{Total Asset Threshold Value})$
Relative Sales	Germany	Firm	BvD Orbis	The logged ratio of the firm's total sales to the relevant regulatory threshold in that year: $\text{Log}(\text{Total Sales}/\text{Total Sales Threshold Value})$

Relative Employees	Germany	Firm	BvD Orbis	The logged ratio of the firm's total employees to the relevant regulatory threshold in that year: $\text{Log}(\text{Total Employees}/\text{Total Employees Threshold Value})$
Standardized Audit Scope	Europe	Country	BvD Orbis	The proportion of firms exceeding the regulatory audit thresholds using a representative firm-size distribution by industry. The industry-firm size distribution is created by pooling all firms in that industry across countries and years. A weighted average of the standardized scope is then created on the country-level by accounting for all industries within that country.
Standardized Disclosure Scope	Europe	Country	BvD Orbis	The proportion of firms exceeding the regulatory disclosure thresholds using a representative firm-size distribution by industry. The industry-firm size distribution is created by pooling all firms in that industry across countries and years. A weighted average of the standardized scope is then created on the country-level by accounting for all industries within that country.
Bartik IV (Pre-Determined Firm Share)	Germany	County	BvD Orbis	An instrumental variable capturing the proportion of firms above the regulatory audit thresholds, which reduces treatment variation by holding the industry's firm-share fixed at 2008 levels.
Bartik IV (Representative Firm-Size Distribution)	Germany	County	BvD Orbis	An instrumental variable capturing the proportion of firms above the regulatory audit thresholds, which reduces treatment variation by employing a representative firm-size distribution across German countries and years.

Bartik IV (Representative Firm-Size Distribution and Pre- Determined Firm Share)	Germany	County	BvD Orbis	An instrumental variable capturing the proportion of firms above the regulatory audit thresholds, which reduces treatment variation by employing both a representative firm-size distribution across German counties and years, as well as holding the industry's firm-share fixed at 2008 levels.
No. Restatements	Germany	County	Bundesanzeiger	The total number of firms with restatements in that county in that year.
No. Qualified (Audit) Opinions	Germany	Firm, County	Bundesanzeiger	An indicator for a qualified audit opinion at the firm level. County-level variables capture the total number of firms that received a qualified audit opinion in a given county and year.
No. Error Announcements	Germany	County	Bundesanzeiger	The total number of firms that issued an error announcement on their financial statements in that county in that year.
Financial Statement Divergence	Germany, Europe	Firm, County, Country	BvD Orbis	The Financial Statement Divergence (FSD) score is calculated as the mean absolute deviation of the distribution of firms' financial statement (i.e., balance sheet and income statement items) numbers from Benford's theoretical distribution. A higher divergence score is indicative of lower accounting quality (Amiram et al., 2015). County/country-level values are average scores for all of the firms in a given county/country and year.
Net Assets	Europe	Country	BvD Orbis	The average net assets (i.e., Total Assets - Total Liabilities) of companies undergoing bankruptcy within that country during that year. Firms are categorized as "bankrupt" if Orbis labels their status as follows: "In liquidation," "Dissolved," "Bankruptcy," "Dissolved (bankruptcy)," "Dissolved (liquidation)".

Corr. Accruals to CFO	Europe	Country	BvD Orbis	The Spearman correlation between the change in total accruals and the change in cash flow from operations multiplied by $-1$ , as defined by <a href="#">Leuz et al. (2003)</a> and <a href="#">Burgstahler et al. (2006)</a>
Ratio Std. Dev	Europe	Country	BvD Orbis	The ratio of the standard deviations of operating income and cash flow from operations, multiplied by $-1$ , as defined by <a href="#">Leuz et al. (2003)</a> and <a href="#">Burgstahler et al. (2006)</a>
Small Profit to Loss Ratio	Europe	Country	BvD Orbis	The ratio of the number of small profits divided by the number of small losses, as defined by <a href="#">Leuz et al. (2003)</a> and <a href="#">Burgstahler et al. (2006)</a> . A firm is categorized as having a “small profit/loss” if that profit/loss falls within one percent of their lagged total assets.
Total Accruals	Europe	Country	BvD Orbis	The median ratio within a country of the magnitude of total accruals of a firm divided by the magnitude of the cash flow from operations. Total accruals are calculated as follows: $(\Delta \text{total current assets} - \Delta \text{cash}) - (\Delta \text{total current liabilities} - \Delta \text{short-term debt}) - \text{depreciation expense}$ . Cash flow from operations is equal to operating income minus total accruals.
EM Score	Europe	Country	BvD Orbis	The first principal component of a PCA consisting of Corr. Accruals to CFO, Ratio Std. Dev, Small Profit to Loss Ratio, and Total Accruals Magnitude.
Leverage	Europe	Country	BvD Orbis	The logarithm of Total Liabilities/Total Assets.
Productivity	Europe	Country	BvD Orbis	The aggregate total factor productivity within a country and year, which is defined as $\log \text{sales} - (0.3 * \log \text{tangible assets} + 0.7 * \log \text{employees})$ .

Value Added	Europe	Country	EU KLEMS	The logarithm of value-added, which is computed using the current prices.
Taxes	Europe	Country	Eurostat	The logarithm of the total amount of corporate taxes collected within a country.
Human Development Index	Europe	Country	UNDP	An index measuring the aggregate well-being of individuals in a certain country and year. The index takes into account the life expectancy, education, and per-capita income of citizens.
Happiness Score	Europe	Country	WVS/EVS	A proxy measuring the happiness of the individual. This question is surveyed via the World Values Survey (WVS) and the European Values Survey (EVS). The exact question surveyed is: "Taking all things together, would you say you are (read out and code one answer): 1 Very happy; 2 Rather happy; 3 Not very happy; 4 Not at all happy"
Health Score	Europe	Country	WVS/EVS	A proxy measuring the happiness of the individual. This question is surveyed via the World Values Survey (WVS) and the European Values Survey (EVS). The exact question surveyed is: "All in all, how would you describe your state of health these days? Would you say it is... (read out): 1 Very good; 2 Good; 3 Fair; 4 Poor; 5 Very poor"
Avg. Wage of Employees	Europe	Audit Firm	BvD Orbis	Employee Cost/Number of Employees
Number of Owners	Germany	Firm	BvD Orbis	The number of owners recorded for a firm.
Number of Industries	Germany	Firm	BvD Orbis	The number of primary and secondary 4-digit NAICS industries the firm operates in.

**Notes:** This table lists variables used in the paper, and their detailed definitions. Note that several variables have the same name, but differ either because of the setting (i.e. German or European), or because of the level of aggregation (country-level, firm-level, audit-firm level, employee-level, etc.).

**Table A3: Simulated Instrument and Audit Firm' Client Portfolio and Inputs**

	Log(No. Clients) (1)	Log(Client Size) (2)	Log(Total Assets) (3)	Log(Fixed Assets) (4)	Log(No. of Employees) (5)	Log(Cost of Employees) (6)
Standardized Audit Scope	0.167*** (0.027)	-0.668*** (0.020)	0.425*** (0.088)	0.811*** (0.153)	0.288*** (0.099)	0.239*** (0.065)
Fixed Effects Structure	Audit Firm, Year	Audit Firm, Year	Audit Firm, Year	Audit Firm, Year	Audit Firm, Year	Audit Firm, Year
Cluster	Audit Firm	Audit Firm	Audit Firm	Audit Firm	Audit Firm	Audit Firm
Observations	1,239,884	1,230,470	8,389	7,732	5,595	6,582
R <sup>2</sup>	0.847	0.862	0.897	0.857	0.954	0.946

**Notes:** This table reports the estimates from regressions of audit firms' outcomes on *Standardized Scope*, a variable capturing the scope of audit mandates within a country, but using a standardized firm-size distribution by industry (i.e. a firm-size distribution in which all firms in that industry across all the countries and years are pooled). This table repeats the analysis in Table 3 and Table 4, using the standardized scope rather than the raw treatment variation. The outcome in column 1 is the logged number of clients the audit firm has in their portfolio. The outcome in column 2 is the average size of the clients in the audit firms' portfolio, computed as the average total assets of the client firms. The outcome in column 3 is that audit firms' total assets. The outcome in column 4 is the average size of the clients in the audit firms' portfolio, computed as the average total assets of the client firms. The outcome in column 5 is the logged total labor costs of the audit firm. All specifications include fixed effects for audit firms and years. Standard errors, reported in parentheses, are clustered at the audit-firm level for all specifications. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% level, respectively.

**Table A4: Simulated Instrument and Audit Market Structure**

	Log(No. of Audit Firms) (1)	Log(HHI) (2)
Standardized Audit Scope	0.911*** (0.239)	-0.908** (0.433)
Fixed Effects Structure	Country Year	Country Year
Cluster	Country	Country
Observations	337	335
$R^2$	0.854	0.676

**Notes:** This table reports the estimates from regressions of measures of the audit market’s structure on *Standardized Scope*, a variable capturing the scope of audit mandates within a country, but using a standardized firm-size distribution by industry (i.e. a firm-size distribution in which all firms in that industry across all the countries and years are pooled). This table repeats the analysis in Table IX, using the standardized scope rather than the raw treatment variation. The outcome in column 1 is the logged total number of audit firms within a country. The outcome in column 2 is the logged Herfindahl–Hirschman Index (HHI). All specifications include fixed effects for countries and years. Standard errors, reported in parentheses, are clustered at the audit-firm level for all specifications. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% level, respectively.

## Table A5: Bartik Instruments and Auditors' Quantity and Wages

**Panel A:** Bartik Instruments and Auditors' Quantity

	# of Employees (1)	# of Employees (2)	# of Employees (3)
Audit Occ × Audit Ind × Above Thresholds	283.084 (398.850)	530.327* (291.874)	301.104 (392.895)
Bartik IV	Pre-Determined Firm Share	Representative Firm-Size Distribution	Pre-Determined Firm Share & Representative Firm-Size Distribution
Main Effects & Two-Way Interactions Fixed Effects Structure	Yes Occ × County × Year, Ind × County × Year, Occ × Ind × Year	Yes Occ × County × Year, Ind × County × Year, Occ × Ind × Year	Yes Occ × County × Year, Ind × County × Year, Occ × Ind × Year
Cluster	County	County	County
Observations	1,352,301	1,364,022	1,344,577

**Panel B:** Bartik Instruments and Auditors' Wages

	Log(Wages) (1)	Log(Wages) (2)	Log(Wages) (3)
Audit Occ × Audit Ind × Above Thresholds	-5.875 (4.135)	-8.843*** (3.336)	-7.849* (4.527)
Bartik IV	Pre-Determined Firm Share	Representative Firm-Size Distribution	Pre-Determined Firm Share & Representative Firm-Size Distribution
Main Effects & Two-Way Interactions Fixed Effects Structure	Yes Occ × County × Year, Ind × County × Year, Occ × Ind × Year	Yes Occ × County × Year, Ind × County × Year, Occ × Ind × Year	Yes Occ × County × Year, Ind × County × Year, Occ × Ind × Year
Cluster	County	County	County
Observations	1,346,333	1,357,977	1,338,625

**Notes:** This table reports the estimates from regressions of the logged wages of employees within a German county on *Above Thresholds*, a variable capturing the proportion of firms in a county that exceed at least two of three regulatory thresholds. Panel A repeats the analysis from Table V, but instruments for the raw treatment variation (*Above Thresholds*) using several Bartik IV's, while Panel B repeats the analysis from Table VI. Analyses in this table are conducted on the occupation-industry-county level. In this table, only the incremental effect on auditors at audit firms is reported for parsimony, although all main effects and two-way interactions (as reported in Table V and Table VI are also included in the regression). The interaction between *Audit Occ*, *Audit Ind* and *Above Thresholds* captures the incremental effect of audit mandates on auditors working in audit firms. Column 1 uses a Bartik IV that uses a pre-determined industry firm share. Column 2 uses a Bartik IV that employs a representative firm-size distribution by industry (i.e. firm-size distribution for that industry across counties and years are pooled together). Column 3 uses a Bartik IV that combines the elements from both columns 1 (i.e. pre-determined firm-share) and 2 (i.e. representative firm-size distribution). Columns 1 to 3 include fixed effects for industries × occupations × years, counties × occupations × years, and counties × industries × years. Standard errors, reported in parentheses, are clustered at the county level for all specifications. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% level, respectively.



**Table A6: Audit Mandates and Firms' Accounting Quality**

Panel A: Impact on Accounting Quality (German County-Level)					
	No. Restatements (1)	No. Qualified Audit Opinions (2)	No. Error Announcements (3)	Financial Statement Divergence (4)	Net Assets (5)
Above Thresholds	-0.245 (0.236)	1.164 (0.780)	-0.023 (0.281)	-0.017*** (0.004)	8.645 (12.348)
Fixed Effects Structure	County, Year	County, Year	County, Year	County, Year	County, Year
Cluster	County	County	County	County	County
Observations	5,548	5,548	5,548	5,548	5,541
R <sup>2</sup>	0.168	0.222	0.364	0.835	0.077

Panel B: Impact on Accounting Quality (Bartik IV - German County Level)					
	No. Restatements (1)	No. Qualified Audit Opinions (2)	No. Error Announcements (3)	Financial Statement Divergence (4)	Net Assets (5)
Bartik IV (Representative Firm-Size Distribution)	-1.072* (0.676)	3.797* (2.255)	-0.912 (0.763)	-0.010 (0.008)	16.433 (34.375)
Fixed Effects Structure	County, Year	County, Year	County, Year	County, Year	County, Year
Cluster	County	County	County	County	County
Observations	5,533	5,533	5,533	5,533	5,526
R <sup>2</sup>	0.170	0.222	0.367	0.832	0.076

**Panel C: Impact on Accounting Quality (Country-Level)**

	Financial Statement Divergence (1)	Corr. Accruals to CFO (2)	Ratio Std. Dev (3)	Small Profit to Loss Ratio (4)	Total Accruals (5)	EM Score (6)	Net Assets (7)
Standardized Audit Scope	-0.011 (0.014)	-0.052 (0.058)	-0.051 (0.083)	-0.470 (0.548)	-0.005 (0.025)	-0.378 (0.248)	7.301 (13.491)
Standardized Disclosure Scope	-0.009 (0.011)	-0.091 (0.104)	-0.022 (0.040)	0.278 (0.631)	0.024 (0.020)	-0.280 (0.407)	8.162 (14.709)
Fixed Effects Structure	Country, Year	Country, Year	Country, Year	Country, Year	Country, Year	Country, Year	Country, Year
Cluster	Country	Country	Country	Country	Country	Country	Country
Observations	456	418	443	456	447	418	454
R <sup>2</sup>	0.602	0.603	0.860	0.352	0.552	0.882	0.681

**Notes:** This table reports the estimates from regressions of measures of accounting quality on measures of the extent of audit mandates. Following the literature, we use various measures of accounting quality, including measures based on official restatements and warnings in Germany's official register (e.g., the number of restatements, the number of qualified audit opinions, the number of error announcements, available in the German sample), measures based on properties of the reported numbers (e.g., congruence with Benford's law, correlation between accounting accruals and cash flow, the relative standard deviations of accruals and cash flow, the ratio of small profits to small losses, and the relative magnitude of accruals to cash flow), and measures capturing the protection of creditors (e.g., the net assets at bankruptcy). Detailed variable definitions are reported in Table A.2. Panel A reports estimates of the impact of audit mandates on accounting quality in the German country-level design. This design uses *Above Thresholds* as the treatment, a variable capturing the proportion of firms in a country that exceed at least two of three regulatory audit thresholds. All columns include country and year fixed effects. Panel B reports instrumental variable estimates of the impact of audit mandates on accounting in the German country-level design. This design uses *Bartik IV (Representative Firm-Size Distribution)* as a treatment, an instrumental variable capturing the proportion of firms above the regulatory audit thresholds. This instrumental variable focuses on a subset of the treatment variation by employing a representative firm-size distribution across German counties and years when calculating the share of firms above audit thresholds. All columns include county and year fixed effects. Panel C reports estimates of the impact of audit mandates on accounting quality in the European country-level design. This setting uses *Standardized Audit Scope* as a treatment, an instrumental variable capturing the proportion of firms above the regulatory audit thresholds. This instrumental variable focuses on a subset of the treatment variation by employing a representative firm-size distribution across countries and years when calculating the share of firms above audit thresholds. The European country-level design uses *Standardized Disclosure Scope* to control for partially overlapping disclosure mandates. All specifications include fixed effects for counties and years in Panels A and B, and for countries and years in Panel C. Standard errors, reported in parentheses, are clustered at the county level in Panels A and B, and at the country level in Panel C. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% level, respectively.

**Table A7: Audit Mandates and Countries' Economic Outcomes**

	Leverage (1)	Productivity (2)	Value Added (3)	Taxes (4)
Standardized Audit Scope	-0.048 (0.043)	0.004 (0.078)	-0.153 (0.156)	0.149 (0.117)
Standardized Disclosure Scope	-0.013 (0.030)	0.031 (0.080)	-0.243 (0.173)	-0.048 (0.075)
Fixed Effects Structure	Country, Year	Country, Year	Country, Year	Country, Year
Cluster	Country	Country	Country	Country
Observations	456	456	437	418
$R^2$	0.882	0.746	0.994	0.989

**Notes:** This table reports the estimates from regressions of broad, country-level economic outcomes on *Standardized Audit Scope*. The outcome in column 1 is the country-level average of firms' leverage. The outcome in column 2 is the aggregate total factor productivity for a country in a year. The outcome in column 3 is the logarithm of the value added, which is reported by EU KLEMS. The outcome in column 4 is the logarithm of the total amount of corporate taxes collected within a country and year, which comes from Eurostat. Detailed variable definitions are reported in Table A.2. This analysis is performed for our European setting. All specifications include fixed effects for countries and years. Standard errors, reported in parentheses, are clustered at the country level. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% level, respectively.

**Table A8: Audit Mandates and Citizens' Well-Being**

	Human Development Index (1)	Happiness Score (2)	Health Score (3)
Standardized Audit Scope	-0.005 (0.006)	-0.013 (0.064)	0.040 (0.065)
Standardized Disclosure Scope	-0.018** (0.007)	-0.229 (0.010)	-0.098 (0.110)
Fixed Effects Structure	Country, Year	Country, Year	Country, Year
Cluster	Country	Country	Country
Observations	458	60	60
$R^2$	0.973	0.920	0.924

**Notes:** This table reports the estimates from regressions of broad, country-level individual satisfaction outcomes on *Standardized Audit Scope* and *Standardized Disclosure Scope*. The outcome in column 1 is the Human Development Index, a composite measure of aggregate well-being created and reported by the United Nations Development Programme (UNDP). The outcome in column 2 is the average Happiness Score of individuals surveyed via the World Values Survey and European Values Survey in a given country. The outcome in columns 3 is the average health score of individuals surveyed via the World Values Survey and European Values Survey in a given country. Detailed variable definitions are reported in Table A.2. This analysis follows our European country-level design. All specifications include fixed effects for countries and years. Standard errors, reported in parentheses, are clustered at the country level. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% level, respectively.

**Table A9: Audit Mandates and Auditors' Log Quantity**

	Log(# of Employees) (1)	Log(# of Employees) (2)	Log(# of Employees) (3)	Log(# of Employees) (4)
Audit Occ × Audit Ind × Above Thresholds	3.396 (3.935)	2.667 (3.421)	3.840 (3.358)	5.650 (4.282)
Audit Occ × Above Thresholds	1.176* (0.611)	0.411 (0.587)	0.237 (0.699)	
Audit Ind × Above Thresholds	3.694** (1.628)	4.773** (1.953)	-1.171 (1.962)	
Audit Occ	-0.476*** (0.070)			
Audit Ind	-0.484** (0.229)			
<b>Linear Combinations</b>				
Audit Occupation × Audit Industry Effect ( $\beta_1 + \beta_2 + \beta_3$ )	9.839* (5.661)	9.298* (5.298)	2.050 (3.919)	
Audit Occupation Effect ( $\beta_1 + \beta_2$ )	5.292 (4.412)	3.377 (3.853)	3.397 (3.791)	
Audit Industry Effect ( $\beta_1 + \beta_3$ )	8.101 (5.879)	8.511 (5.512)	1.911 (3.986)	
Fixed Effects Structure	County, Year	County, Year, Occ × Ind	Occ × Year, Ind × Year, Occ × Ind, County × Ind, County × Occ	Ind × Occ × Year, County × Occ × Year, County × Ind × Year
Cluster	County	County	County	County
Observations	2,317,137	2,305,517	2,279,172	1,371,959
$R^2$	0.029	0.304	0.665	0.742

**Notes:** This table reports the estimates from regressions of the logged number of employees within a German county on *Above Thresholds*, a variable capturing the proportion of firms in a county that exceed at least two of three regulatory thresholds. Analyses in this table are conducted on the occupation-industry-county level. The interaction between *Audit Ind* and *Above Thresholds* captures the incremental effect of the mandate on non-auditors employees working in audit firms. The interaction between *Audit Occ* and *Above Thresholds* captures the incremental effect of the mandate on auditors working in non-audit firms. The interaction between *Audit Occ*, *Audit Ind* and *Above Thresholds* captures the incremental effect of audit mandates on auditors working in audit firms. The columns differ in their fixed effects structures. Column 1 includes the least restrictive structure with fixed effects for counties and years. Column 2 additionally includes fixed effects for occupations × industries. Column 3 includes fixed effects for occupations × years, industries × years, occupations × industries, counties × industries, and counties × occupations. Column 4 includes fixed effects for industries × occupations × years, counties × occupations × years, and counties × industries × years. Standard errors, reported in parentheses, are clustered at the county level for all specifications. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% level, respectively.

**Table A10: Audit Mandates and Auditors' Quantity with Spillovers**

**Panel A: Audit Mandates and Auditors' Quantity with Spillovers**

	# of Employees (1)	# of Employees (2)	# of Employees (3)	# of Employees (4)
Audit Occ $\times$ Audit Ind $\times$ Above Thresholds	144.978* (78.505)	136.192* (77.623)	291.018** (132.073)	110.005 (187.479)
Audit Occ $\times$ Audit Ind $\times$ Peers Above Thresholds	-232.582*** (82.555)	-220.906*** (85.120)	-401.839*** (130.004)	-6832.174*** (1967.470)
Main Effects & Two-Way Interactions Fixed Effects Structure	Yes County, Year	Yes County, Year, Occ $\times$ Ind	Yes Occ $\times$ Year, Ind $\times$ Year, Occ $\times$ Ind, County $\times$ Ind, County $\times$ Occ	Yes Ind $\times$ Occ $\times$ Year, County $\times$ Occ $\times$ Year, County $\times$ Ind $\times$ Year
Cluster	County	County	County	County
Observations	2,317,137	2,305,517	2,279,172	1,371,959
$R^2$	0.012	0.087	0.357	0.398

**Panel B: Audit Mandates and Auditors' Wages with Spillovers**

	Log(Wages) (1)	Log(Wages) (2)	Log(Wages) (3)	Log(Wages) (4)
Audit Occ $\times$ Audit Ind $\times$ Above Thresholds	-6.425*** (1.652)	-4.652*** (1.474)	-4.605** (2.148)	-4.061 (2.786)
Audit Occ $\times$ Audit Ind $\times$ Peers Above Thresholds	6.112** (2.927)	3.298 (2.726)	2.912 (2.779)	19.687 (26.182)
Main Effects & Two-Way Interactions Fixed Effects Structure	Yes County, Year	Yes County, Year, Occ $\times$ Ind	Yes Occ $\times$ Year, Ind $\times$ Year, Occ $\times$ Ind, County $\times$ Ind, County $\times$ Occ	Yes Ind $\times$ Occ $\times$ Year, County $\times$ Occ $\times$ Year, County $\times$ Ind $\times$ Year
Cluster	County	County	County	County
Observations	2,309,859	2,298,230	2,271,792	1,365,872
$R^2$	0.059	0.572	0.734	0.804

**Notes:** This table reports the estimates from regressions of the quantity and logged wages of employees within a German county on *Above Thresholds*, a variable capturing the share of firms in a county that exceed at least two of three regulatory thresholds, and *Peers Above Thresholds*, a variable capturing the share of firms in neighboring counties above the thresholds. Analyses in this table are conducted on the occupation-industry-county level. In this table, only the incremental effect on auditors at audit firms is reported for parsimony, although all main effects and two-way interactions (as reported in Table V and Table VI are also included in the regression). The interaction between *Audit Occ*, *Audit Ind* and *Above Thresholds* captures the incremental effect of audit mandates on auditors working in audit firms. The interaction between *Audit Occ*, *Audit Ind* and *Peers Above Thresholds* accounts for any spillover effects that may occur depending on the audit scope in nearby counties. The columns differ in their fixed effects structures. Column 1 includes the least restrictive structure with fixed effects for counties and years. Column 2 additionally includes fixed effects for occupations  $\times$  industries. Column 3 includes fixed effects for occupations  $\times$  years, industries  $\times$  years, occupations  $\times$  industries, counties  $\times$  industries, and counties  $\times$  occupations. Column 4 includes fixed effects for industries  $\times$  occupations  $\times$  years, counties  $\times$  occupations  $\times$  years, and counties  $\times$  industries  $\times$  years. Standard errors, reported in parentheses, are clustered at the county level for all specifications. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% level, respectively.

**Table A11: Audit Mandates and Auditors' Wages (Orbis)**

Outcome	Log(Avg Wage of Employees) Audit Firm Level (1)	Log(Avg Wage of Employees) Audit Firm Level (2)	Log(Avg Wage of Employees) Country Level (3)	Log(Avg Wage of Employees) Country Level (4)
Above Thresholds	-0.110* (0.057)		-0.369* (0.208)	
Standardized Audit Scope		-0.087 (0.064)		-0.273 (0.220)
Fixed Effects Structure	Audit Firm Year	Audit Firm Year	Country Year	Country Year
Cluster	Audit Firm	Audit Firm	Country	Country
Observations	4,938	4,938	330	330
R <sup>2</sup>	0.792	0.792	0.700	0.697

**Notes:** This table reports the estimates from regressions of logged average wages within audit firms on *Above Thresholds*, a variable capturing the proportion of firms in a country that exceed at least two of three regulatory thresholds, and on *Standardized Audit Scope*, a variable capturing the scope of audit mandates within a country, but using a standardized firm-size distribution by industry (i.e. a firm-size distribution in which all firms in that industry across all the countries and years are pooled). The average wage is calculated as the audit firms' total labor cost divided by the total number of employees. The analyses in columns 1 and 2 are conducted at the audit-firm level, and in columns 3 and 4 are conducted at the country level. Columns 1 and 2 include fixed effects for audit firms and years, and columns 3 and 4 include fixed effects for countries and years. Standard errors, reported in parentheses, are clustered at the audit-firm level in columns 1 and 2, and at the country level in columns 3 and 4. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% level, respectively.

**Table A12: Audit Mandates and Auditors' Wages (State FE)**

	Log(Wages) (1)	Log(Wages) (2)	Log(Wages) (3)	Log(Wages) (4)
Audit Occ $\times$ Audit Ind $\times$ Above Thresholds	-6.402*** (1.697)	-4.625*** (1.378)	-4.412*** (1.536)	-5.628*** (1.851)
Audit Occ $\times$ Above Thresholds	-0.155 (0.685)	1.391*** (0.490)	-0.368 (0.692)	0.104 (0.807)
Audit Ind $\times$ Above Thresholds	2.116 (1.597)	0.504 (1.223)	3.128** (1.431)	2.879* (1.556)
Audit Occ	1.201*** (0.096)			
Audit Ind	-0.155 (0.213)			
<b>Linear Combinations</b>				
Audit Occupation $\times$ Audit Industry Effect ( $\beta_1 + \beta_2 + \beta_3$ )	-4.441*** (0.821)	-2.731*** (0.754)	-1.653 (1.338)	-2.646* (1.380)
Audit Occupation Effect ( $\beta_1 + \beta_2$ )	-6.557*** (1.808)	-3.235** (1.357)	-4.780*** (1.512)	-5.525*** (1.823)
Audit Industry Effect ( $\beta_1 + \beta_3$ )	-4.286*** (0.940)	-4.121*** (0.848)	-1.285 (1.365)	-2.750* (1.429)
Fixed Effects Structure	State, Year	State, Year, Occ $\times$ Ind	Occ $\times$ Year, Ind $\times$ Year, Occ $\times$ Ind, State $\times$ Ind, State $\times$ Occ	Ind $\times$ Occ $\times$ Year, State $\times$ Occ $\times$ Year, State $\times$ Ind $\times$ Year
Cluster	State	State	State	State
Observations	2,309,859	2,298,230	2,297,481	2,078,385
$R^2$	0.043	0.567	0.599	0.623

**Notes:** This table reports the estimates from regressions of the logged wages of employees within a German county on *Above Thresholds*, a variable capturing the proportion of firms in a county that exceed at least two of three regulatory thresholds. Analyses in this table are conducted on the occupation-industry-county level. This table repeats the analysis from Table 6, but substitutes the county FE for state FE, which allows for a great degree of cross-sectional variation between German counties but within German states. The interaction between *Audit Ind* and *Above Thresholds* captures the incremental effect of the mandate on non-auditors employees working in audit firms. The interaction between *Audit Occ* and *Above Thresholds* captures the incremental effect of the mandate on auditors working in non-audit firms. The interaction between *Audit Occ*, *Audit Ind* and *Above Thresholds* captures the incremental effect of audit mandates on auditors working in audit firms. The columns differ in their fixed effects structures. Column 1 includes the least restrictive structure with fixed effects for states and years. Column 2 additionally includes fixed effects for occupations  $\times$  industries. Column 3 includes fixed effects for occupations  $\times$  years, industries  $\times$  years, occupations  $\times$  industries, states  $\times$  industries, and states  $\times$  occupations. Column 4 includes fixed effects for industries  $\times$  occupations  $\times$  years, states  $\times$  occupations  $\times$  years, and states  $\times$  industries  $\times$  years. Standard errors, reported in parentheses, are clustered at the county level for all specifications. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% level, respectively.