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Reporting Regulation and Corporate Innovation

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Reporting Regulation and Corporate Innovation

Matthias Breuer[*], Christian Leuz[†], and Steven Vanhaverbeke[‡]

Abstract

We investigate the impact of reporting regulation on corporate innovation. Exploiting thresholds in Europe's regulation and a major enforcement reform in Germany, we find that forcing firms to publicly disclose their financial statements discourages innovative activities. Our evidence suggests that reporting regulation has significant real effects by imposing proprietary costs on innovative firms, which in turn diminish their incentives to innovate. At the industry level, positive information spillovers (e.g., to competitors, suppliers, and customers) appear insufficient to compensate the negative direct effect on the prevalence of innovative activity. The spillovers instead appear to concentrate innovation among a few large firms in a given industry. Thus, financial reporting regulation has important aggregate and distributional effects on corporate innovation.

Keywords: Innovation, Regulation, Disclosure, Financial Reporting, Patents, Growth

JEL Classifications: K22, L51, M41, M42, M48, O43, O47

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1. Introduction

Disclosure and financial reporting mandates are ubiquitous. They typically aim to improve the functioning of capital markets and to protect firms' investors and other stakeholders. Despite substantial evidence of capital-market benefits from corporate disclosures (Healy & Palepu 2001), firms frequently oppose disclosure and reporting regulation arguing that it forces them to reveal proprietary information (e.g., about profitable markets), which dissipates their gains from innovation and hurts their incentives to innovate (Arrow 1962). How serious this concern is, however, remains unclear. For one, firms could point to proprietary costs to disguise that they oppose transparency for ulterior reasons (Berger & Hann 2007). Moreover, even if a mandate forces firms to reveal proprietary information, other firms could benefit (Zingales 2009). This redistribution could leave aggregate innovation unchanged or even enhance it if mandatory reporting speeds up the adoption of novel processes and products or generates substantial follow-on innovation by other firms. The potential for such spillovers implies that estimating the direct effect of regulation on regulated firms' innovation is difficult (Glaeser & Guay 2017) and, furthermore, that the aggregate and distributional effects of financial reporting regulation on corporate innovation are far from clear.

In this study, we investigate the effects of regulation mandating the public disclosure of financial statements on corporate innovation. Corporate innovation is key to productivity and economic growth and, at the same time, an activity for which the potential proprietary costs of reporting mandates are pertinent. As pointed out, to examine how reporting regulation affects innovation, we need to account for the possibility that the regulation not only has direct effects, but also indirectly affects firms via information spillovers, including those in the control group.[1] We account for the potential spillovers in two ways (Berg *et al.* 2020). First, we estimate the aggregate

[1] For this very reason, spillovers pose a threat to identification in firm-level designs (Glaeser & Guay 2017). One could find a (seemingly) negative direct effect on treated firms merely because the control firms benefit from spillovers; not because mandated firms actually innovate less. Our aggregate design reduces this concern by allowing for spillovers among related firms, for which they are likely largest. For more discussion of the aggregation level see Section 4.

impact of reporting regulation on innovation activity for all firms in a given country and two-digit industry, whether they are required to report or not. This aggregate assessment captures any spillovers among firms operating in the same industry and country. We highlight that this aggregation is not perfect, as it misses cross-industry or cross-country spillovers, but it presents a significant improvement over firm-level designs. Second, we explicitly estimate spillovers that originate from mandating firms operating in the same *and* other industries. By explicitly accounting for such spillovers, we can decompose the aggregate impact of regulation into its direct effect on mandated firms and its indirect effects on other firms. This decomposition allows us to shed light on the distributional effects of disclosure regulation when it comes to innovation.

To estimate the effects on corporate innovation, we exploit unique features of reporting regulation in Europe. The regulation, set forth in the Accounting Directives of the European Union (EU), stipulates that all limited-liability firms—private and public ones—must disclose their financial statements, including a management report discussing business risks, R&D activities, and firm strategy. However, countries can grant exemptions to smaller private firms, leading to size-based thresholds that vary by country. Exempted firms must typically provide only an abridged balance sheet with abbreviated notes, allowing them to withhold substantial information that otherwise would have to be disclosed in the income statement, more detailed notes, or the management report. Despite the exemptions, the reporting mandates have contributed significantly to corporate transparency in Europe (Kalemli-Ozcan *et al.* 2015; Breuer 2020). An important exception to this statement is Germany. In contrast to other European countries, Germany failed to enforce its reporting mandate until 2007, when mounting pressure by the EU commission triggered a substantial enforcement reform (e.g., Bernard 2016; Vanhaverbeke *et al.* 2019; Breuer 2020).

The European setting exhibits several desirable features when investigating the effect of mandatory reporting on innovative activity. First, the size-based thresholds across EU countries and the German enforcement reform generate substantial variation in the amount of financial information

that otherwise opaque private firms are required to provide. Second, both the size-based thresholds and the enforcement change enable us to use two alternative, quasi-experimental research designs. Third, the EU regulation and the German enforcement reform pertain to *all* limited-liability firms rather than a few public firms, which is important when estimating aggregate effects.[2] Notably, private firms play an important role for innovation (e.g., Rothwell 1978; Acs & Audretsch 1990; Vossen 1998; Schneider & Veugelers 2010). Last but not least, there are detailed innovation input and output data for European and especially German firms, including various innovation types, allowing us to measure innovation effects more granularly and also fairly comprehensively. Importantly, these innovation data are confidentially reported to national research centers, allaying concerns that firms' reporting requirements or strategic disclosure incentives distort the availability or content of the data.

We employ two alternative research designs to identify the effect of reporting regulation on innovation at the industry level. In the European setting, we exploit the fact that countries' distinct exemption thresholds generate variation in the share of firms facing mandatory reporting across industries. For example, industries with innately greater fixed asset requirements exhibit a larger fraction of firms that exceed the asset-based exemption thresholds. The same applies for labor-intensive industries and the employee-based exemption thresholds. We use this country-industry-level variation in the *intensity* of the regulation and employ a *cross-sectional* difference-in-differences design. This design does not rely on changes in countries' thresholds across time, but instead compares differences in innovation for industries with many versus few large firms in countries with high versus low exemption thresholds. Thus, conceptually, there are two differences in a given year: (1) the difference in the shares of mandated firms in a given country *across* industries because industries have

[2] Out of the 24 million active firms in Europe, 80% are limited-liability companies (EU 2019b). Small- and medium-sized enterprises (SMEs) represent over 99.8% of active enterprises within the economy and employ 93 million people, accounting for 67 % of employment in the EU-28 non-financial business sector (EU 2017). Importantly, many SMEs contribute significantly to innovation: 38.3% of EU-28 SMEs developed at least one product or process innovation between 2014-2016, compared to 67.8% of large enterprises (EU 2019a). Some SMEs developed disruptive or breakthrough innovations, while others innovated in more incremental ways. The proportion of innovative SMEs (large enterprises) that introduced at least one new-to-the-market innovation between 2014 and 2016 was 13% (32%).

different firm-size distributions and (2) the difference in the shares of mandated firms in a given industry *across* countries because countries' thresholds differ.

To ensure that (potentially endogenous) differences in firm sizes across countries or changes over time do not confound our measure of regulatory intensity, we do *not* use the actual share of mandated firms in a given country, industry, and year as our intensity measure. Instead, we construct a Europe-wide and time-invariant firm-size distribution per industry and then calculate our intensity measure as the hypothetical share of firms that would face the mandate if a given country's exemption thresholds were applied to this firm-size distribution. This intensity treatment is known as a simulated instrument (Currie & Gruber 1996; Mahoney 2015) and akin to a Bartik instrument (Goldsmith-Pinkham *et al.* 2020). By using it, we ensure that the treatment variable of interest varies only due to differences in the exemption thresholds across countries as well as systematic differences in firm sizes across industries. As such, it alleviates concerns about reverse causality (e.g., technology shocks causing firms in certain industries to grow above the thresholds) and omitted factors correlated with countries' firm-size differences (e.g., industrial policies and specialization).

In the German setting, we exploit the fact that the enforcement reform pertained to limited-liability firms, but not other firms (e.g., unlimited-liability or public firms). This feature creates variation in the *intensity* with which the enforcement reform treats local markets (defined at the county-industry level), depending on the pre-existing shares of mandated firms (i.e., limited-liability firms among all firms) in the local markets. We use this county-industry-level variation in the intensity of the *shift* in enforcement as our market-level treatment in a *time-series* difference-in-differences design, which essentially compares changes in innovation activity across local markets. For firm-level tests, we use a standard, time-series difference-in-differences design comparing treated (limited-liability) and control firms, either unlimited-liability or publicly traded firms, around the enforcement reform.

The two settings exhibit complementary strengths and weaknesses. The main strength of the European setting is that it is more highly aggregated (country-industry level) and hence more likely to

estimate the net impact of mandatory reporting on corporate innovation, which comprises the direct impact on mandated firms and the indirect impact on other firms. In addition, the European analysis essentially compares different country-industry equilibria and as such allows for long-run adjustments in industries along all margins, including potential financing benefits spurred by greater industry-wide transparency. In this sense, our estimates based on the European analysis represent a *net-net* effect of the mandate on innovation at the country-industry level. However, the high level of aggregation of this analysis comes at the cost of power, limiting it to observations at the country-industry level. The main strengths of the German setting in turn are (i) the power that comes with the granular *county*-industry (or firm-level) variation in enforcement and (ii) the detailed input and output measures of corporate innovation. Although the within-country regional aggregation in the German setting neglects potentially important spillovers, it affords more granular analyses that help with the mechanism. Thus, we use the German setting to examine the *direct* impact on mandated firms (instead of the aggregate net impact) and to uncover underlying forces of the net impact. In this sense, the enforcement reform analysis complements the aggregate analysis in the European setting.

We combine financial information on private and public firms in Europe from Bureau van Dijk's Amadeus database, patent data for European firms from Bureau van Dijk's Orbis database and the European Patent Office's PATSTAT database, and *confidential* information on innovation inputs and outputs from Eurostat's Community Innovation Surveys and the Mannheim Innovation Panel. The European sample covers up to 26 countries over a time span of 15 years from 2000 to 2014. The German sample covers more than 20,000 unique firms over 12 years from 2002 to 2013.

In the European setting, we find that mandatory financial reporting is significantly negatively associated with the prevalence of corporate innovation (e.g., fewer innovating firms) at the country-industry level. Thus, within-country-industry spillovers appear insufficient to compensate for the negative direct effect on firms' innovative activities. We do not find significant evidence that the mandates reduce total innovation spending though. The latter suggests that, while reporting mandates

discourage many firms' innovation activities, a few, presumably larger firms appear to increase their spending, which in turn suggests both spillovers and a concentration of innovation spending. Consistent with this redistribution of innovative activity, we find that reporting mandates reduce innovation activities of mandated firms, while they spur innovation activities of *other* firms, especially larger customers, suppliers, and competitors. The latter finding is broadly consistent with the literature on information spillovers from mandatory reporting of public firms on private firms' investments and business formation (e.g., Badertscher *et al.* 2013; Barrios *et al.* 2020; Bernard *et al.* 2020).

In the German setting, we also find that forcing firms to provide financial reports is negatively associated with the number of innovating firms in local markets, consistent with the European results. But here, we even find that reporting mandates are significantly negatively associated with the total innovation spending in local markets. This decline in spending at the county level appears to be driven by firms operating in niche markets with few or any local competitors. These regional "monopolists" frequently stop innovating altogether, likely because mandated reporting dissipates the gains from innovation. In line with this proprietary-cost explanation for the effect of mandatory reporting on innovation, we present results that the mandates are negatively associated with firms' profit margins, sales from new-to-market innovations, and cost reductions due to process improvements.

In supplemental tests, we investigate the impact of reporting mandates on firms' financing, patenting, and financial-statement-based innovation measures. We first document that reporting regulation reduces the likelihood that firms' innovative activities are hampered by financial constraints. In line with a vast literature (e.g., Leuz & Wysocki 2016), this evidence suggests mandatory reporting provides capital-market benefits. These benefits, however, appear limited for the private firms in our setting and cannot offset the discouraging effect of the mandate on corporate innovation due to the loss of proprietary information. Next, we find that reporting mandates exhibit an ambiguous relation with patenting. On the one hand, mandatory financial reporting discourages innovations, and thus implies fewer patents. On the other hand, mandatory reporting hurts secrecy, which in turn increases

the use of patenting to protect firms' remaining innovations. We finally document that reporting mandates are negatively associated with financial-statement-based innovation measures (e.g., changes in intangible assets), corroborating our innovation-survey-based findings.

Our evidence is remarkably consistent across the two settings and designs: Mandatory reporting discourages innovation, especially by (smaller) firms in niche markets with few competitors. At the country-industry (and highest aggregation) level, the negative direct effect of mandatory reporting appears to outweigh positive spillover effects on other firms. It is unclear whether the net impact is still negative for the economy as a whole once potential cross-industry and cross-country spillovers are accounted for. We leave this issue for future research. The result that comes through regardless is that reporting regulation concentrates innovative activity among a few, typically larger firms. This distributional effect can have important ramifications for market structure and the type of innovations (e.g., Acs & Audretsch 1987, 1988; Holmstrom 1989; Rossi-Hansberg *et al.* 2019).

Our study contributes to several streams of the literature. First and foremost, it belongs to the literature on the real effects of financial reporting regulation (e.g., Leuz & Wysocki 2016; Roychowdhury *et al.* 2019). We provide novel evidence on the aggregate and distributional effects of reporting regulation on corporate innovation, a real activity central to economic growth. We jointly examine direct and indirect impacts and show both negative forces as well as positive spillover effects of mandatory disclosure on corporate innovation. Our study is closely related to concurrent work on mandatory *patent* disclosures (e.g., Hedge *et al.* 2018; Kim & Valentine 2020).[3] Our focus, however, is on *reporting* regulation, rather than disclosure regimes that are directly tied to innovative activity or its patent protection. In this regard, our study is more similar to Allen *et al.* (2018). They examine the impact of SOX on innovation and provide evidence that costly reporting regulation can negatively affect young firms' innovative activity. Their study suggests that SOX did not increase transparency

[3] The papers on mandatory patent disclosures exploit the 1999 American Investors Protection Act (AIPA). Using this law change, Dass *et al.* (2018) and Saidi and Zaldokas (2019) document an increase in patenting, liquidity, and external financing due to enhanced disclosure, while Kim and Valentine (2020) and Hussinger *et al.* (2018) document a reduction of firms' incentives to innovate due to concerns about the loss of private information in the patenting process.

for these firms, yet diverted scarce resources away from innovative activities toward regulatory compliance. In our setting, the inverse holds: firms are required to *prepare* full financial statements irrespective of disclosure. Thus, incremental compliance costs from the reporting mandate are likely small, yet the resulting increase in disclosure is substantial.

Other studies on the link between disclosure and innovation tend to focus on the firm-level relation between voluntary financial reporting and innovation, using proxies such as R&D expenses or patents. The evidence is mixed. Some studies find that more transparent firms exhibit greater innovative activities, consistent with reduced funding costs or agency conflicts (e.g., Brown & Martinsson 2018; Zhong 2018). Other studies suggest innovative firms choose more opaque financial reporting practices due to concerns about proprietary costs (e.g., Dambra *et al.* 2015; Barth *et al.* 2017; Chaplinsky *et al.* 2017). Our study differs in three ways. First, we study mandatory rather than voluntary financial reporting, which gives us plausibly exogenous variation in firms' reporting. Second, and consistent with our focus on mandates, we estimate aggregate effects at the industry level, instead of firm-level effects.[4] Third, we use detailed input and output data on various types of corporate innovation. The latter is important because patents are a relatively narrow and potentially misleading proxy for firms' overall innovative activity (e.g., Gittelman 2008; Nagaoka *et al.* 2010; Reeb & Zhao 2020). Moreover, our data do not stem from firms' financial reports, which mitigates concerns about the strategic disclosure of R&D expenses (e.g., Koh & Reeb 2015).

Our study also contributes to the literature on proprietary costs of financial reporting. Survey evidence suggests that firms frequently point to concerns about the loss of proprietary information when justifying secrecy or opposing demands for greater transparency (e.g., Graham *et al.* 2005; Minnis & Shroff 2017). As these claims could have ulterior reasons, showing the effect of proprietary costs on disclosure decisions or the impact from disclosure mandates is challenging (e.g., Berger 2011; Lang

[4] Importantly, Brown and Martinsson (2018) and Kim (2019) also provide market-level tests. They find that greater country-level transparency and patent disclosures, respectively, spur innovation. We find in our two settings that mandatory financial reporting, on net, hurts innovation.

& Sul 2014). However, several recent studies provide evidence supporting the proprietary cost hypothesis (e.g., Verrecchia 1983). For example, Bernard (2016), Breuer (2020), and Glaeser and Omartian (2019) show that reporting mandates impose competitive costs on firms. Li *et al.* (2017), Glaeser (2018), and Gassen and Muhn (2018), in turn, find that concerns about proprietary costs reduce firms' disclosures.[5] Our study provides specific and detailed evidence of proprietary costs with respect to firms' innovation activities by showing that mandatory reporting can hurt firms' return to innovation and harm their innovation incentives.

Finally, our patent results contribute to a nascent literature on the complementarities between firms' disclosure and patenting strategies. This literature highlights that patenting is just one among several ways in which firms can protect their innovations. Patenting provides legal protection in exchange for disclosure of patent information. Alternatively, firms can choose to protect their innovation through (trade) secrecy (Arundel 2001). The latter creates a link to financial reporting, which can reveal proprietary information. Consistent with this link, Glaeser (2018) and Glaeser *et al.* (2019) document that firms' patenting decisions are positively associated with firms' financial reporting incentives. Our study adds evidence that mandatory reporting can increase the propensity to use patenting, as secrecy is hampered by the mandate. This shift toward patenting could lead to wrong inferences if one relies solely on patenting activity to measure overall innovative activity.

2. Reporting Regulation and Innovation: Conceptual Underpinnings

Firms that engage in innovative activities generate proprietary know-how, for instance, about lucrative markets, products or services as well as about new technologies and processes. This know-how allows firms to differentiate from competitors and to earn (quasi-)rents. To shield these rents from competitors and contracting partners (e.g., customers and suppliers), firms protect proprietary information through secrecy or by legal means, e.g., patenting.

[5] Aside from these studies with causal evidence, there is a large, earlier literature documenting associations between proxies for proprietary costs and firms' disclosure choices (e.g., Harris 1998; Leuz 2004; Verrecchia & Weber 2006; Berger & Hann 2007; Dedman & Lennox 2009; Bens *et al.* 2011).

Financial reports, however, reveal some of this proprietary information generated by firms' business and innovative activities. For instance, the income statement shows R&D expenses, profit margins, and cost structures. A firm's profit margin is typically indicative of its competitive position (e.g., product differentiation, pricing power). Similarly, information about the cost structure (or gross margin) could reveal cost-leadership advantages in production processes and sourcing (see also Berger *et al.* 2019). The balance sheet provides information about a firm's financial resources as well as its tangible and (sometimes) intangible assets (i.e. patents, copyrights, trademarks).[6] In addition, financial reports provide extensive narrative disclosures, especially in the management report, which entails discussing key products and services, a firm's strategy, and its R&D activities.

Thus, the disclosure of financial reports could impose proprietary costs by facilitating direct and indirect competitor learning. It could, for example, not only influence a competitor's strategic decisions about new investments or which markets to enter, but also trigger further information search. When a competitor learns from the financial report how profitable a firm is, the competitor could invest additional resources in figuring out what drives the high profit margin or the distinctive cost structure. The financial report could trigger a search for additional, more detailed information in scientific or industry-specific publications, patent databases, by going to trade fairs, speaking to suppliers or by reverse engineering products. While competitors operating in the same industry or market are likely aware of a firm's products and services, the financial statements provide information on how *profitable* these products and services are.[7] In addition, this information could induce new firms to enter the industry or market (e.g., Darrough & Stoughton 1990; Wagenhofer 1990).

Survey evidence supports the notion that firms are concerned about disclosing financial

[6] For example, mentioning a patent or patent application in the narrative disclosures of the financial report or recording a patent on the balance sheet can be informative, as either one points to the existence of a patent for which more detailed information is publicly available in patent office online databases (Wyatt & Abernethy 2008).

[7] Similar concerns are raised by managers and regulators. A review by the ICAEW (2013, p. 33) stated: "A firm's knowledge of what is profitable and what is not is a form of intellectual capital—akin to an invention, but often much more transient. If this information is disclosed, then the firm's competitors benefit as they learn which fields to move into and which to avoid, without having to incur the costs of being first movers. In this situation, the winners from disclosure are the imitators, and the losers are the pioneers."

statements to the public because it can reveal proprietary information. For example, Minnis & Shroff (2017) find that 61% of firms are concerned that competitors download and view their financial statements if they are publicly available. Moreover, 48% of surveyed firms state that they downloaded financial statement information about one of their competitors in the past. Similarly, Graham *et al.* (2005) document that 59% of CFOs fear giving away "company secrets" or hurting their competitive position through voluntary disclosure.

Importantly, financial reports are not only relevant to competitors, but could also impose competitive costs by weakening a firm's bargaining power with its contracting partners. For example, it could prompt a customer of a high-margin firm to re-negotiate prices or to search for alternative producers with lower margins (e.g., Max-Planck-Institute 2009; Minnis & Shroff 2017).[8] Similarly, it could enable a labor representative at a low-wage or high-margin firm to benchmark labor costs and profitability across firms and bargain for higher wages (e.g., Palmer 1977; Amernic 1985; Liberty & Zimmerman 1986; Aobdia & Cheng 2018). The disclosure of financial reports could also allow suppliers and banks to identify new customers, resulting in outside options and hence competition for existing procurement or lending relationships (e.g., Costello 2013; Breuer *et al.* 2018). The overall thrust of these arguments is that financial reporting has the potential to spur new arm's length transactions and change the resource allocation in the economy (e.g., Hombert & Matray 2016).

Firms consider competitive costs resulting from the revelation of proprietary information to competitors and contracting partners when making organizational, financing, and reporting choices. Innovating firms, for example, tend to work with few trusted suppliers (e.g., Bönte & Wiethaus 2007; Aobdia 2015), raise financial capital from a limited number of capital providers (e.g., Bhattacharya & Chiesa 1995; Asker & Ljungqvist 2010; Kerr & Nanda 2015), and avoid disclosing their financial reports or limit voluntary disclosures (e.g., Bhattacharya & Ritter 1983; Barth *et al.* 2017).

[8] Survey evidence in Minnis & Shroff (2017) supports this notion. They document that 46% (37%) of companies download the financial report of their customers (suppliers). According to survey evidence in Arrunada (2011), 85% (25%) of firms use information services to access information about their clients (suppliers).

Financial reporting regulation counters these tendencies by mandating the public disclosure of firms' financial reports. The specific rationale for reporting mandates differs somewhat across countries, but broadly speaking, the mandates typically aim to improve the functioning of capital markets and to protect firms' investors and other stakeholders, by leveling the informational playing field between corporate insiders and outsiders. However, in light of the discussed usefulness of financial reports to competitors and contracting partners, a key concern is that mandatory reporting not only brings capital-market benefits, but also imposes competitive costs on firms, especially innovative ones (e.g., Max-Planck-Institute 2009; Zingales 2009). Consistent with this concern, firms frequently oppose new reporting mandates, pointing to their proprietary or competitive costs (e.g., Graham *et al.* 2005; Minnis & Shroff 2017; Zhou 2018).[9] Thus, it is important to study the costs and benefits of reporting regulation.

Evaluating the effects of mandatory reporting on innovation is challenging because a mandate may harm some firms, but help the competitive positions of others, necessitating an analysis at the aggregate level, be it the market or the economy. The loss of proprietary information by one firm may simply be a gain by another firm. For the economy as a whole, such information spillovers could be desirable to the extent they disseminate knowledge and spur follow-on innovations (e.g., Hedge *et al.* 2018). However, such redistribution could also be harmful if mandatory reporting reduces aggregate innovative activity in the economy because firms anticipate that proprietary costs diminish their returns to innovation (Arrow 1962). Thus, the net effect of mandatory reporting on corporate innovation in the economy is ultimately an empirical question.[10]

While the net effect is ambiguous, firm-specific costs and benefits of reporting mandates likely depend on a firm's competitive position and size (e.g., Max-Planck-Institute 2009; Bernard 2016;

[9] However, as Berger and Hann (2007) and Leuz *et al.* (2008) discuss, firms could also oppose financial disclosures and reporting mandates for agency or private benefit reasons, nevertheless citing proprietary costs to justify their opposition.
[10] While the firm-level relation between competition and innovation is generally ambiguous, Schmutzler (2010) documents that competition for ex-post rents (e.g., spurred by disclosure) is unambiguously negative for ex-ante innovation incentives. Accordingly, the relevant question is whether the negative direct impact is offset by positive spillovers in the aggregate.

Bernard *et al.* 2018). For example, the proprietary costs of a mandate are likely higher for a local monopolist than a firm operating in a competitive market. Absent the reporting mandate, the local monopolist can protect its rents by hiding its profitability from its competitors and contracting partners. A firm in a competitive market, by contrast, earns limited rents irrespective of whether it has to report or not. In a similar vein, a small firm should be hit harder by a mandate than a large firm. Absent the reporting mandate, a small firm can minimize proprietary costs by communicating privately with its narrow stakeholder base. A large firm would report publicly, and incur proprietary costs, even without a mandate, because it needs to communicate with a broad set of stakeholders (e.g., Buzby 1975). In addition, a large firm likely benefits more from the spillovers caused by mandating other firms to report, compared to a small firm (e.g., Max-Planck-Institute 2009). A large firm, for example, can leverage its extensive resources and bargaining power to extract a share of the other firms' rents (e.g., Bernard 2016). A small firm would find it more difficult to take advantage of investment opportunities in new markets or to bargain with its contracting partners for better prices by threatening to switch to other suppliers or customers. Thus, this discussion highlights that reporting regulation potentially has important distributional consequences that are worth studying.

3. Institutional Background

3.1. Reporting Regulation in Europe

The EU Accounting Directives regulate firms' financial reporting in Europe since the 1980s. The EU regulation requires limited-liability firms—private and public ones—to prepare and publicly disclose a full set of audited financial statements. Typically, these financial statements include a balance sheet, an income statement, an audit opinion, extensive notes, and a management report discussing the competitive position and strategy, key products and services, business risks, investment and financing plans as well as activities in the field of research and development (see example in Online Appendix). To reduce the regulatory burden for smaller firms, EU regulation allows private firms below certain size thresholds to report less and/or forgo a financial statement audit. These

exemptions are based on a combination of thresholds defined for total assets, sales, and employees. These thresholds *uniformly* apply to all industries within a given country. While the EU sets maximum exemption thresholds, countries can set lower levels, subjecting more firms to the full reporting requirements. This discretion has resulted in notable variation in the relevant thresholds for reporting and auditing across EU countries.[11]

The threshold-based exemptions allow a substantial fraction of firms to reduce markedly what information they have to provide publicly. In many countries, exempted firms must disclose only an abbreviated balance sheet with abridged notes. Although these firms still have to prepare a full set of financial statements for internal purposes and private reporting to their shareholders, the exemptions allow them to hide proprietary information about (i) their innovation inputs (e.g., R&D expenses) and outputs or successes (e.g., profit margins and the cost structure) that otherwise would be revealed in the income statements as well as (ii) their R&D activities and future actions (e.g., investments, financing, and strategy) that otherwise would have to be discussed in the management report.[12] In the Online Appendix, we provide an example of exempted reporting and show for this firm how much more it has to report once it crosses the thresholds and has to comply with full reporting.[13]

3.2. Enforcement Reform in Germany

Germany, as a member state of the EU, transposed the EU Accounting Directives into national law in the 1980s and hence German firms have been subject to the EU reporting regulation for a long time. However, this mandate had been weakly enforced until a sweeping reform in 2007 (e.g., Bernard 2016). Before the reform, limited-liability firms were required to file their financial

[11] The respective maximum thresholds set by the EU were around 4 million Euros in total assets, 8 million Euros in sales, and 50 employees during the majority of our sample period. For country-specific threshold variation, see, for example, Cna Interpreta (2011), Minnis and Shroff (2017), Bernard *et al.* (2018), and Accountancy Europe (2019).

[12] There is some variation in what firms have to provide or they are exempt from. For instance, firms can use one of two income-statement formats in Europe. They either classify expenses by nature (e.g., wage expense and material expense) or function (e.g., cost of goods sold, advertising expense). The former is more prevalent in continental Europe, whereas the latter is more prevalent in the UK. Thus, the estimated reporting mandate effect in the EU setting reflects the average reporting format, exemption, and enforcement level across our sample countries, industries, and years.

[13] While this example illustrates the increase in information under full reporting, we emphasize that our identification strategy does not rely on such over-time variation when firms outgrow the thresholds.

statements with local courts and to publish their statements in local newspapers. The local courts were not tasked to ensure compliance or to engage in proactive enforcement, and monetary sanctions for non-compliance were low. As a result, the share of limited-liability firms complying with the reporting mandate was as low as 5-10%.

In 2007, Germany reformed its enforcement of the reporting mandate via the Bill on the Electronic Registers for Commerce, Companies and Associations (EHUG), effective for financial statements with fiscal years ending in December 2006 or later. Germany's reform efforts were a direct response to mounting pressure from the European Commission and the transposition deadline for the Company Law Disclosures Directive (EU Directive 2003/58/EC), which required the implementation of a central electronic publication register by 2007. The reform created a central electronic publication register in charge of the dissemination of limited-liability firms' financial statements, instituted centralized and proactive enforcement of the mandate by the Ministry of Justice, and introduced escalating fines for non-compliant firms. Following the reform, the share of limited-liability firms providing the required financial reports increased to above 90%. This compliance increase substantially enhanced corporate transparency in Germany as it meant that financial statements of more than 900,000 firms became available to the public for the first time.

4. Data and Level of Aggregation

We combine financial and innovation data for limited-liability firms in Europe from several sources. For the European sample, we obtain financial information from Bureau van Dijk's Amadeus database and firm-patent links from Bureau van Dijk's Orbis database. We use patent data from the European Patent Office's PATSTAT database as well as detailed information on corporate innovation activity across Europe from Eurostat's Community Innovation Survey.[14] Importantly, the

[14] We use the confidential micro-level data (called secure-use files) from all available survey waves (2000, 2004, 2006, 2008, 2010, 2012, and 2014). The survey waves are carried out by the EU member states and European Statistical System members. In each country, the data are collected by a team of statisticians specializing in innovation studies and working at an independent research institute or the national statistical office. The survey questions are harmonized across countries,

Community Innovation Survey is confidential and collects information about firms' innovation activity irrespective of their reporting status under the mandate. In the Online Appendix, we provide extensive details on survey methodology and data quality. We obtain information on European countries' exemption thresholds for their reporting mandates from Breuer (2020). The resulting sample covers up to 26 countries over a time span of 15 years from 2000 to 2014. Within each country, we aggregate firm-level financial and patent data to the two-digit NACE industry level to create a country-industry-year level dataset. In aggregating the innovation-survey responses, we use population weights to obtain measures that are representative for the entire population of firms in each country, which is important for the estimation of aggregate effects.

In choosing the level of aggregation, we face a tradeoff between accommodating spillovers and statistical power. A higher level of aggregation naturally accounts for more spillovers but in the extreme one can no longer assess statistical significance. Our two-digit industry-country level aggregation for the European analysis includes any redistribution effects across firms, including positive spillover effects from customers, suppliers, and customers, within the same coarse industry in a given country. To illustrate, the average two-digit industry in Germany comprises more than 30,000 firms operating in more than 14 distinct five-digit subindustries. While we acknowledge that spillovers could go beyond these broad industry boundaries as well as countries, we note that information spillovers tend to be strongest within industries and local markets (e.g., Engelberg *et al.* 2018), and the typical firm in our sample operates in local markets. According to the Eurostat data, the vast majority of our sample firms (80%) indicate that their largest market is at the local level or national (other regions in same country). Consistent with this, the average firm's sales to customers outside of its own country amount to only 2%. These statistics and considerations support the chosen level of aggregation and suggest that our design captures most spillovers.

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and cognitive tests are regularly conducted to assure that the questions elicit the desired information. Member states are required to provide innovation statistics to the EU, and almost all Member States *require* firms to answer the survey.

For the German sample, we obtain financial information on both limited- and unlimited-liability firms from the Mannheim Enterprise Panel (MEP). The MEP is based on the firm-level data of Creditreform, the dominant credit bureau in Germany.[15] It is the most comprehensive micro database of companies in Germany outside the confidential business register maintained by the Federal Statistical Office of Germany. The MEP database includes unique-patent identifiers, allowing us to link our sample firms with all patents available in the PATSTAT database to construct patent indicators (ZEW 2019a). We augment this data with detailed information on innovation inputs and outputs from the Mannheim Innovation Panel (MIP), which is based on successive issues of the EU's Community Innovation Survey. This German sample covers more than 20,000 unique firms over 12 years from 2002 to 2013. The firm-level panel, however, is unbalanced as the innovation surveys do not ask the same questions every year and firms do not always respond to all questions. Moreover, there is substantial churn due to the limited survival of especially smaller firms. The panel is replenished to account for churn and adjusted for non-random response bias via representative re-sampling (see Online Appendix), but firm-level data are sparse nevertheless. We again aggregate data to the market level using two-digit industries and, in this case, counties as the relevant regional aggregation.[16] Aggregating at the county-industry-level also mitigates the limitations of the firm-level panel data because with this aggregation (and representative sampling) it is not important for the same firm to answer the same question over time or around the enforcement reform in Germany.

5. Research Design

We exploit both of the aforementioned settings—threshold-based mandates in Europe and a major enforcement reform in Germany—to empirically investigate the effect of mandated financial reporting on corporate innovation. Both settings allow us to use difference-in-differences designs,

[15] See Bersch *et al.* (2014) for more details about the construction of the MEP database.
[16] In line with prior research (e.g., Huber 2018; Breuer 2020), we choose counties as a relevant regional aggregation level. German counties represents an intermediate administrative level between municipalities and German states. They are comparable to US counties (Nomenclature of Territorial Units for Statistics level 3).

which purge our estimates from various confounding differences across countries (e.g., code- vs. common-law countries), industries (e.g., labor- vs. capital-intensive industries), or over time (e.g., crisis vs. normal times). The two settings have complementary strength and weaknesses and allow us to provide estimates from a cross-sectional as well as a time-series difference-in-differences design.

5.1. Exemption Thresholds

A central feature of the threshold-based regulation in Europe is that a given country's exemption thresholds affect industries in different and, importantly, predictable ways. For example, a regulation that exempts firms below the 50-employees threshold from full reporting affects labor-intensive industries more strongly than capital-intensive industries. Analogous arguments can be made for a threshold based on total assets, which likely affects capital-intensive industries more strongly. Thus, the same threshold implies heterogeneous regulatory intensities across industries.

We exploit this country-industry-level heterogeneity in regulatory intensity in the following cross-sectional difference-in-differences design:[17]

$$Y_{cit} = \beta Reporting_{cit-1} + \alpha_{ct} + \delta_{it} + \varepsilon_{cit},$$

where Y_{cit} is the dependent variable (e.g., the share of patenting firms) in a given country c, industry i, and year t; $Reporting_{cit-1}$ captures the regulatory intensity measured as the share of firms above country c's reporting-exemption thresholds in industry i and year $t-1$; and α_{ct} is a country-year fixed effect, while δ_{it} is an industry-year fixed effect.[18]

To ensure that our regulatory intensity measure is not unduly confounded by endogenous differences or changes in firm sizes across countries and over time (e.g., due to technology shocks or firm growth), we use a simulated instruments approach following Currie and Gruber (1996) and

[17] Our design exploits cross-sectional variation in country-industry-level treatment intensity. We explicitly do not focus on time-series variation for several reasons. First, there were only few, limited changes in thresholds over time (Figure A1). Second, these few changes coincided with other major changes at the country level. Third, market-wide innovation effects likely take time to play out, rendering short-window time-series designs less useful than cross-sectional designs.

[18] In alternative specifications, we use the share of firms exceeding both the reporting- and auditing-thresholds as our (credible) reporting intensity measure.

Mahoney (2015). Instead of using the actual share of firms exceeding a given country's exemption thresholds in a given country-industry-year, we use a standardized share of firms as our intensity measure (i.e., our simulated instrument). To construct the standardized share, we calculate the hypothetical fraction of firms that exceed a given country's exemption thresholds when applying one representative firm-size distribution per industry (Breuer 2020). We construct this distribution by pooling all firms in a given industry across countries and years.[19] The resulting distribution is not only representative for the typical firm-size distribution for a given industry in Europe, but also does not vary across countries (e.g., due to industrial specialization) or over time (e.g., due to technology shocks). By using this distribution, we obtain a standardized measure of regulatory intensity that varies only due to differences in country-level exemption thresholds and systematic differences in industry-level firm-size distributions (see also Figure A1 illustrating this variation). This approach addresses concerns about reverse causality (e.g., technology shocks causing firms to grow above the threshold) and omitted variables correlated with countries' firm-size differences (e.g., industrial specialization).

Using the standardized share of mandated firms, our *cross-sectional* difference-in-differences design compares corporate innovation in more versus less intensively regulated industries in the same year using (1) the difference in the shares of mandated firms in a given country *across* industries (due to industry-level firm-size distributions) and (2) the difference in the shares of mandated firms in a given industry *across* countries (due to exemption thresholds). By using a within-country-year design, we control for *any* confounding cross-country differences (e.g., property rights, education, etc.) and *any* country-specific changes over time, observed or unobserved. This feature addresses important concerns about the endogeneity of thresholds chosen by countries at a given point in time (e.g., Ball 1980; Leuz 2010; Hail *et al.* 2017). It represents a substantial advantage over the usual (time-series) difference-in-differences design that exploits a regulatory change in a given country as treatment.

Our identifying assumption is that there are no other factors correlated with corporate

[19] For a detailed description of the construction of the standardized firm-size distributions, see Breuer (2020).

innovation *and* our intensity measure at the country-industry level. A typical concern with this assumption is that a multitude of country-industry-level factors could be correlated with corporate innovation (e.g., growth opportunities or technology shocks). However, these factors do not vary with our standardized intensity measures due to the construction of the simulated instrument.[20] A remaining concern with the identifying assumption is that countries endogenously set their thresholds at the country-industry level. The institutional details of our setting suggest this is unlikely to be the case. Within a given country, the thresholds are set uniformly across industries. The thresholds appear to be motivated by a desire to reduce the disproportionate regulatory burden for smaller firms (in all industries) that results among other things from the fixed costs associated with financial reporting requirements.[21] If the EU or specific countries really intended to treat industries differently, they could have set at least some industry-specific exemption thresholds, but they chose not to do this. It is therefore also unlikely that the uniform reporting thresholds are the result of some deliberate tailoring of the thresholds to individual industries. And even if a country tailored its country-level thresholds to one or a few specific industries (e.g., its most important ones), then this country-industry-specific choice would make the chosen thresholds plausibly exogenous for all other industries, except the specifically targeted one(s), and presumably these other industries would dominate the analysis.

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[20] After accounting for country-year (ct) and industry-year (it) fixed effects, the (standardized) reporting treatment essentially captures the interaction of country-level thresholds and industry-level firm-size distributions.

$$1/N_i \sum_{j=1}^{N_i} 1(s_{ij} > \overline{s}_{ct}),$$

where N is the number of firms in an industry, s is the size of firm j, and $\overline{s}$ is the exemption-threshold in a given country at a given point in time. In contrast, the reporting treatment would capture endogenous changes and differences in country-industry-specific firm-size distributions, even after accounting for the country-year and industry-year fixed effects, if we were not using the standardized industry-distributions to calculate the share:

$$1/N_{cit} \sum_{j=1}^{N_{cit}} 1(s_{cijt} > \overline{s}_{ct}).$$

[21] Fixed costs depress the profit margin more, the lower a firm's sales. This scale effect is not specific to a particular industry and one reason why the EU prescribes a uniform sales-based exemption threshold for all industries (e.g., European Commission 2019)

5.2. Enforcement Reform

In the second design, we exploit the enforcement reform in Germany as a major shift in the effective regulation of limited-liability firms' reporting over time and use the following temporal difference-in-differences analysis with a continuous treatment variable:

$$Y_{dit} = \beta LimitedShare_{di} \times Post_t + \alpha_{dt} + \delta_{it} + \phi_{di} + \varepsilon_{dit},$$

where Y_{dit} is the dependent variable (e.g., the share of innovating firms) in a given county (or district) d, industry i, and year t; $LimitedShare_{di}$ captures cross-sectional variation in the intensity of the reporting regulation at the county-industry level, measured as the average share of limited-liability firms among all (limited- and unlimited-liability) firms in a given county d and industry i in the pre-enforcement period (2002 to 2006); $Post_t$ is an indicator taking the value of one for all years after the enforcement reform (2008 to 2013); α_{it} is a county-year fixed effect, δ_{it} is an industry-year fixed effect, and ϕ_{di} is a county-industry fixed effect.[22]

The basic idea behind the market-level, difference-in-differences design is that industries in counties with a greater share of limited-liability firms should be more affected by the enforcement reform of the mandate. This county-industry "exposure" should explain changes in innovative activities at the county-industry level around the reform, if there are any. The key identifying assumption of this design is that, absent the enforcement reform, changes in county-industries' innovation activity over time would have been unrelated to the (pre-existing) share of limited-liability firms in a given county and industry, which is essentially a parallel-trends assumption.

In supplemental tests, we complement this continuous-treatment, market-level design with two firm-level (and more conventional) difference-in-differences designs. In the first firm-level

[22] We measure the share of limited-liability firms in the population covered by the MEP. Aside from the confidential German census data, this panel is the most comprehensive database, spanning various types of firms, including sole-proprietorships, partnerships (e.g., OHG and KG), and corporations (e.g., GmbH and AG). Inclusion in the MEP is independent of the reporting mandate and the share is not computed based on survey responses, but the actual share in the MEP population.

alternative, we compare the innovation activity of limited-liability firms with the activity of unlimited-liability firms before and after the enforcement reform. In the second alternative, we compare the innovation activity of private (limited-liability) firms with the activity of public firms before and after the enforcement reform. These two alternative designs differ in the choice of the control group. Unlimited-liability firms were not required to report publicly before or after the reform. By contrast, public (limited-liability) firms were required to report publicly and this requirement was strictly enforced by the respective stock exchanges before and after the reform.

An important assumption for our difference-in-differences designs to provide unbiased estimates is that there are no spillovers from treated to control units (or vice versa). This assumption is most plausible in our aggregate designs (e.g., where the unit of observation is at the country-industry level) and least plausible for the firm-level designs. A violation of the no-spillover assumption biases our estimates upward (in case of negative competition spillovers) or downward (in case of positive information spillovers). Despite these potential biases, we complement our aggregate design with more local designs, including firm-level analyses because their estimates can be informative with respect to the distributional effects of reporting regulation, especially when interpreted in conjunction with the aggregate estimates. For example, the firm-level estimates allow us to discern whether a null result in the aggregate is due to a one-for-one redistribution of innovative activity between treated and control firms or rather due to the absence of a treatment effect.

6. Results

6.1. Descriptive Statistics

Table 1 presents descriptive statistics for our treatment and outcome variables. (For a list of variable definitions, refer to the Variable Appendix.) In the European sample (Panel A), our main variable of interest is the reporting intensity variable "Reporting," which captures the share of firms subject to full reporting requirements in a country and two-digit industry. The distribution of this intensity measure has several notable features. The average (median) intensity for two-digit industries

is 22% (12%). The intensity measure spans the full range from 0% to 100%, with the majority of the values falling between 5% and 25%, which means that typically the largest 5 to 25% of the firms in an industry have to report fully. In this sense, the treatment variable primarily captures variation in mandatory reporting among the *largest* firms in a given industry. These firms are likely of substantial importance for market- or industry-level outcomes. However, the intensity variable also extends to relatively small firms in many industries, allowing us to capture an average effect over a meaningful range of firm sizes. We provide extensive distributional information on the reporting intensities in the Online Appendix (Figure A1). The figure shows the vast majority of the variation in the intensities comes from differences in firm sizes across industries and differences in thresholds across countries, which is the variation we exploit in our design (and not changes in the thresholds over time). The alternative treatment variable "Reporting and Auditing" captures the share of firms facing mandates for reporting and auditing. It has very similar statistics as "Reporting" but allows us to check if the results are different if reported financials also have to be audited and hence are more credible.

In the German sample (Panels B and C), the three treatment variables of interest are the share of limited firms ("Limited Share"), an indicator for limited firms ("Limited"), and an indicator for private firms ("Private"). The share of limited firms ("Limited Share"), calculated for all firms in a given county, industry, and year in the broad MEP data, ranges from 0% to 100%. Its average (median) is 59% (60%) at the market level (Panel B). In contrast, the share of "limited" firms in the firm-level innovation-survey data is 97% (Panel C). The remaining 3% are unlimited-liability firms of a particular type (KG, OHG), which are the most comparable to the limited firms. Similarly, the share of "private" firms in the firm-level data is 99%. The remaining 1% are publicly listed firms. The rarity of unlimited and publicly listed firms in the firm-level innovation-survey data is in part due to representative sampling and in part due to better coverage of limited firms in the innovation focused MIP data. The limited number of control firms reduces the power of firm-level analyses, which further supports our market-level design in the German setting. As noted earlier, the market-level design also

addresses spotty time series at the firm level in the MIP data, which poses a challenge in a time-series difference-in-differences design. Given the random sampling and replacement of the firms in the MIP data, we can exploit changes at the market rather than firm-level over time without substantial concerns about endogenous sample selection or attrition over time.

With respect to innovation outcomes, the descriptive statistics for the European sample (Panel A) suggest that 36% (33%) of firms in the average (median) two-digit industry are innovating (i.e., introducing new-to-the-firm or new-to-the-market products, services, or processes).[23] A little less than half of these innovations (16% on average) are not only "new to the firm," but entirely "new to the market." By contrast, the share of patenting firms is only between 1% (0%) to 6% (2%) in the average (median) industry, highlighting that patenting captures only a very small share of corporate innovation. These statistics suggest that innovative activities are widespread in the economy, i.e., performed by a large share of firms, but only few firms use patenting as a strategy to protect their innovations.

In the German sample, we find very similar patterns as in the European sample, although the German sample is slightly more tilted toward innovative firms. In the average county, 55% (60%) of firms are innovating in a given year, but again only 8% (8%) of firms apply for patents in a given year and county in Panel B (C). The share of firms with entirely new-to-the-market innovations is 29% in Panel B and 30% in Panel C. In sum, there is a substantial share of innovating firms in our sample.

6.2. Reporting Regulation in Europe

6.2.1. Main Effect of Regulation on Innovation

We begin our analysis by investigating the impact of reporting regulation on aggregate

[23] The Community Innovation Survey defines an innovation as "the introduction of a new or significantly improved product, process, organisational method, or marketing method by your enterprise. An innovation must have characteristics or intended uses that are new or which provide a significant improvement over what was previously used or sold by your enterprise. However, an innovation can fail or take time to prove itself" (Community Innovation Survey 2014a). For more details and examples, see methodological notes of the Community Innovation Survey (2014b) and the Online Appendix.

innovation in the European sample. Table 2 presents country-industry-level regressions for various measures of innovation activity on reporting intensity.[24] Innovation activity is measured at the two-digit industry level using population-weighted survey responses from the Community Innovation Surveys. At this relatively high level of aggregation, the analysis captures potential spillovers within broad industry groupings. The population-weighting ensures the representativeness of the survey-based innovation measures for a given industry and country.[25]

In Panel A, mandatory reporting intensity is not significantly associated with the average innovation spending (columns 1 and 2). However, reporting intensity is significantly negatively associated with the share of innovating firms (column 3). This share captures firms adopting products, processes, or services that are new to the firm or new to the market. Next, we decompose this broad measure of innovation activity into its key components. We find that mandatory reporting or mandatory reporting and auditing exhibit negative associations with all the key components, albeit at varying levels of significance: the share of firms reporting new-to-the-market innovations (columns 5 and 6), product innovations (columns 7 and 8), and process innovations (columns 9 and 10). In Panel B, we document similar evidence using total innovation spending and the total number of firms with innovations as our outcomes. By using totals, rather than simple averages, we essentially present size-weighted, aggregate results.

In terms of economic magnitude, our estimates imply that increasing the share of limited-liability firms that are subject to mandatory reporting by, for instance, 10 percentage points is associated with a 1.2 percentage-point decrease in the share of innovating firms (column 1 of Panel

[24] See Tables 3 and 8 in Breuer (2020) for a validation of the simulated reporting intensity and an assessment of correlated factors.

[25] Stratified random sampling was used to ensure the sample was representative. The stratification of the sample was based on the economic activity of the enterprise (NACE Rev.2 classification), on the enterprise size, and in some countries also on the geographical region (NUTS2 level). Weights are included to the responses to compensate for sampling design and unit non-response. The population weights ensure that the averages are representative for the whole industry and country. For example, in the few countries where the survey is not mandatory, it allows us to take into account that larger firms are more likely to respond to the survey compared to smaller firms. In addition, some countries oversampled larger firms in their survey, and by using population weights we adjust for such biases.

A). Considering the range in the reporting intensity, this effect is economically meaningful (but also plausible). Importantly, this estimate represents the *net* effect at the two-digit industry level. It is net of any redistribution across firms as well as positive spillovers among customers, suppliers, and competitors within the same industry, including any potential financing benefits.[26] Moreover, it is net of any long-run changes in the industries (e.g., a shift toward arm's length contracting and greater entry into the industry) spurred by greater industry-wide transparency.

Collectively, the results in Table 2 provide a first indication that reporting mandates reduce corporate innovation even after allowing for industry-wide redistribution and spillovers. The aggregate results, while economically significant, are statistically tenuous. The tenuous nature likely reflects not only low statistical power (relatively few observations at the two-digit industry-country level), but also the existence of countervailing forces, i.e., a negative direct impact for the firms that are forced to report versus positive indirect effects or spillovers on the other firms in the market. Consistent with potentially important spillovers and redistribution, the results in Table 2 document that the number of innovating firms appears to decline, while aggregate innovation spending appears unaffected. Together, these results already hint at a redistribution of innovative activity toward a limited number of (likely larger) firms, resulting in a concentration of innovation in the economy.

6.2.2. Direct versus Indirect Effects of Reporting Regulation

Next, we explore the underlying forces and decompose the aggregate *net* effect of reporting regulation into the direct effect of firms' own reporting mandates and the indirect spillover effects resulting from other firms' reporting mandates.

To empirically implement this decomposition, we construct reporting intensities capturing the extent to which *other*, yet related firms are subject to reporting mandates. We identify such related firms using input-output tables. Specifically, for each focal industry, we construct reporting intensities

[26] In subsequent sections, we explore the channels that make up the net effect of mandatory reporting. We disentangle the direct and indirect (redistribution and spillover) effects in section 6.2.2 and investigate the relative importance of financing benefits vis-à-vis proprietary costs in section 6.4.

for its input ("supplier") and output ("customer") industries. We then weight the reporting intensities of supplier and customer industries with their respective shares of inputs to and outputs from the respective focal industry. Note that the focal industry could receive inputs from or deliver outputs to firms in its own industry. But because not all suppliers and customers operate in the same two-digit industry as firms in the focal industry, the resulting supplier and customer reporting intensities differ from the focal industry's reporting intensity. This feature allows us to separately estimate the direct impact of mandating firms in a given industry and the indirect spillover impact of mandating other firms in the same industry *and* other industries (e.g., competitors, suppliers, or customers).

Table 3 presents the estimates from country-industry-level regressions of innovation activity on a focal industry's own reporting intensity and its supplier and customer reporting intensities. Controlling for supplier and customer reporting intensities, we continue to find that more extensive reporting mandates in a given industry decrease corporate innovation, consistent with our results in Table 2, but the decline in innovation is now more pronounced (for all proxies). This result makes sense because in this specification offsetting spillovers from suppliers and customers that face reporting mandates are separately estimated and no longer in the main reporting coefficient. Consistent with the notion that firms benefit from these spillovers, the coefficients on the supplier and customer intensities are typically positive and often statistically significant.

In terms of economic magnitude, our estimates imply that a 10 percentage-point increase in the share of firms subject to mandatory reporting is associated with a 2.2 percentage-point decrease in the share of innovating firms, after excluding supplier and customer spillovers (column 3 of Panel A in Table 3). The same increase in the reporting share is associated with only a 1.2 percentage-point decrease when including supplier and customer spillovers (column 3 of Panel A in Table 2). These comparisons nicely illustrate the positive spillovers from reporting mandates for customers and, in particular, suppliers. The results also highlight why it is important to conduct the regulatory analysis at an aggregate level, as otherwise one does not capture the net impact.

The results in Table 3 suggest the industry-level net effect of reporting mandates combines negative direct effects with positive indirect effects on corporate innovation. They are consistent with the notion that reporting mandates redistribute firms' gains from innovation to other related firms. For instance, customers could strike tougher bargains with their suppliers when they see that (reporting) suppliers have relatively high margins.

To further explore the redistribution of gains from innovation, Table 4 presents estimates from regressions of aggregate profitability (or productivity) on a focal industry's own reporting intensity and its supplier and customer reporting intensities. We find that imposing mandates on suppliers and customers enhances the aggregate profitability in the focal industry (columns 1 and 2), consistent with a redistribution of gains from innovation.[27] We further find that the increase in profitability due to supplier and customer mandates is primarily captured by larger firms (columns 3 and 4), as shown by an increase in the covariance between firms' market share (or size) and their profitability (in the vein of Olley & Pakes 1996; Bartelsman *et al.* 2013). Firms' own reporting mandates, by contrast, tend to hurt firms with high market shares and/or profitability, as shown by negative (albeit not statistically significant) coefficients for the own reporting intensities.

In sum, the results in Table 4 are consistent with a redistribution of innovation gains from firms facing mandates, especially profitable ones, to other firms, especially larger ones. Thus, one potential economic consequence of mandatory financial reporting is a concentration of innovation activity among larger firms in industries that are relatively less affected by the reporting mandate.

[27] We refer to revenue productivity as "profitability" because it essentially represents a ratio-based measure of profits (Foster *et al.* 2008). We tabulate the results for labor productivity, a simple measure which relates firms' sales to their amount of labor. The results are robust to using a measure of total factor productivity, which relates firms' sales to their labor and capital inputs. In the European setting, we rely on these admittedly coarse profitability measures, because many firms are exempt from reporting their profitability (limiting the availability of firms' profit information in the Amadeus data). In the following German setting, by contrast, we can use direct profitability measures specifically tied to firms' return to their innovation as reported in their survey responses.

6.3. Enforcement Reform in Germany

6.3.1. Main Effect of Regulation on Innovation

We now switch in our analysis to a single-country setting and exploit the German enforcement reform. In this setting, we can no longer aggregate at the country level and have to define markets more narrowly at the regional level, aggregating at the county and two-digit-industry level. In return, we have a more powerful setting to investigate the direct impact of mandatory reporting on affected firms, because we can exploit finer local variation in the reporting mandate and observe more detailed outcomes (e.g., firms' returns to innovation). These features also allow us to shed more light on the channels through which reporting regulation affects corporate innovation in the aggregate.

Table 5 presents the estimates from county-industry-level regressions of innovation activities on the interaction of the share of limited firms and a post-enforcement indicator. This interaction essentially captures the increase in the effective strength of the reporting mandate at the local market level. That is, the enforcement reform had a larger effect in markets with a high share of limited firms, which after the reform face a much more stringent reporting mandate.[28]

In column 1 of Panel A, we find that the increase in the strength of the mandate is associated with significantly lower innovation spending. Figure 1 plots the innovation spending effect over time. Consistent with the parallel trends assumption, we do not observe a differential trend between markets with higher vis-à-vis lower shares of limited firms in the pre-enforcement period. After the reform, innovation spending declines, at first gradually and then stabilizes at a significantly lower level.[29] In addition to innovation spending, we find that the share of innovating firms (broadly defined) declines after the enforcement reform. Similar declines are also observed for the individual components of

[28] See Figure A1 in Breuer (2020) for evidence that county-industries with greater limited-liability-firm shares exhibit larger increases in public financial reporting after the enforcement reform than county-industries with lower shares.

[29] The enforcement regime became effective for fiscal years ending December 31, 2006, and later. There is an approximately 12-months lag between the fiscal-year end and the publication date. Between December 31, 2006 and December 31, 2007, 123,446 financial statement were publicly available. The following year, 1,079,235 financial statements were publicly available, covering nearly all limited liability firms in Germany (Bundesanzeiger 2019). Given that the timing of the reform overlaps with the 2007 financial crisis and the ensuing great recession, we corroborate in section 6.4.2 that our results are not confounded by worsened access to external financing (see also Vanhaverbeke *et al.* 2019).

this measure: the share of firms with new-to-market innovations, product innovations, and process innovations. Panel B documents that these declines are also observed for total spending and the total number of firms with any of these types of innovation, which implies that the results not only hold for the average firm in an industry and county, but also in the (size-weighted) aggregate.

Collectively, the results in Table 5 suggest more extensive mandatory reporting reduces innovation activity in local markets. These results are consistent with and corroborate the earlier findings in the European setting. The negative impact of mandatory reporting is estimated with greater power at the local level than in the European setting, as evidenced by much higher significance levels. This increase in power is likely driven by two factors: (i) the larger number of observations and (ii) the local market design, which is less aggregated and hence accommodates fewer offsetting spillovers. As such, the local market results primarily capture the *direct* impact of the mandate on innovation, not the net impact including spillovers. This feature could explain why we find a negative effect on innovation spending in the German setting, but fail to find one in the more aggregated European setting. To explore this explanation, we next examine whether the local impact of the mandate depends on the number of firms in the market that can provide offsetting spillovers.

6.3.2. Heterogeneous Effects in Competitive vs. Monopolistic Markets

In this section, we estimate separate effects for the enforcement reform in local markets with many firms (more competitive) and few firms (more monopolistic). Table 6 provides estimates from county-industry-level regressions of innovation on the strength of the mandate, separately for local markets with an above median number of firms ("high") and markets with a below median number of firms ("low"). We find that mandatory reporting is more negatively associated with innovation spending and innovating firms in markets with few firms, i.e., in regional oligopolies or monopolies. Notably, the decline in spending in markets with few firms appears to be driven by local monopolists

stopping innovation activities altogether (column 4).[30]

The results in Table 6 provide an explanation for why we observe negative spending effects in the local market design, yet do not observe a clear decline in the more aggregated European setting. In the local market design, local markets with few firms tend to dominate or be overrepresented compared to a sample using firm-level observations. Our results suggest that, in these markets, local monopolists stop innovating, so spending goes down. In the economy-wide, European setting, the spending declines of local monopolists are less relevant and/or offset by the shift in innovation activities to other larger firms in the economy, as suggested by our results in Table 2 and Table 4.

Collectively, the results in Table 6 suggest that mandatory reporting primarily discourages innovation activity of local monopolists. This makes sense considering that local monopolists cannot benefit from offsetting information spillovers from other local firms, whereas firms in crowded markets at least benefit from other firms' reporting. Put differently, a mandate is less costly if firms can reciprocally exploit each other's disclosures. The results in Table 6 are further consistent with the idea that, absent any reporting mandate, local monopolists can protect their rents from innovation via secrecy. Firms in more crowded markets, by contrast, are less likely to earn substantial rents to begin with and cannot easily hide their profits and rents given the proximity of their competitors, which facilitates the dissipation of proprietary information even absent reporting mandates (e.g., via employee poaching) (Li *et al.* 2017; Glaeser 2018). To shed light on the importance of proprietary costs from financial reporting for the negative innovation effect, we explicitly investigate the effects on profitability and economic gains from innovation in the next section.

[30] In supplemental tests, we document that the impact is concentrated along the extensive margin in the local market design (Table A1). In the firm-level design, the impact of the mandate occurs primarily at the intensive margin, as this design focuses on firms operating in the more crowded markets (due to the implicit requirement of the fixed effects, which require at least one control firm in the same county-year and industry-year).

6.4. Channels and Alternative Explanations

6.4.1. Proprietary Costs versus Innovation Efficiency

Our results are consistent with reporting regulation discouraging corporate innovation, because it dissipates firms' gains from innovation. However, an alternative interpretation is that our findings reflect improved innovation efficiency. Information on other firms' innovative activities can, for example, help firms identify worthwhile activities and avoid duplicate innovation efforts. To distinguish between these potential explanations, we investigate several measures that reflect the economic returns to innovation. We expect to observe lower returns if mandatory reporting dissipates gains from innovation, whereas we expect to observe unchanged or even improved returns if a reporting mandate enhances innovation efficiency.

Table 7 presents the estimates from county-industry-level regressions of various returns to innovation measures on the effective strength of the German reporting mandate. We find that an increase in the strength of the mandate is negatively associated with firms' profit margins, sales from new-to-market innovations, the share of sales from new-to-market innovations among total sales, the share of sales increases from quality improvements, and cost reductions from process improvements (all at the county-industry level).[31] Thus, the returns to innovation decline across the board after the enforcement reform strengthened the reporting mandate in Germany.

In sum, the results in Table 7 support the interpretation that the channel for the effect of reporting mandates on innovation is the proprietary costs of reporting. They do not appear consistent with the alternative interpretation that reporting mandates enhance the efficiency of innovations. Further supporting this conclusion are the results of our earlier analyses showing declines not just in innovation inputs (e.g., spending), but especially in innovation outputs (e.g., product, process, or service innovations). Notably, we find that even new-to-the-market innovations decline, which is

[31] We calculate the aggregate percent of sales from new-to-market innovations by weighting the reported percentages with available sales data. By contrast, we aggregate the share of sales increases due to quality improvements by simply calculating the total and taking its logarithm (plus one) as the data does not allow us to observe the sales increase amount relative to which the survey respondents stated the percentage number.

inconsistent with a mere reduction of duplicate efforts.

6.4.2. Financing Frictions

Another potential channel through which reporting regulation could affect innovation is through its impact on firms' ability to finance new investments (e.g., Brown *et al.* 2009; Kerr & Nanda 2015; Brown & Martinsson 2018; Park 2018). Our results suggest that this channel is insufficient to (over)compensate the decline in industry-wide innovation due to proprietary costs. Arguably, this outcome is not particularly surprising in our setting. Capital-market benefits often motivate firms' voluntary reporting. That is, firms that, on net, benefit from more disclosure can always provide it voluntarily. As a result, mandatory reporting primarily expands the reporting of firms, for whom the capital-market benefits of public reporting do *not* outweigh the corresponding costs (e.g., proprietary costs). In our sample of private firms, the capital-market benefits from public reporting are limited for most firms because they obtain financing from a limited number of capital providers (e.g., owner-managers and relationship banks) with whom they can and do communicate privately. The private communication allows firms to inform their main capital providers and to reduce financing frictions, but avoids the leakage of proprietary information.

Although we expect the capital-market benefits from a mandate to be smaller for private firms, there may still be instances in which the mandate has financing benefits for some firms in the industry or the industry as a whole (e.g., due to spillovers, standardization, and reduction of duplicate information collection efforts; Minnis & Shroff 2017).[32] Consistent with this line of reasoning, Table 8 documents that firms report fewer external financing constraints as an impediment to innovation after the enforcement reform strengthened the reporting mandate in Germany. We also find some evidence suggesting fewer internal financing constraints. These results are consistent with a large literature in accounting (Leuz & Wysocki 2016) and suggest mandatory reporting comes with capital-

[32] See, for example, Garmaise and Natividad (2016) for information spillovers from transparent firms to others and improved access to credit. See (Zingales 2009) and Leuz (2010) for overviews on the benefits of mandatory reporting.

market benefits, in our case at the market level. Still, these benefits are not large enough to produce a positive net effect with respect to market-wide innovation.

Importantly, the evidence in Table 8 and Figure 1 also allays concerns that the negative impact on innovation in the German setting reflects confounding influences from the financial crisis, which occurred in the post-period of the enforcement reform. The documented reduction in financing constraints is inconsistent with the explanation that the crisis hit limited-liability firms harder than unlimited-liability firms (e.g., as a result of limited collateral), which in turn spuriously results in a negative innovation effect. Note further that our analysis includes county-year fixed effects, which should absorb much of the crisis impact on innovation. We nevertheless gauge if there is any residual impact of the crisis on our results by controlling (locally) for firms' exposures to the distress of a major German bank (Commerzbank) during the financial crisis (Huber 2018) and find that inferences are largely unaffected (Table A2).[33]

6.5. Other Measures of Corporate Innovation

Our results are based on fairly broad, yet concrete innovation measures derived from firms' confidential responses to the Community Innovation Surveys. These survey-based measures are frequently used in innovation research and policy. In contrast, studies in accounting, finance, and economics tend to rely on patents and accounting information (R&D expenses) to measure corporate innovation activity. In this section, we investigate the impact of reporting regulation on these alternative measures of innovation to align our findings with the literature and also to validate the survey responses used to measure innovation.

6.5.1. Patents

Patents reflect innovation but they also represent one particular form with which firms protect rents from innovation. Moreover, patents grant formal legal protection only in exchange for mandated

[33] It is worth noting that our German results are consistent with the European setting and that, in the latter, we do not exploit changes over (crisis) time but instead rely on a cross-sectional identification strategy. Thus, it is unlikely that the financial crisis or other major shocks during our sample period drive our results.

disclosure of patent information. These features have two important implications. First, patents capture only a subset of innovations. Supporting this claim, our descriptive evidence documents that only a small fraction of all innovation activity is patented (in line with, e.g., Arundel & Kabla 1998; Argente *et al.* 2020; Granja & Moreira 2020). Second, patents are a form of disclosure. As such, firms' patenting and reporting strategies are intertwined (e.g., Glaeser *et al.* 2019; Reeb & Zhao 2020).

These institutional features render the effect of mandatory reporting on corporate patenting ambiguous. On the one hand, a mandate could decrease patents through their negative impact on innovation activity. On the other hand, the increase in reporting due to the mandate makes it more important for firms to protect their innovations in some other way (as secrecy is less effective), which in turn could increase the use of patents. Thus, patents are arguably a problematic measure of innovative activity when studying the aggregate impact of reporting mandates.

Consistent with an ambiguous relationship, we find in Table 9 that reporting mandates are positively associated with patenting in the aggregate design of the European setting (Panel A), whereas they are negatively associated with patenting in the local market design of the German setting (Panel B). The positive association in the aggregate design likely reflects the increased use of patenting to protect firms' remaining innovations. In the local market design, however, the negative association reflects that local monopolists do not have (m)any remaining innovations to protect, as they often stop innovating altogether. In line with this interpretation, Panel C shows (using the firm-level design) that firms' survey responses indicate that secrecy has become less important after the reform effectively expanded the mandate. At the same time, the importance of patenting and actual patent applications increase after the reform (Panel C). Note that the firm-level analysis by construction is tilted towards more crowded markets (as it is weighted by each firm-year). Firms in these markets reduce their innovation spending only along the intensive margin, but do not stop innovating altogether. Accordingly, these firms shift from secrecy toward patenting for their remaining innovations. Thus, our local-market and firm-level results are internally consistent.

Besides illustrating the ambiguous relation between mandatory reporting and patenting, the results in Table 9 document that firms' responses to the Community Innovation Survey align with their actual patenting behavior recorded in PATSTAT. In each of the panels of Table 9, the respective treatment variable is associated with firms' survey responses in the same direction as it is with firms' actual patenting behavior. This correspondence validates the survey-based innovation measures.

Lastly, the patenting results in Table 9 reinforce the proprietary costs explanation for the negative effect of reporting on corporate innovation. In column 3 of Panel A, we find that reporting mandates increase the share of patent citations *originating from competitors* in the same country-industry. This finding is consistent with the interpretation that reporting mandates increase within-industry competition by revealing the profitability of innovative firms to which innovative firms respond by increasing their patenting (which in turn competitors have to cite).

6.5.2. Accounting Information

Financial statements reflect firms' innovation activity in various, though imperfect ways. The balance sheet, for example, provides information on the investments in tangible and some intangible assets. Most intangible assets, however, do not make it onto the balance sheet (e.g., Lev 2001). In addition to the balance sheet, the income statement can, for example, provide an estimate of firms' R&D expenses. Often, however, these expenses are not broken out separately and buried in other expense line items (e.g., Koh & Reeb 2015). The absence of comprehensive and innovation-specific items hampers the usefulness of individual accounting line items for our purpose of assessing the aggregate impact of reporting mandates. This issue is compounded by the fact that reporting mandates mechanically affect the availability of accounting-based innovation measures through their impact on the availability of accounting information (e.g., for database providers). For example, aggregate R&D may appear to be increasing after a reporting mandate simply because it forces more firms to disclose R&D expenses. With these caveats in mind, we examine the relation between mandatory reporting and accounting-based innovation measures, on one hand to check for consistency with our main

results and on the other hand to make our results comparable to other studies in the literature.

Consistent with our earlier results, reporting mandates are negatively associated with measures of innovation derived from accounting numbers (Table 10). We find that reporting mandates are negatively associated with investments in tangible and, in particular, intangible assets. We further find some evidence that reporting mandates are negatively associated with firms' R&D intensity (defined as R&D expenses over sales), albeit insignificantly. The lack of significance is likely a consequence of power as the coefficient magnitudes are sizeable. The R&D intensity results are estimated based on a severely restricted subsample, as only few European companies provide as a separate R&D line item in the income statement and hence is often missing in the Amadeus database. Despite these limitations, the results for the accounting-based innovation measures support our conclusion that mandatory reporting reduces corporate innovation.

7. Discussion of the Results

Using multiple settings and detailed innovation input and output data, we consistently find that mandatory reporting reduces the prevalence of corporate innovation activities. This decline in the prevalence of innovation activity does not appear to reflect a reduction in wasteful duplication of innovation efforts and a corresponding increase in innovative efficiency. Instead, the results point to reduced incentives to innovate, even after accounting for positive spillovers within broad two-digit industries. They provide a plausible explanation for why Breuer (2020) finds that reporting mandates spur competition, yet do not appear to have positive (or may even have negative) effects on industry-level productivity growth. We emphasize, however, that the question of whether the negative net impact of mandatory reporting on industry-level innovation generalizes to the economy-wide level is still unclear as our aggregate analysis neglects potential cross-industry and cross-country spillovers. What is clear though is that reporting regulation has important distributional consequences: some firms win, others lose. This distributional impact can have important ramifications for market structure and innovation incentives at the economy level.

Our evidence is consistent with the notion that reporting regulation deters corporate innovation due to the dissipation of proprietary information to competitors and contracting partners (e.g., suppliers). Looking at our evidence as well as related work, we surmise that three interrelated economic mechanisms are at play. First, reporting mandates diminish firms' bargaining power and rents (Melitz & Ottaviano 2008; Breuer 2020), limiting the rewards from innovation. Consistent with this mechanism, we find negative effects on profit margins and positive effects from customer and supplier reporting, both of which are consistent with learning and increased bargaining power. Second, reporting mandates have been shown to shorten the duration of firms' contracting relationships (Dewatripont & Maskin 1995; Hombert & Matray 2016; Breuer *et al.* 2018; Sutherland 2018), which in turn likely hurts the incentives for long-term investments such as R&D. Third, reporting mandates increase the number of contracting partners (Berger *et al.* 2001; Asker & Ljungqvist 2010; Saidi & Zaldokas 2019), reducing the efficacy of secrecy as a strategy to protect proprietary information and know-how about innovative products, services and processes. Broadly speaking, the three mechanisms are consistent with a shift away from relationships and the notion that disclosure regulation is integral to and furthers arms' length transactions (e.g., Leuz & Wüstemann 2004).

We find the strongest effects from mandatory reporting among smaller firms and in local markets with few existing competitors. This pattern suggests smaller, local monopolists in niche markets are particularly affected. Without a mandate, these firms can essentially hide their existence or at least their profitability. By contrast, firms operating in crowded and competitive markets earn limited rents and are well known, so they cannot hide much, irrespective of financial reporting. Similar arguments can be made for firms that already make very active use of patenting and hence have to provide substantial and detailed information about their innovations. They are likely less affected than smaller and lesser known firms in niche markets using primarily secrecy to protect their innovations.

Consistent with this line of arguments, we find the strongest effects of reporting regulation along the extensive instead of the intensive margins of innovation spending, innovation outputs, and

patenting. An interesting implication of these findings and patterns is that mandatory reporting appears to lead to a concentration of innovative activity at larger firms operating across several industries. Consistent with such a concentration, Bernard (2016) and Breuer (2020), analyzing market entry effects, document that it is predominantly larger competitors that enter into local niche markets in response to reporting mandates. As a result, reporting mandates can reduce market-share concentration in local markets and narrow industries as shown in Breuer (2020), but still increase the concentration of market power at the national level and across industries (Rossi-Hansberg *et al.* 2019). Such concentration of market power and innovative activity among larger firms is consistent with recent and broader trends in innovation activity (Rammer & Schubert 2018; EU 2019a). Similar to other information technologies (e.g., Begenau *et al.* 2018; Farboodi *et al.* 2019), reporting mandates appear to disproportionally benefit larger firms. It is plausible that the direct effect of a mandate on corporate innovation tends to hit larger firms less than smaller firms. Larger firms often disclose much more information voluntarily (e.g., Buzby 1975; Dedman & Lennox 2009; Breuer *et al.* 2020), can hide sensitive information through complexity (e.g., Bens *et al.* 2011), and face smaller, resource-constrained competitors. At the same time, the indirect (spillover) effect of a reporting mandate tends to benefit larger firms more than smaller firms. The former can exploit investment opportunities that are revealed by a competitor or contracting partner through the mandate more easily, given, among others, their financial resources, data-processing capabilities, and existing advertising channels.

8. Conclusion

In this study, we examine the effects of financial reporting regulation on corporate innovation. We analyze two different settings: threshold-based reporting mandates in the EU and a major enforcement reform in Germany, both of which give rise to plausibly exogenous differences in the intensity with which European and German firms face reporting mandates. The two settings have different advantages and drawbacks, but provide remarkably consistent findings and conclusions.

We find evidence that requiring firms to publicly disclose their financial reports reduces

mandated firms' innovation incentives, but increases their propensity to use patenting as a means to protect their innovations. At the same time, we find that mandated firms' reporting spurs innovation incentives of other firms (e.g., competitors, customers, or suppliers), especially larger ones. The net impact of these countervailing forces on the prevalence of corporate innovation activity appears to be negative, at least at our highest level of aggregation (i.e., the country-industry level).

Our evidence is consistent with the notion that mandatory reporting deters firms' incentives to innovate and generate proprietary know-how because of concerns about the loss of proprietary information. While our evidence suggests reporting regulation provides positive information spillovers benefiting other firms, they appear not large enough to fully offset the decline in the number of innovating firms *at the industry level*. In summary, our evidence suggests that proprietary costs and the ensuing reduction or, at least, concentration of corporate innovation in the economy are important considerations for regulators and policy makers when setting reporting regulation.

In closing, we want to reiterate the following caveats. While we are ultimately interested in whether innovation activity is lost to the economy due to reporting regulation, our ability to speak to this overarching question is constrained by two important limitations. First, our highest level of aggregation is at the country-industry level, not the economy level. We choose the country-industry level because industry level variation enhances power (more observations) and affords identification with respect to reporting regulation, which is endogenous at the economy level. Compared to the commonly used firm-level analysis, this aggregation level makes an important step toward accommodating spillovers among related firms. However, it neglects potential spillovers across broad industries and country boundaries. Second, our survey-based innovation measures best capture the *prevalence* of innovation activity rather than its aggregate *value*. While our measures are more innovation-specific and comprehensive than most other measures (e.g., patents or accounting information), they do not perfectly capture the value-weighted aggregate of innovation activity, which would be the ideal measure necessary to conclusively answer our motivating question.

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Variable Appendix

VARIABLE DEFINITIONS		
Panel A: Exemptions in Europe		
Treatment	Source	Description
Reporting	Amadeus	Share of firms above country-level reporting threshold calculated using a standardized firm-size distribution per industry
Auditing	Amadeus	Share of firms above country-level auditing threshold calculated using a standardized firm-size distribution per industry
Reporting and Auditing	Amadeus	Minimum of "Reporting" and "Auditing"
Supplier Reporting	Amadeus/Eurostat	Reporting share of domestic supplier industries (calculated by weighting reporting shares with domestic input shares for a given focal industry using Eurostat's FIGARO input-output table)
Customer Reporting	Amadeus/Eurostat	Reporting share of domestic customer industries (calculated by weighting reporting shares with domestic output shares for a given focal industry using Eurostat's FIGARO input-output table)
Supplier Reporting and Auditing	Amadeus/Eurostat	Minimum of reporting and auditing share of domestic supplier industries (calculated by weighting reporting shares with domestic input shares for a given focal industry using Eurostat's FIGARO input-output table)
Customer Reporting and Auditing	Amadeus/Eurostat	Minimum of reporting and auditing share of domestic customer industries (calculated by weighting reporting shares with domestic output shares for a given focal industry using Eurostat's FIGARO input-output table)
Outcomes	Source	Description
Innovation Spending	Eurostat	Log of total innovation spending (includes in-house and external R&D, acquisition of external knowledge, equipment, machinery or software for innovation purposes, product design and professional development of innovation activities and marketing of innovation) plus one
Innovating Firm	Eurostat	Indicator taking the value of one for firms that introduce new or significantly improved products, processes, or services
New-To-Market Innovation	Eurostat	New-to-the-market innovations (the enterprise was the first one to market these products/services)
Product Innovation	Eurostat	Indicator taking the value of one for firms that introduce new or significantly improved

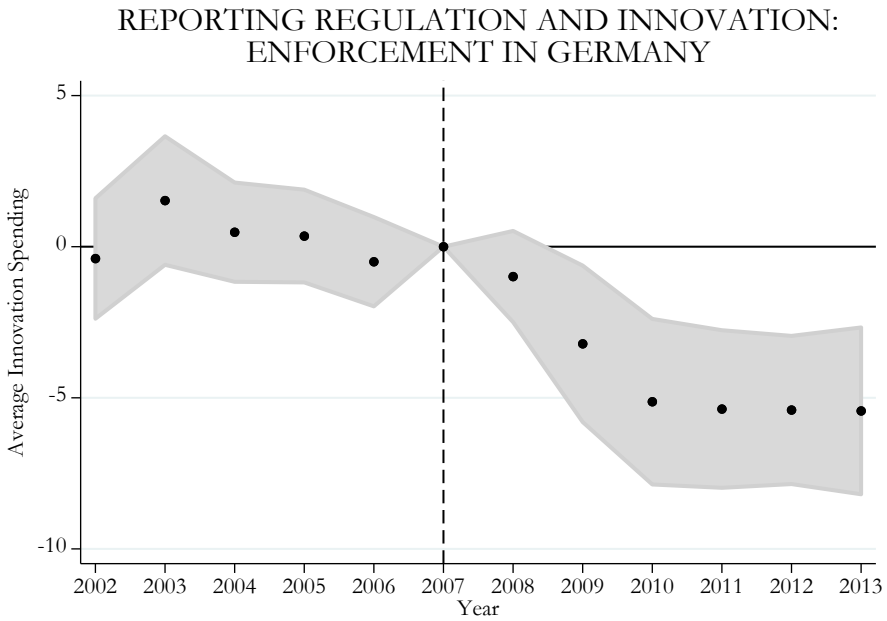
		products
Process Innovation	Eurostat	Indicator taking the value of one for firms that introduce new or significantly improved services
Sales per Employee	Amadeus	Log sales less log employees
Sales per Employee and Capital	Amadeus	Log sales less 0.3 times log tangible assets and 0.7 log employees
Market Share and Sales per Employee	Amadeus	Covariance between market share and sales per employee calculated as the difference between the market-share weighted sales per employee and the simple average of sales per employee
Market Share and Sales per Employee and Capital	Amadeus	Covariance between market share and sales per employee and capital calculated as the difference between the market-share weighted sales per employee and capital less and the simple average of sales per employee and capital
Patenting Firm	Eurostat	Indicator taking the value of one for firms that apply for a patent
Patent Application Firm	PATSTAT	Indicator taking the value of one for firms that apply for a patent
Competitor-Forward Cites	PATSTAT	Share of forward patent cites from competitors in same country-industry
Change in Tangible Assets	Amadeus	Log difference in tangible assets over time
Change in Intangible Assets	Amadeus	Log difference in intangible assets over time
R&D Intensity	Amadeus	R&D expense scaled by sales

Panel B: Enforcement Reform in Germany		
Treatment	Source	Description
Limited Share	Creditreform	Share of limited-liability firms among firms in county, industry, and year
Limited	Creditreform	Indicator taking the value of one for limited-liability/affected firms (GmbH, GmbH & Co. KG), and zero for unlimited-liability firms (KG, OHG)
Private	Creditreform	Indicator taking the value of one for private limited-liability firms, and zero for publicly-listed firms (sample restricted to: GmbH, GmbH & Co. KG, and AG)
Supplier Limited Share	Creditreform/Eurostat	Limited-liability share of local supplier industries for a given industry (calculated by weighting the limited share of supplier industries of a given industry in a given county by domestic input shares from Eurostat's FIGARO input-output table)
Customer Limited Share	Creditreform/Eurostat	Limited-liability share of local customer industries for a given industry (calculated by weighting the limited share of customer industries of a given industry in a given county by domestic output shares from Eurostat's FIGARO input-output table)
Post	Creditreform	Indicator taking the value of one for years after 2007, and zero before
Outcomes	Source	Description
Innovation Spending	MIP	Log (plus 1) of total innovation spending (includes in-house and external R&D, acquisition of external knowledge, equipment, machinery or software for innovation purposes, product design and professional development of innovation activities and marketing of innovation)
Innovation Spending (Extensive)	MIP	Indicator taking the value of one for firms with positive total innovation spending, and zero for firms with zero spending
Innovation Spending (Intensive)	MIP	Log of total innovation spending (for firms with positive spending only)
New-To-Market Innovations	MIP	New-to-the-market innovations (the enterprise was the first one to market these products/services)
Innovating Firm	MIP	Indicator taking the value of one for firms that introduce new or significantly improved products, processes, or services

Product Innovation	MIP	Indicator taking the value of one for firms that introduce new or significantly improved products
Process Innovation	MIP	Indicator taking the value of one for firms that introduce new or significantly improved processes
Importance of Secrecy	MIP	Importance of secrecy as a means to protect innovations (scale: 0 to 3)
Importance Patenting	MIP	Importance of patents as a means to protect innovations (scale: 0 to 3)
Patent Applications	PATSTAT	Log (plus 1) of number of applied patents
Patenting Firm	PATSTAT	Patent application indicator
Profit Margin	MIP	Level of profit margin (scale: 1 to 9)
Sales from New-to-Market Innovations	MIP	Log (plus 1) of sales from new-to-market innovations
Share of Sales from New-to-Market Innovations	MIP	Share of sales attributable to new-to-market innovations
Share of Sales Increase from Quality Improvements	MIP	Log (plus 1) share of sales increase attributable to quality improvements
Cost Reduction from Process Improvements	MIP	Indicator taking the value of one for firms with a cost reduction due to process improvements
External Financing Constraint	MIP	Indicator taking the value of one for firms for which external financing constitutes a constraint to innovation
Internal Financing Constraint	MIP	Indicator taking the value of one for firms for which internal financing constitutes a constraint to innovation
Controls	Source	Description
Employees	Amadeus/Creditreform	Log (plus 1) number of employees

Figures & Tables

Figure 1



Notes: The figure presents the relation between innovation spending and the intensity of the enforcement of reporting mandates over time. The black dots represent difference-in-differences coefficients for each year (with 2007 as the base year) from a regression of average innovation spending at the county, industry, and year level on the share of affected (limited) firms in the pre-enforcement period interacted with individual year indicators. The gray area represents a pointwise 90% confidence interval.

Table 1

DESCRIPTIVE STATISTICS

Panel A: Exemptions in Europe (Country-Industry Level)

Variable	Market Level	N	Mean	SD	p1	p25	p50	p75	p99
Reporting		31,953	0.220	0.271	0.001	0.054	0.123	0.252	1.000
Reporting and Auditing		31,953	0.159	0.176	0.001	0.050	0.111	0.209	1.000
Supplier Reporting		16,971	0.224	0.264	0.009	0.092	0.143	0.210	0.997
Customer Reporting		16,662	0.244	0.264	0.009	0.103	0.164	0.245	0.999
Supplier Reporting and Auditing		16,971	0.158	0.155	0.009	0.088	0.136	0.187	0.993
Customer Reporting and Auditing		16,662	0.178	0.158	0.009	0.098	0.156	0.220	0.997
Innovation Spending	Simple Average	6,316	11.206	2.949	0.000	10.147	11.543	12.828	16.725
Innovation Spending	Total	6,326	16.067	3.857	0.000	14.847	16.630	18.282	22.056
Innovating Firm	Simple Average	6,662	0.362	0.221	0.000	0.196	0.333	0.496	1.000
Innovating Firm	Total	6,672	218.280	598.071	0.000	11.398	43.480	153.798	2786.903
New-To-Market Innovations	Simple Average	6,694	0.161	0.167	0.000	0.041	0.113	0.232	0.911
New-To-Market Innovations	Total	6,704	83.566	250.299	0.000	3.180	15.077	56.750	1104.041
Product Innovation	Simple Average	6,703	0.258	0.207	0.000	0.101	0.215	0.370	1.000
Product Innovation	Total	6,713	146.072	422.455	0.000	7.000	28.590	101.414	1913.684
Process Innovation	Simple Average	6,631	0.273	0.188	0.000	0.142	0.246	0.362	1.000
Process Innovation	Total	6,641	161.052	432.180	0.000	8.083	32.270	115.614	2210.229
Sales per Employee	Weighted Average	30,977	12.676	1.481	9.766	11.780	12.544	13.302	17.518
Sales per Employee and Capital	Weighted Average	30,802	9.341	1.122	7.127	8.652	9.234	9.832	12.876
Market Share and Sales per Employee	Covariance	30,273	1.089	0.916	-0.401	0.499	0.920	1.477	4.230
Market Share and Sales per Employee and Capital	Covariance	30,044	0.705	0.735	-0.584	0.242	0.570	1.012	3.262
Patenting Firm	Simple Average	3,198	0.059	0.120	0.000	0.000	0.016	0.062	0.562
Patent Application Firm	Simple Average	31,936	0.008	0.025	0.000	0.000	0.000	0.004	0.114
Actual Reporting	Simple Average	31,953	0.194	0.270	0.000	0.022	0.074	0.231	1.000
Competitor-Forward Cites	Simple Average	11,773	0.022	0.072	0.000	0.000	0.000	0.012	0.307
Change in Tangible Assets	Simple Average	31,688	-0.028	0.499	-2.642	-0.056	-0.001	0.067	0.618
Change in Tangible Assets	Weighted Average	31,353	0.015	0.575	-2.669	-0.037	0.031	0.116	1.049
Change in Intangible Assets	Simple Average	30,865	-0.189	0.578	-2.898	-0.265	-0.150	-0.038	0.850
Change in Intangible Assets	Weighted Average	30,276	-0.062	0.776	-3.068	-0.223	-0.049	0.120	2.047
R&D Intensity	Simple Average	2,990	0.912	11.942	0.000	0.003	0.021	0.085	15.122
R&D Intensity	Weighted Average	2,990	0.107	1.771	0.000	0.002	0.014	0.049	1.012

Panel B: Enforcement Reform in Germany (County-Industry Level)									
Variable	Market Level	N	Mean	SD	p1	p25	p50	p75	p99
Limited Share		56,929	0.589	0.231	0.000	0.436	0.596	0.764	1.000
Supplier Share		37,425	0.603	0.164	0.161	0.520	0.627	0.712	0.926
Customer Share		37,425	0.606	0.139	0.225	0.529	0.621	0.698	0.898
Post		56,929	0.371	0.483	0.000	0.000	0.000	1.000	1.000
Innovation Spending ('000 Euros)	Simple Average	29,702	4,587.016	83,351.990	0.000	0.000	30.000	400.000	42,600.040
Innovation Spending ('000 Euros)	Total	29,702	7,017.119	118,556.900	0.000	0.000	40.000	510.000	61,999.950
Innovation Spending	Simple Average	29,702	7.446	6.365	0.000	0.000	10.309	12.899	17.567
Innovation Spending	Total	29,702	7.648	6.540	0.000	0.000	10.597	13.142	17.943
Spending (Extensive)	Simple Average	29,702	0.531	0.467	0.000	0.000	0.500	1.000	1.000
Spending (Extensive)	Total	29,702	0.809	1.157	0.000	0.000	1.000	1.000	4.000
Spending (Intensive)	Simple Average	17,704	12.650	2.188	8.006	11.238	12.612	14.021	18.310
Spending (Intensive)	Total	17,704	12.831	2.291	8.006	11.290	12.766	14.316	18.661
New-To-Market Innovations	Simple Average	26,725	0.291	0.424	0.000	0.000	0.000	0.667	1.000
New-To-Market Innovations	Total	26,725	0.432	0.741	0.000	0.000	0.000	1.000	3.000
Innovating Firm	Simple Average	49,466	0.551	0.445	0.000	0.000	0.600	1.000	1.000
Innovating Firm	Total	49,466	1.090	1.890	0.000	0.000	1.000	1.000	7.000
Product Innovation	Simple Average	48,876	0.441	0.444	0.000	0.000	0.400	1.000	1.000
Product Innovation	Total	48,876	0.877	1.619	0.000	0.000	1.000	1.000	6.000
Process Innovation	Simple Average	48,800	0.367	0.426	0.000	0.000	0.000	1.000	1.000
Process Innovation	Total	48,800	0.715	1.253	0.000	0.000	0.000	1.000	5.000
Importance Patenting	Simple Average	30,063	0.577	1.005	0.000	0.000	0.000	1.000	3.000
Importance Patenting	Total	30,063	0.895	1.784	0.000	0.000	0.000	2.000	7.000
Patent Applications	Simple Average	56,929	0.139	0.497	0.000	0.000	0.000	0.000	2.565
Patent Applications	Total	56,929	0.210	0.667	0.000	0.000	0.000	0.000	3.367
Patenting Firm	Simple Average	56,929	0.077	0.229	0.000	0.000	0.000	0.000	1.000
Patenting Firm	Total	56,929	0.165	0.474	0.000	0.000	0.000	0.000	2.000
Profit Margin	Simple Average	26,851	3.605	1.724	1.000	2.000	3.500	5.000	7.000
Profit Margin	Total	26,851	5.302	6.747	1.000	2.000	4.000	6.000	26.000
Sales from New-to-Market Innovation	Simple Average	26,293	10.529	9.943	0.000	0.000	16.305	19.729	24.960
Sales from New-to-Market Innovation	Weighted Average	26,293	10.699	10.106	0.000	0.000	16.540	20.060	25.386
Share of Sales from New-to-Market Innovation	Simple Average	26,293	0.037	0.103	0.000	0.000	0.000	0.025	0.500
Share of Sales from New-to-Market Innovation	Total	26,219	0.037	0.106	0.000	0.000	0.000	0.020	0.510
Share of Sales Increase from Quality Improvements	Simple Average	22,619	0.021	0.059	0.000	0.000	0.000	0.005	0.262
Share of Sales Increase from Quality Improvements	Total	22,619	0.029	0.077	0.000	0.000	0.000	0.010	0.405
Cost Reduction from Process Improvements	Simple Average	24,168	0.265	0.415	0.000	0.000	0.000	0.500	1.000

Cost Reduction from Process Improvements	Total	24,168	0.364	0.613	0.000	0.000	0.000	1.000	2.000
External Financing Constraint	Simple Average	24,562	0.329	0.440	0.000	0.000	0.000	1.000	1.000
External Financing Constraint	Total	24,562	0.489	0.832	0.000	0.000	0.000	1.000	3.000
Internal Financing Constraint	Simple Average	24,451	0.369	0.452	0.000	0.000	0.000	1.000	1.000
Internal Financing Constraint	Total	24,451	0.551	0.903	0.000	0.000	0.000	1.000	3.000
Employees	Simple Average	55,601	401.813	4,482.303	1.000	14.000	45.000	143.000	4,153.000
Employees	Total	55,601	868.681	8,925.645	1.000	17.000	69.000	261.000	10,808.000
Employees (Log)	Simple Average	55,601	3.950	1.606	0.693	2.708	3.829	4.970	8.332
Employees (Log)	Total	55,601	4.360	1.847	0.693	2.890	4.248	5.568	9.288

Panel C: Enforcement Reform in Germany (Firm Level)								
Variable	N	Mean	SD	p1	p25	p50	p75	p99
Limited	129,739	0.972	0.166	0.000	1.000	1.000	1.000	1.000
Private	123,692	0.991	0.093	1.000	1.000	1.000	1.000	1.000
Post	135,437	0.565	0.496	0.000	0.000	1.000	1.000	1.000
Innovation Spending ('000 Euros)	51,500	4,083.832	85,419.280	0.000	0.000	10.000	280.000	36,300.000
Innovation Spending	51,500	6.646	6.417	0.000	0.000	9.210	12.543	17.407
Spending (Extensive)	51,500	0.533	0.499	0.000	0.000	1.000	1.000	1.000
Spending (Intensive)	27,449	12.470	2.156	8.006	11.002	12.429	13.816	18.120
New-To-Market Innovations	44,462	0.297	0.457	0.000	0.000	0.000	1.000	1.000
Innovating Firm	110,582	0.564	0.496	0.000	0.000	1.000	1.000	1.000
Product Innovation	108,796	0.453	0.498	0.000	0.000	0.000	1.000	1.000
Process Innovation	108,476	0.369	0.482	0.000	0.000	0.000	1.000	1.000
Importance Secrecy	38,191	0.991	1.257	0.000	0.000	0.000	2.000	3.000
Importance Patenting	55,249	0.591	1.079	0.000	0.000	0.000	1.000	3.000
Patent Applications	135,437	0.113	0.474	0.000	0.000	0.000	0.000	2.398
Patenting Firm	135,437	0.080	0.271	0.000	0.000	0.000	0.000	1.000
Employees	131,797	408.530	5,942.451	1.000	11.000	33.000	117.000	4,129.000
Employees (Log)	131,797	3.748	1.640	0.693	2.485	3.526	4.771	8.326

Notes: The table presents descriptive statistics for treatment and outcome variables. Corresponding variable definitions can be found in the "Variable Appendix" table. Panel A provides the statistics for the country-industry (two-digit NACE) analysis in the European setting. Panel B provides the statistics for the county-industry (two-digit NACE) analysis in the German setting. Panel C provides the statistics for the firm-level analysis in the German setting. Simple averages are the unweighted averages of variables within a given country, industry, and year. Weighted averages are computed as the market-share-weighted sums of variables (where the market share is calculated using sales) within a given country, industry, and year. Totals are the sums of variables within a given country, industry, and year. Covariances are the differences between weighted averages and simple averages of variables within a given country, industry, and year. Logarithm (plus 1) transformations are applied after taking averages within a given country, industry, and year.

Table 2

REPORTING REGULATION AND INNOVATION:
EXEMPTIONS IN EUROPE

Panel A: Country-Industry Level (Average: 2-digit NACE)

Outcome	Innovation Spending		Innovating Firm		New-To-Market Innovations		Product Innovation		Process Innovation	
Market Level	Simple Average		Simple Average		Simple Average		Simple Average		Simple Average	
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Reporting	0.613		-0.121**		-0.046		-0.098*		-0.100*	
	(0.90)		(-2.05)		(-1.11)		(-1.76)		(-1.73)	
Reporting and Auditing		0.059		-0.081		-0.082*		-0.152**		-0.024
		(0.07)		(-1.30)		(-1.68)		(-2.61)		(-0.43)
Country-Year FE	X	X	X	X	X	X	X	X	X	X
Industry-Year FE	X	X	X	X	X	X	X	X	X	X
Observations	6,129	6,129	6,473	6,473	6,503	6,503	6,514	6,514	6,444	6,444
Clusters (Country-Industry)	1,394	1,394	1,406	1,406	1,407	1,407	1,411	1,411	1,404	1,404
Clusters (Country-Year)	127	127	133	133	133	133	133	133	133	133
Adj. R^2	0.614	0.614	0.668	0.668	0.579	0.579	0.646	0.647	0.584	0.584

Panel B: Country-Industry Level (Aggregate 2-digit NACE)										
Outcome	Innovation Spending		Innovating Firm		New-To-Market Innovations		Product Innovation		Process Innovation	
Market Level	Total		Total		Total		Total		Total	
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Reporting	0.339		-286.206**		-37.106		-144.001*		-217.254**	
	(0.40)		(-2.29)		(-0.75)		(-1.77)		(-2.31)	
Reporting and Auditing		0.200		-301.651**		-45.600		-145.309*		-238.566***
		(0.21)		(-2.59)		(-0.99)		(-1.90)		(-2.67)
Country-Year FE	X	X	X	X	X	X	X	X	X	X
Industry-Year FE	X	X	X	X	X	X	X	X	X	X
Observations	6,135	6,135	6,489	6,489	6,519	6,519	6,529	6,529	6,460	6,460
Clusters (Country-Industry)	1,393	1,393	1,419	1,419	1,423	1,423	1,421	1,421	1,418	1,418
Clusters (Country-Year)	127	127	133	133	133	133	133	133	133	133
Adj. R^2	0.677	0.676	0.579	0.579	0.573	0.573	0.576	0.576	0.561	0.560

Notes: The table presents estimates from regressions of innovation measures on the share of firms subject to full reporting (and auditing) requirements in the European setting. In Panel A, the innovation measures are simple averages calculated for a given country, industry, and year. In Panel B, the innovation measures are totals calculated for a given country, industry, and year. "Reporting" is the share of simulated firms exceeding reporting-related exemption thresholds in a given country, industry, and year using a standardized firm-size distribution per industry across all countries and years. "Reporting and Auditing" is the share of simulated firms exceeding reporting- and auditing-related exemption thresholds in a given country, industry, and year using a standardized firm-size distribution per industry across all countries and years. The regressions include industry-year fixed effects and country-year fixed effects. We truncate the outcomes at the 1st and 99th percentile of their distributions, after accounting for the fixed effects. *t*-statistics (in parentheses) are based on standard errors clustered at the country-industry level and the country-year level. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level (two-tailed), respectively.

Table 3

REPORTING REGULATION AND INNOVATION:
INNOVATION SPILLOVERS (EUROPE)

Panel A: Reporting only

Outcome	Innovation Spending	Innovating Firm	New-To-Market Innovations	Product Innovation	Process Innovation
Market Level	Simple Average	Simple Average	Simple Average	Simple Average	Simple Average
Column	(1)	(2)	(3)	(4)	(5)
Reporting	0.032	-0.221***	-0.053	-0.182**	-0.210***
	(0.03)	(-2.72)	(-0.85)	(-2.19)	(-2.65)
Supplier Reporting	-2.707	0.394**	0.177	0.390***	0.375**
	(-1.26)	(2.52)	(1.58)	(2.80)	(2.53)
Customer Reporting	3.010**	0.102	-0.006	0.051	0.032
	(2.51)	(1.06)	(-0.08)	(0.55)	(0.38)
Country-Year FE	X	X	X	X	X
Industry-Year FE	X	X	X	X	X
Observations	3,502	3,667	3,672	3,682	3,649
Clusters (Country-Industry)	749	750	751	751	747
Clusters (Country-Year)	121	126	126	126	126
Adj. R^2	0.636	0.693	0.622	0.688	0.608

Panel B: Reporting and Auditing					
Outcome	Innovation Spending	Innovating Firm	New-To-Market Innovations	Product Innovation	Process Innovation
Market Level	Simple Average	Simple Average	Simple Average	Simple Average	Simple Average
Column	(1)	(2)	(3)	(4)	(5)
Reporting and Auditing	-1.529	-0.129	-0.100	-0.217**	-0.151*
	(-1.26)	(-1.48)	(-1.42)	(-2.45)	(-1.80)
Supplier Reporting and Auditing	-2.101	0.223	0.122	0.270*	0.295*
	(-0.94)	(1.34)	(1.03)	(1.80)	(1.89)
Customer Reporting and Auditing	2.004*	0.028	-0.099	-0.006	-0.032
	(1.66)	(0.32)	(-1.19)	(-0.07)	(-0.42)
Country-Year FE	X	X	X	X	X
Industry-Year FE	X	X	X	X	X
Observations	3,502	3,667	3,672	3,682	3,649
Clusters (Country-Industry)	749	750	751	751	747
Clusters (Country-Year)	121	126	126	126	126
Adj. R^2	0.636	0.691	0.623	0.687	0.607

Notes: The table presents estimates from regressions of innovation measures on the shares of firms, suppliers, and customers subject to full reporting (and auditing) requirements in the European setting. The innovation measures are simple averages calculated for a given country, industry, and year. In Panel A, "Reporting" is the share of simulated firms exceeding reporting-related exemption thresholds in a given country, industry, and year using a standardized firm-size distribution per industry across all countries and years. "Supplier Reporting" is the input-share-weighted intensity of reporting mandates in the supplier industries of a given country, industry, and year. "Customer Reporting" is the output-share-weighted intensity of reporting mandates in the customer industries of a given country, industry, and year. In Panel B, "Reporting and Auditing" is the share of simulated firms exceeding reporting- and auditing-related exemption thresholds in a given country, industry, and year using a standardized firm-size distribution per industry across all countries and years. "Supplier Reporting and Auditing" is the input-share-weighted intensity of reporting and auditing mandates in the supplier industries of a given country, industry, and year. "Customer Reporting and Auditing" is the output-share-weighted intensity of reporting and auditing mandates in the customer industries of a given country, industry, and year. The regressions include industry-year fixed effects and country-year fixed effects. *t*-statistics (in parentheses) are based on standard errors clustered at the country-industry level and the country-year level. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level (two-tailed), respectively

Table 4

REPORTING REGULATION AND INNOVATION:
PROFITABILITY SPILLOVERS (EUROPE)

Panel A: Reporting Only

Outcome	Sales per Employee	Sales per Employee and Capital	Market Share and Sales per Employee	Market Share and Sales per Employee and Capital
Market Level	Weighted Average	Weighted Average	Covariance	Covariance
Column	(1)	(2)	(3)	(4)
Reporting	-0.170	-0.194	-0.390	-0.348
	(-0.45)	(-0.64)	(-1.21)	(-1.38)
Supplier Reporting	1.339**	1.391**	1.094*	1.139**
	(2.15)	(2.43)	(1.93)	(2.31)
Customer Reporting	0.677*	0.459	0.691**	0.560**
	(1.88)	(1.29)	(2.24)	(1.99)
Country-Year	X	X	X	X
Industry-Year	X	X	X	X
Observations	16,169	16,129	15,937	15,845
Clusters (Country-Year)	1,125	1,122	1,121	1,120
Clusters (Country-Industry)	372	372	368	369
Adj. R^2	0.792	0.743	0.490	0.491

Panel B: Reporting and Auditing				
Outcome	Sales per Employee	Sales per Employee and Capital	Market Share and Sales per Employee	Market Share and Sales per Employee and Capital
Market Level	Weighted Average	Weighted Average	Covariance	Covariance
Column	(1)	(2)	(3)	(4)
Reporting and Auditing	-0.162	-0.001	-0.465	-0.298
	(-0.40)	(-0.00)	(-1.26)	(-1.00)
Supplier Reporting and Auditing	1.634***	1.484***	1.293**	1.130**
	(2.66)	(2.70)	(2.31)	(2.33)
Customer Reporting and Auditing	0.787**	0.544	0.713**	0.624**
	(2.17)	(1.56)	(2.29)	(2.24)
Country-Year	X	X	X	X
Industry-Year	X	X	X	X
Observations	16,169	16,129	15,937	15,845
Clusters (Country-Year)	1,125	1,122	1,121	1,120
Clusters (Country-Industry)	372	372	368	369
Adj. R^2	0.792	0.744	0.491	0.492

Notes: The table presents estimates from regressions of profitability (or productivity) measures on the shares of firms, suppliers, and customers subject to full reporting (and auditing) requirements in the European setting. The profitability measures are sales-weighted averages or covariances (differences between sales-weighted and equally weighted measures) in a given country, industry, and year. In Panel A, "Reporting" is the share of simulated firms exceeding reporting-related exemption thresholds in a given country, industry, and year using a standardized firm-size distribution per industry across all countries and years. "Supplier Reporting" is the input-share-weighted intensity of reporting mandates in the supplier industries of a given country, industry, and year. "Customer Reporting" is the output-share-weighted intensity of reporting mandates in the customer industries of a given country, industry, and year. In Panel B, "Reporting and Auditing" is the share of simulated firms exceeding reporting- and auditing-related exemption thresholds in a given country, industry, and year using a standardized firm-size distribution per industry across all countries and years. "Supplier Reporting and Auditing" is the input-share-weighted intensity of reporting and auditing mandates in the supplier industries of a given country, industry, and year. "Customer Reporting and Auditing" is the output-share-weighted intensity of reporting and auditing mandates in the customer industries of a given country, industry, and year. The regressions include industry-year fixed effects and country-year fixed effects. *t*-statistics (in parentheses) are based on standard errors clustered at the country-industry level and the country-year level. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level (two-tailed), respectively.

Table 5

REPORTING REGULATION AND INNOVATION:
ENFORCEMENT IN GERMANY

Panel A: County-Industry Level (Average: 2-digit NACE)					
Outcome	Innovation Spending	Innovating Firm	New-To-Market Innovations	Product Innovation	Process Innovation
Market Level	Simple Average	Simple Average	Simple Average	Simple Average	Simple Average
Column	(1)	(2)	(3)	(4)	(5)
Limited Share×Post	-3.026***	-0.132***	-0.073	-0.126***	-0.086**
	(-4.06)	(-3.46)	(-1.29)	(-3.30)	(-2.32)
County-Industry FE	X	X	X	X	X
County-Year FE	X	X	X	X	X
Industry-Year FE	X	X	X	X	X
Observations	26,774	47,283	23,597	46,680	46,592
Clusters (County-Industry)	5,857	8,193	5,459	8,163	8,156
Adj. R^2	0.528	0.393	0.412	0.415	0.322

Panel B: County-Industry Level (Aggregate: 2-digit NACE)					
Outcome	Innovation Spending	Innovating Firm	New-To-Market Innovations	Product Innovation	Process Innovation
Market Level	Total	Total	Total	Total	Total
Column	(1)	(2)	(3)	(4)	(5)
Limited Share×Post	-3.050***	-0.510***	-0.213***	-0.462***	-0.340***
	(-4.02)	(-6.09)	(-2.73)	(-5.89)	(-4.94)
County-Industry FE	X	X	X	X	X
County-Year FE	X	X	X	X	X
Industry-Year FE	X	X	X	X	X
Observations	26,778	47,279	23,597	46,672	46,589
Clusters (County-Industry)	5,861	8,178	5,460	8,150	8,148
Adj. R^2	0.528	0.561	0.377	0.550	0.440

Notes: The table presents estimates from regressions of innovation measures on the intensity of enforcement of reporting mandates in the German setting. In Panel A, the innovation measures are simple averages calculated for a given county, industry, and year. In Panel B, the innovation measures are totals calculated for a given county, industry, and year. The enforcement intensity is captured by the interaction of the share of affected (limited-liability) firms in the pre-enforcement period in a given county and industry ("Limited Share") and a post-enforcement reform indicator ("Post"). The regressions include county-industry, county-year, and industry-year fixed effects. We truncate the outcomes at the 1st and 99th percentile of their distributions, after accounting for the fixed effects. *t*-statistics (in parentheses) are based on standard errors clustered at the county-industry level. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level (two-tailed), respectively.

Table 6

REPORTING REGULATION AND INNOVATION: NUMBER OF FIRMS (GERMANY)						
Outcome	Innovation Spending		Innovation Spending (Extensive)		Innovating Firm	
Market Level	Simple Average		Simple Average		Simple Average	
Number of Firms	High	Low	High	Low	High	Low
Column	(1)	(2)	(3)	(4)	(5)	(6)
Limited Share×Post	-2.554	-4.373***	-0.005	-0.313***	-0.100	-0.132***
	(-1.51)	(-4.56)	(-0.03)	(-4.52)	(-1.09)	(-2.83)
County-Industry FE	X	X	X	X	X	X
County-Year FE	X	X	X	X	X	X
Industry-Year FE	X	X	X	X	X	X
Observations	12,273	12,673	12,307	12,642	22,825	23,234
Clusters (County-Industry)	2,466	3,110	2,474	3,108	3,640	4,446
Adj. R^2	0.500	0.538	0.449	0.508	0.363	0.403

Notes: The table presents estimates from regressions of innovation measures on the intensity of enforcement of reporting mandates for county-industries with a high vis-à-vis low number of firms in the pre-enforcement period (median split) in the German setting. The innovation measures are simple averages calculated for a given county, industry, and year. The enforcement intensity is captured by the interaction of the share of affected (limited-liability) firms in the pre-enforcement period in a given county and industry ("Limited Share") and a post-enforcement reform indicator ("Post"). The regressions include county-industry, county-year, and industry-year fixed effects. We truncate the outcomes at the 1st and 99th percentile of their distributions, after accounting for the fixed effects. *t*-statistics (in parentheses) are based on standard errors clustered at the county-industry level. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level (two-tailed), respectively.

Table 7

REPORTING REGULATION AND INNOVATION:
ECONOMIC RETURNS TO INNOVATION (GERMANY)

Panel A: County-Industry Level (Average: 2-digit NACE level)

Outcome	Profit Margin	Sales from New-To-Market Innovations	Share of Sales from New-To-Market Innovations	Share of Sales Increase from Quality Improvements	Cost Reduction from Process Improvements
Market Level	Simple Average	Simple Average	Simple Average	Simple Average	Simple Average
Column	(1)	(2)	(3)	(4)	(5)
Limited Share×Post	-0.356*	-3.798***	-0.017*	-0.010*	-0.085
	(-1.69)	(-3.30)	(-1.84)	(-1.65)	(-1.54)
County-Industry FE	X	X	X	X	X
County-Year FE	X	X	X	X	X
Industry-Year FE	X	X	X	X	X
Observations	24,768	23,141	23,088	19,154	20,846
Clusters (County-Industry)	5,787	5,388	5,329	4,748	5,086
Adj. R^2	0.535	0.553	0.403	0.311	0.433

Panel B: County-Industry Level (Aggregate: 2-digit NACE level)					
Outcome	Profit Margin	Sales from New-To-Market Innovations	Share of Sales from New-To-Market Innovations	Share of Sales Increase from Quality Improvements	Cost Reduction from Process Improvements
Market Level	Total	Total	Weighted Average	Total	Total
Column	(1)	(2)	(3)	(4)	(5)
Limited Share×Post	-1.112**	-3.911***	-0.021**	-0.013	-0.145*
	(-2.40)	(-3.35)	(-2.13)	(-1.49)	(-1.89)
County-Industry FE	X	X	X	X	X
County-Year FE	X	X	X	X	X
Industry-Year FE	X	X	X	X	X
Observations	24,767	23,140	23,016	19,165	20,850
Clusters (County-Industry)	5,778	5,387	5,323	4,765	5,087
Adj. R^2	0.576	0.553	0.415	0.266	0.352

Notes: The table presents estimates from regressions of profitability measures on the intensity of enforcement of reporting mandates in the German setting. In Panel A, the innovation measures are simple averages calculated for a given county, industry, and year. In Panel B, the profitability measures are totals or sales-weighted averages calculated for a given county, industry, and year. The enforcement intensity is captured by the interaction of the share of affected (limited-liability) firms in the pre-enforcement period in a given county and industry ("Limited Share") and a post-enforcement reform indicator ("Post"). The regressions include county-industry, county-year, and industry-year fixed effects. We truncate the outcomes at the 1st and 99th percentile of their distributions, after accounting for the fixed effects. *t*-statistics (in parentheses) are based on standard errors clustered at the county-industry level. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level (two-tailed), respectively.

Table 8

REPORTING REGULATION AND INNOVATION: FINANCING CHANNEL (GERMANY)				
Outcome	External Financing Constraint		Internal Financing Constraint	
Market Level	Simple Average	Total	Simple Average	Total
Column	(1)	(2)	(3)	(4)
Limited Share×Post	-0.123*	-0.403***	-0.033	-0.393***
	(-1.78)	(-3.68)	(-0.48)	(-3.49)
County-Industry FE	X	X	X	X
County-Year FE	X	X	X	X
Industry-Year FE	X	X	X	X
Observations	22,528	22,535	22,418	22,420
Clusters (County-Industry)	5,199	5,197	5,191	5,184
Adj. R^2	0.666	0.580	0.663	0.573

Notes: The table presents estimates from regressions of financing constraints on the intensity of enforcement of reporting mandates in the German setting. The financial constraints measures are simple averages or totals calculated at the county, industry, and year. The enforcement intensity is captured by the interaction of the share of affected (limited-liability) firms in the pre-enforcement period in a given county and industry ("Limited Share") and a post-enforcement reform indicator ("Post"). The regressions include county-industry, county-year, and industry-year fixed effects. We truncate the outcomes at the 1st and 99th percentile of their distributions, after accounting for the fixed effects. *t*-statistics (in parentheses) are based on standard errors clustered at the county-industry level. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level (two-tailed), respectively.

Table 9

REPORTING REGULATION AND PATENTS				
Panel A: Country-Industry Level in Europe (Average: 2-digit NACE)				
Source	CIS Survey		PATSTAT	PATSTAT
Outcome	Patenting		Patent Application	Competitor-Forward
	Firm		Firm	Cites
Market Level	Simple Average		Simple Average	Simple Average
Column	(1)		(2)	(3)
Reporting	0.041		0.015***	0.058***
	(0.87)		(2.88)	(3.27)
Country-Year FE	X		X	X
Industry-Year FE	X		X	X
Observations	3,106		31,298	11,454
Clusters (Country-Industry)	1,292		2,188	1,407
Clusters (Country-Year)	66		387	378
Adj. R^2	0.542		0.645	0.206
Panel B: County-Industry Level in Germany (Average: 2-digit NACE)				
Source	CIS Survey		PATSTAT	
Outcome	Importance Patenting		Patent Applications	
Market Level	Simple Average	Total	Simple Average	Total
Column	(1)	(2)	(3)	(4)
Limited Share×Post	-0.375***	-0.597***	-0.032	-0.076**
	(-2.68)	(-2.68)	(-1.59)	(-2.48)
County-Industry FE	X	X	X	X
County-Year FE	X	X	X	X
Industry-Year FE	X	X	X	X
Observations	27,976	27,980	54,947	54,955
Clusters (County-Industry)	5,621	5,621	8,560	8,571
Adj. R^2	0.726	0.616	0.691	0.645

Panel C: Firm Level in Germany						
Source	CIS Survey		CIS Survey		PATSTAT	
Outcome	Importance Secrecy		Importance Patenting		Patent Applications	
Column	(1)	(2)	(3)	(4)	(5)	(6)
Limited×Post	-0.575***		0.063		0.016**	
	(-3.59)		(0.74)		(2.00)	
Private×Post		-0.233		0.150		0.086***
		(-0.86)		(1.22)		(3.03)
Controls	X	X	X	X	X	X
Firm FE	X	X	X	X	X	X
County-Year	X	X	X	X	X	X
Industry-Year FE (4-digit)	X	X	X	X	X	X
Observations	32,275	32,238	46,084	46,150	112,106	110,809
Clusters (Firm)	9,130	9,054	11,138	11,048	22,418	21,494
Adj. R^2	0.943	0.941	0.912	0.913	0.882	0.898

Notes: The table presents estimates from regressions of patenting measures on variation in reporting mandates. In Panel A, the patent measures are simple averages calculated for a given country, industry, and year in the European setting using Eurostat and PATSTAT data. The treatment variation, "Reporting", is the share of simulated firms exceeding reporting-related exemption thresholds in a given country, industry, and year using a standardized firm-size distribution per industry across all countries and years. The regressions include industry-year fixed effects and country-year fixed effects. *t*-statistics (in parentheses) are based on standard errors clustered at the country-industry level and the country-year level. In Panel B, the patent measures are simple averages and totals calculated for a given county, industry, and year in the German setting using the MIP and PATSTAT data. The treatment variation is the interaction of the share of affected (limited-liability) firms in the pre-enforcement period in a given county and industry ("Limited Share") and a post-enforcement reform indicator ("Post"). The regressions include county-industry, county-year, and industry-year fixed effects. *t*-statistics (in parentheses) are based on standard errors clustered at the county-industry level. In Panel C, the patent measures are calculated at the firm-level in the German setting using the MIP and PATSTAT data. "Limited" is an indicator taking the value of one for affected (limited-liability) firms, and zero for unaffected (unlimited-liability) firms. "Private" is an indicator taking the value of one for affected (private limited-liability) firms, and zero for unaffected (publicly-listed limited-liability) firms. "Post" is an indicator taking the value of one for the post-enforcement reform period. The regressions include firm, county-year, and industry-year fixed effects (where the industries are defined using four-digit NACE classifications). In all panels, we truncate the outcomes at the 1st and 99th percentile of their distributions, after accounting for the fixed effects. *t*-statistics (in parentheses) are based on standard errors clustered at the firm level. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level (two-tailed), respectively.

Table 10

REPORTING REGULATION AND ACCOUNTING INFORMATION												
Outcome	Change in Tangible Assets				Change in Intangible Assets				R&D Intensity			
Market Level	Simple Average		Weighted Average		Simple Average		Weighted Average		Simple Average		Weighted Average	
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Reporting	-0.090***		-0.019		-0.116**		-0.168**		-1.528		-0.133	
	(-2.92)		(-0.43)		(-2.50)		(-2.17)		(-1.45)		(-0.84)	
Reporting and Auditing		-0.019		0.074		-0.150**		-0.182**		-1.351		-0.332
		(-0.49)		(1.44)		(-2.56)		(-2.02)		(-0.84)		(-1.53)
Country-Year FE	X	X	X	X	X	X	X	X	X	X	X	X
Industry-Year FE	X	X	X	X	X	X	X	X	X	X	X	X
Observations	31,055	31,055	30,727	30,727	30,249	30,249	29,671	29,671	2,695	2,695	2,691	2,691
Clusters (Country-Industry)	2,177	2,177	2,168	2,168	2,153	2,153	2,143	2,143	310	310	311	311
Clusters (Country-Year)	387	387	387	387	387	387	387	387	90	90	89	89
Adj. R^2	0.950	0.950	0.886	0.886	0.856	0.856	0.604	0.604	0.417	0.416	0.258	0.259

Notes: The table presents estimates from regressions of financial-statement-based innovation measures on the share of firms subject to full reporting (and auditing) requirements in the European setting. The innovation measures are simple averages or sales-weighted averages calculated for a given country, industry, and year. "Reporting" is the share of simulated firms exceeding reporting-related exemption thresholds in a given country, industry, and year using a standardized firm-size distribution per industry across all countries and years. "Reporting and Auditing" is the share of simulated firms exceeding reporting- and auditing-related exemption thresholds in a given country, industry, and year using a standardized firm-size distribution per industry across all countries and years. The regressions include industry-year fixed effects and country-year fixed effects. We truncate the outcomes at the 1st and 99th percentile of their distributions, after accounting for the fixed effects. *t*-statistics (in parentheses) are based on standard errors clustered at the country-industry level and the country-year level. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level (two-tailed), respectively.

Online Appendix

(for online publication only)

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Community Innovation Survey

Definition of Innovation

The following description is provided on the first page of the 2014 Community Innovation Survey questionnaire (Community Innovation Survey 2014a):

> An **innovation** is the introduction of a new or significantly improved product, process, organisational method, or marketing method by your enterprise.
>
> An innovation must have characteristics or intended uses that are new or which provide a significant improvement over what was previously used or sold by your enterprise. However, an innovation can fail or take time to prove itself.
>
> An innovation need only be new or significantly improved for your enterprise. It could have been originally developed or used by other enterprises or organisations.
>
> **Innovation activities** include the acquisition of machinery, equipment, buildings, software, and licenses; engineering and development work, feasibility studies, design, training, R&D and marketing when they are specifically undertaken to develop and/or implement a product or process innovation. This includes also all types of R&D consisting of research and development activities to create new knowledge or solve scientific or technical problems.

Examples

The following examples are provided in the official methodological notes accompanying the 2014 Community Innovation Survey questionnaire (Community Innovation Survey 2014b):

> Enterprise managers are unlikely to have difficulty in recognizing major innovations such as the iPhone, ABS braking systems, new anti-cancer drugs, 'sharing economy' innovations such as Lyft, Uber and AirBandB, or financial derivatives. For this reason, the examples given below describe innovations that can be significant but might not be easy to recognize as an innovation. This should help the respondent to think of similar types of innovations in their own enterprise.
>
> 4.1 Product innovations
>
> Product innovations cover goods and services with characteristics or intended uses that differ significantly from previous products produced by the enterprise. This includes new or significantly improved technical specifications, components and materials, incorporated software, user friendliness or other functional characteristics.
>
> The product innovations can consist of goods or services that are entirely new to the firm or new to the firm's market, or goods or services that have been significantly improved.
>
> Product innovations **exclude the following**:
>
> - Minor changes or improvements.
> - Routine upgrades.
> - Seasonal changes (such as for clothing lines).
> - Customisation for a single client that does not include significantly different attributes compared to products made for other clients.
> - Design changes that do not alter the function or technical characteristics of a good or service.
> - The simple resale of new goods and services purchased from other enterprises, but include goods and services developed and produced by foreign affiliates for your enterprise.
>
> 4.1.1 Examples of new or significantly improved goods
>
> - Replacing existing materials with materials with improved characteristics (breathable textiles, light but strong composites, environmentally-friendly plastics, etc).
> - Introducing new or improved components in existing product lines (cameras in mobile telephones, fastening

systems in clothing, hybrid technologies in cars, etc).

- Equipment that incorporate software that improves user friendliness or convenience, such as toasters that automatically shut off when the bread is toasted or GPS systems that identify the location of specific types of shops or services.
- Adding new functions: bicycle lights that can be recharged through a USB port, rubbish bins that signal when they are full, products that can fold for easy storage, new smartphone apps, etc.
- Wearable technology, clothing and accessories incorporating computer and advanced electronic technologies

4.1.2 Examples of innovative services

- Improving customers' access, such as a home pick-up and drop-off service for rental cars, same-day delivery of online purchases, etc.
- 'Sharing economy' services such as Uber, Lyft, AirBandB, Listia (recycling and reusing goods), TaskRabbit, etc. First time introduction of internet services such as banking, bill-payment systems, electronic purchase and ticketing of travel and theatre tickets, social networking sites, online backup services, cloud-computing, on-demand internet streaming media etc.
- New forms of warranty, such as an extended warranty on new or used goods, or bundling warranties with other services, such as with credit cards, bank accounts, or customer loyalty cards.
- Installing gas heaters in outdoor restaurant and bar terraces or video on demand screens in the back of airline, bus or train seats.

4.1.3 Differentiating between goods and services

A respondent may not always be sure if their innovative product is a good or a service. The respondent's industrial classification is not always a reliable indicator, since firms that are assigned to the manufacturing sector can produce services and service sector firms can produce goods.

Goods are usually tangible, owned by the consumer, and can be used multiple times, for instance furniture, appliances, electronic equipment, packaged software, and clothing. There are exceptions, such as food purchased in a supermarket or diesel purchased from a refinery, which can only be used once, and downloaded movies and music, which are intangible.

Services are usually intangible, can only be used once and are not owned by the consumer. They include banking, retailing, hotel accommodation, insurance, educational courses, air travel, entertainment such as tours, theatres, and sporting events, repair and renovation work, consulting, cloud computing, streaming video and music (in contrast to downloadable video and music), etc.

Some aspects of utilities (gas, sewage, water, electricity, etc) and of construction can have characteristics of both a good and a service. Many utilities appear to provide a product (gas, water, etc) to domestic and commercial users, but they are intermediaries that often do not produce the product (gas or water), but only deliver it to their consumers. Electrical generators are also classified as a service, even when they both produce and deliver electricity. Construction enterprises that build houses or commercial buildings for clients act as a service, but a construction enterprise could also build housing to sell. In the latter case the respondent might see their enterprise as producing a product instead of a service.

In some cases, such as when construction firms build houses to sell, it may be best to leave it to the respondent to determine if they are providing a product or a service.

4.2 Process innovations

Process innovations occur in both service and manufacturing sectors and include new or improved production methods; logistics, delivery and distribution systems, and 'back office' activities, such as maintenance, purchasing, and accounting operations. They include significant changes in specific techniques, equipment and/or software, intended to improve the quality, efficiency or flexibility of a production or supply activity, or a reduction in environmental and safety hazards.

Some process innovations, particularly involving logistics or distribution, are closely linked to organisational innovations, such as for supply chain management. For these, it can be almost impossible to provide clear guidance on

the type of innovation. It is best left to the respondent to decide if the innovation is primarily a process innovation, organisational innovation, or even both.

Process innovations **exclude the following**:

- Minor changes or improvements.
- An increase in production or service capabilities through the addition of manufacturing or logistical systems that are very similar to those already in use.
- Innovations that have an important client interface, such as a pick-up or delivery service (these are product innovations).

4.2.1 Examples of innovative methods of producing goods or services

- Installation of new or improved manufacturing technology, such as automation equipment or real-time sensors that can adjust processes or 3D printing techniques.
- New equipment required for new or improved products.
- Computer-assisted product development or other technology to improve research capabilities, such as bio-imaging equipment. More efficient processing that reduces material or energy requirements per unit of output.
- More efficient processing that reduces material or energy requirements per unit of output.

4.2.2 Examples of innovative logistics, delivery or distribution methods

- Introduction of passive radio frequency identification (RFID) chips to track materials through the supply chain.
- GPS tracking systems for transport equipment.
- Automated feed-back to suppliers using electronic data exchange.
- Content delivery network, large distributed system of servers deployed in multiple data centers across the Internet to serve content to end-users.
- Using natural energy sources for logistics, for instance wind energy in maritime logistics, use of meteorological data and navigational algorithms to find and make use of optimum wind angles to reduce energy consumption of ships.

4.2.3 Examples of innovative supporting activities

- Introduction of software to identify optimal delivery routes.
- New or improved software or routines for purchasing, accounting or maintenance systems.

4.3 Organisational innovations

Organisational innovations involve the implementation of a significant change in business practices, the organisation of work responsibilities and decision-making, which includes training or education to increase skills and responsibilities; and the organisation of external relationships with other enterprises or public institutions. They are intended to improve the enterprise's innovative capacity or performance characteristics, such as the quality or efficiency of workflows or response time to opportunities and crises. Organisational innovations usually involve changes to more than one part of the enterprise's supply chain and are less technology dependent than process innovations.

Organisational innovations **exclude the following**:

- Changes in management strategy, unless accompanied by the introduction of significant organisational change.
- Introduction of new technology that is only used by one division of an enterprise (for example in production). These are usually process innovations.
- Simple extensions of organisational changes that have already been implemented in the past or in one part of the enterprise. For example, the reorganisation of work tasks in one establishment is not an organisational innovation if the same reorganisation was already implemented in a different establishment owned by the enterprise.
- Mergers or acquisitions.

4.3.1 Examples of business practice innovations

- Establishment of formal or informal work teams to improve the access and sharing of knowledge from different departments, such as marketing, research, production, etc.
- Introduction of quality control standards for suppliers and subcontractors.
- Supply management systems to optimize the allocation of resources from sourcing inputs to the final delivery of products.
- First introduction of group or individual performance incentives.
- First introduction of teleworking or a “paperless” office.

4.3.2 Examples of work organisation innovations

- Reduction or increase in the hierarchical structure for decision making.
- Change in responsibilities, such as giving substantially more control and responsibility over work processes to production, distribution or sales staff.
- Introduction of a High Performance Work System (HPWS) characterised by a holistic organisation featuring flat hierarchical structures, job rotation, self-responsible teams, multi-tasking, a greater involvement of lower-level employees in decision making and the replacement of vertical by horizontal communication channels.
- New training or education systems, such as regular videos on each employee’s work station that describe ongoing challenges for the enterprise or provide skill upgrading, with the goal of improving the ability of employees to recognize problems and take responsibility.
- Creation of a new division, for example by splitting the management of marketing and production into two divisions, or alternatively a change to integrate divisions.

4.3.3 Examples of external relations innovations

- First use of outsourcing of research or production if it requires a change in how work flows are organised within the enterprise.
- First use of alliances that require staff to work closely with staff from another organisation, including temporary staff exchanges.

4.4 Marketing innovations

Marketing innovations cover significant changes in how an enterprise markets its goods and services, including changes to design and packaging. Many of them must be the first use by the enterprise. For example, the first use of product placement on the internet for one product line is an innovation, but the second use of internet product placement for a different product line or for a different geographical market is not an innovation.

Marketing innovations **exclude the following**:

- Routine or seasonal changes, such as clothing fashions.
- Advertising, unless based on the use of new media for the first time.
- Design or packaging changes that alter the functionality or user characteristics, these are product innovations.

4.4.1 Examples of design & packaging innovations

- Novel designs of existing products such as flash card memory sticks designed to be worn as jewelry.
- New designs for consumer products, such as appliances or kitchen units designed for very small apartments.
- Adapting packaging for specific markets (different covers and typeface for children and adult versions of the same book).

4.4.2 Examples of product promotion innovations

- First time use of a new advertising media. For instance the first time use of product promotion on television, radio, cinema, in books, films, internet, social media etc.
- First time use of product seeding through opinion leaders, celebrities, or particular groups that are fashion or product trend setters.
- First time use of a loyalty program. A loyalty card, rewards card, point card, advantage card or club card.
- Bundling existing goods or services in new ways to appeal to market segments.

- Developing trademarks for new product lines.
- Mobile marketing (applications). Providing customers with time and location sensitive, personalized information that promotes goods and services.

4.4.3 Examples of product placement innovations

- First use of in-store sales that are only accessible to holders of the store's credit card or reward card.
- First use of media programming for a specific institution, such as closed circuit television for hospitals, buses, or trains that contain programs to stimulate specific product sales.
- First use of direct marketing via email, telephone or mail using a customer database obtained through individuals that visit websites for information or join 'frequent user or buyer' reward plans.
- First use of exclusive retailing, such as only selling high-end products in special stores.
- First use of franchising or distribution licenses.
- First use of new concepts for product presentation.

4.4.4 Examples of pricing innovations

- First use of variable pricing, with the price varying by time of purchase, location of purchaser, etc.
- First use of penetration pricing or loss leaders to establish market share and brand recognition.
- First use of discount systems such as loyalty cards.

Further Information on the Community Innovation Survey: Methodology and Quality

The Community Innovation Survey is commissioned by the EU Commission and conducted by national research centers (e.g., the German version of the CIS is conducted by ZEW – Leibniz Centre for European Economic Research). The collection of CIS data at the national level is strictly regulated by the European Commission.[1] Member states are required to provide innovation statistics to the EU, and almost all Member States require firms to answer the survey. The data are used for the annual European Innovation Scoreboard, and anonymized micro data can be used for academic research at Eurostat's Safe Center in Luxembourg. The data has to be collected and compiled in a standardized way across all countries.

From 2006 onwards, Eurostat discloses Synthesis Quality Reports about the CIS data. These reports highlight that countries were conforming to the regulations on innovation statistics, and provide an overview of the quality of the data. The following sections contain a summary of the different so-called "Synthesis Quality Reports" that were released by Eurostat.[2]

1. <u>Methodological Recommendations and Assessments</u>

According to the Synthesis Quality Reports, all countries follow the methodological guidelines of the European Commission concerning the production and development of Community statistics on Innovation.

All countries covered the core population of NACE sections, and all countries were in compliance with the breakdowns by size classes. In addition, all countries included all the harmonized mandatory questions in their survey. Small deviations are reported across the different synthesis quality reports regarding data collection. For example, some countries added additional non-core questions to the

[1] Commission Regulation No.1450/2004 implementing Decision No. 1608/2003 concerning the production and development of Community statistics on innovation.
[2] For available metadata on the various survey waves see: https://ec.europa.eu/eurostat/web/science-technology-innovation/data/database.

survey, or did not include some of the optional questions.

As prescribed in the methodological guidelines of Eurostat, almost all countries used the national business register as a sampling frame. According to the national quality reports, the databases that were used for sampling were up-to-date, and provided information on identification characteristics of the enterprise, its economic activity and the number of employees.

All countries applied a stratified random sampling methodology, as proposed by Eurostat. The stratification of the sample was based on a firm's industry (NACE classification), the firm's size, and in some countries also on the geographical region (NUTS2 level). To further improve the accuracy of the data for certain strata, most countries oversampled larger firms, while smaller enterprises were randomly sampled.

Because of the stratified random sampling technique, weights have to be given to each observational unit to construct meaningful aggregated statistics. It is recommended by Eurostat to use the inverse of the sampling fraction. For example, the weights of a specific stratum would be equal to N_h/n_h where N_h is the total number of enterprises or employees in stratum h of the population, and n_h is the number of enterprises or employees in the realized sample in stratum h of the population. The proposed method will automatically adjust the sample weights of the respondents to compensate for unit non-response. If a different methodology is used to construct a stratum (e.g. not random sampling, but oversampling of larger firms, or oversampling firms with previously known R&D activities in certain stratum) the weights are adjusted. In addition, if the non-response rate is too high for a specific stratum (i.e. response rate < 70%), countries are required to conduct a non-response survey to assess if there is a difference between the answers of the respondents and non-respondents. If this is the case, the results of the non-response analysis are used to calculate the final weighting factors.

The vast majority of countries made use of both an electronic and mail survey. This approach follows the recommendation for methods alternations, which is considered to be the most effective practice. In many cases, the login and password of the electronic questionnaire were sent by mail. Enterprises that wanted to reply electronically could fill in the electronic questionnaire available on the website through a web-based platform that is specifically developed for the CIS. Respondents could also print the electronic questionnaire and send the questionnaire back by mail or email. Some countries also contacted the enterprises by telephone. This mode served in most countries mainly as a reminder for replying to the survey, and secondly as a follow-up to clarify non-responses and missing data. Cyprus is an exception in this regard, the data is exclusively collected via face-to-face interviews.

2. Conclusions on Quality of Methodology

The Synthesis Quality Reports highlight that the overall assessment of the quality of the CIS methodology is positive. All countries follow the required regulations and guidelines from the Commission. The national CIS quality reports also highlight some of the strengths and weaknesses of the mandated survey methodology. For example, in the CIS 2012 quality reports, fifteen out of twenty-eight countries explicitly highlighted as a main strength the good quality of the data. Nine countries highlighted the high response rate as a main strength, and six national authorities also explicitly highlight the existence of a high coherence with other data sources (e.g. national R&D surveys, SBS data). Regarding weaknesses, the CIS report of 2012 highlights that seven out of twenty-

eight countries indicate that some respondents had difficulties in quantifying innovation expenditures (e.g. difficulties in splitting R&D from other activities), and five countries highlight that some companies have difficulties to assess their own activities as innovative or not innovative. This stands in contrast to eight countries that explicitly highlight that a main strength of the methods used is that respondents have a better knowledge and understanding of the questionnaire. Overall, the general tone of Eurostat and the national research centers is that the overall quality of the required methodology is perceived as high.

3. Accuracy of the CIS Data

The Synthesis Quality Reports also contain an overall assessment of the accuracy of the CIS data. According to the reports, all countries make considerable efforts to reduce errors or at least to identify and correct them.

3.1. Measurement Error

Measurement errors occur during data collection and cause recorded values of variables to be different from the true ones. Such errors are usually caused by the survey questionnaire and/or the respondents. The reports conclude that measurement error is limited due to the continuous efforts taken by all countries. Efforts that are undertaken to reduce measurement error are the following:

1. Experts regularly review cognitive test questions and answers to assure that the questions elicit the desired information.
2. Staff receives training to help and assistant respondents to fill in the questionnaire correctly. In addition, firms receive detail guidelines on how to fill in the survey.
3. Comprehensive data validation is the norm during and after data collection. The micro and the aggregated data are checked and corrected for inconsistencies. Quality controls are done on aggregated and micro data at the national level, but Eurostat also carries out independent quality checks. For example, the answers given in the survey are cross-checked on consistency. In addition, variables are compared to firm-level data from other sources (e.g. prior CIS data if available, national R&D surveys, and SBS statistics). If inconsistencies exist, firms are contacted to clarify their answer.

Next to these measures, the general methodological guidelines regarding data collection and availability are further intended to eliminate any reporting bias.

1. Respondents are made aware that only highly aggregated statistics at the country-industry level (NACE 1) are made available to the public. All micro data is anonymized, and not accessible to the public, and neither to politicians. Moreover, if too few observations are available in a specific country-industry cluster, such information is aggregated at a higher level – or not disclosed at all.
2. Only researchers affiliated to recognized research institutes are allowed to access anonymized micro data at the SAFE center of Eurostat in Luxembourg.[3]
3. In many countries, the survey is conducted by an independent research organization, and not by a government agency itself. For example, in Germany the survey is conducted by ZEW – Leibniz Centre for European Economic Research. This increases the credibility that data will

[3] Some countries also provide access to their micro-data at similar safe centers. For example, the German version of the CIS data can be accessed by researchers at the premises of ZEW in Mannheim.

be treated strictly confidentially, and will not be disclosed to any party.

4. Aggregated CIS indicators are made available only after several years, making it in essentially useless for business managers. Similarly, micro data is only released after a significant period. For example, CIS 2014 was the last available data wave in 2020 that was available for researchers.

The collection of data by independent research organization, the disclosure of highly aggregated data, the significant data release delay, and quality checks performed by the countries and Eurostat allay concerns about measurement error.

3.2. Sampling and Non-Sampling Errors

Sampling and non-sampling errors are eliminated by making use of appropriate sampling techniques. The required sampling techniques lead to smaller sampling errors and make it possible to ensure that there are enough units in the respective domains to produce results of good quality. The non-sampling errors are minimized because most national authorities use the national business registers to draw their sample from. According to Eurostat and the national agencies that conduct the survey, the databases used to draw the sample were up-to-date and of high-quality.

3.3. Non-Response Errors

Non-response errors are reduced by sending reminders to enterprises. Most countries send at least two or three paper reminders to non-responding enterprises. Additionally, these enterprises are contacted by phone or e-mail in order to remind them to fill in and deliver the survey questionnaire. When the response rate is sufficiently high (for each individual stratum), data can be used to extrapolate the findings to the full population.

According to the CIS survey of 2014, the response rate is above 70% in most countries. In the few countries where the non-response rate exceeds 30%, Eurostat requires the country to do an additional non-response survey to assess if differences exist between respondents and non-respondents. If there is a statistical difference between the original survey and the non-response survey for certain strata, the information from the non-response survey is used to recalibrate weights.

More information on the Eurostat Community Innovation Survey Page can be found: https://ec.europa.eu/eurostat/web/microdata/community-innovation-survey

Mannheim Innovation Panel

The German version of the Community Innovation Survey is conducted by ZEW – Leibniz Centre for European Economic Research in Germany. The survey data is based on a harmonized CIS questionnaire sent to a representative sample of firms. Similarly like in other countries, they take various measures to ensure the quality and representativeness of the data. ZEW provides the following abstract description of its data collection and the resulting Mannheim Innovation Panel (ZEW 2019b):

> Since 1993, the ZEW – Leibniz Centre for European Economic Research has been gathering data regarding the innovation behaviour of the German economy on an annual basis. The innovation survey covers firms from various industries including mining, manufacturing, energy- and water- supply, waste disposal, construction, business-related services and distributive services. The survey is representative for Germany and allows projections for the German firm

population as well as for individual industries and size classes. The survey is conducted on behalf of BMBF (Federal Ministry of Education and Research) in cooperation with infas (Institute of Applied Social Science) and Fraunhofer ISI (Institute for Systems and Innovation Research). The MIP is the German contribution to the European Commission's Community Innovation Surveys (CIS).

The annual innovation survey is designed as a panel survey including the same firms every year. Sample size varies among the survey years. In 2010 e.g., more than 6000 firms answered the written questionnaire. Every two years the sample is refreshed by a random sample of newly founded firms in order to substitute firms that are closing or left the market through mergers. The MIP provides important information about the introduction of new products, services and processes, expenditures for innovations, ways to achieve economic success with new products, new services and improved processes. In addition, the MIP collects information on a number of competition-related issues which allows studying various topics in industrial economics.

For more information on the sampling and testing, see Rammer and Peters (2014).

Reporting Examples

These examples below illustrate the substantial difference in the amount of reported information when a firm is below and above the exemption threshold. While this increase takes place right as the firm crosses the exemption threshold, we emphasize that our analysis does not use such endogenous firm-level increases in disclosure over time.

Exempted Reporting

Name	Bereich	Information	V.-Datum
BioNTech RNA Synthesis GmbH Mainz	Rechnungslegung/ Finanzberichte	Jahresabschluss zum Geschäftsjahr vom 01.10.2016 bis zum 31.12.2016	01.06.2018

BioNTech RNA Synthesis GmbH

Mainz

Jahresabschluss zum Geschäftsjahr vom 01.10.2016 bis zum 31.12.2016

Bilanz zum 31. Dezember 2016

BioNTech RNA Synthesis GmbH

AKTIVA

	EUR	EUR
A. Anlagevermögen		
I. Finanzanlagen		
1. Ausleihungen an verbundene Unternehmen		25.000.000,00
B. Umlaufvermögen		
I. Forderungen und sonstige Vermögensgegenstände		
1. Forderungen gegen verbundene Unternehmen	19.517,16	
2. sonstige Vermögensgegenstände	123,98	19.641,14
II. Kassenbestand, Bundesbankguthaben, Guthaben bei Kreditinstituten und Schecks		11.511.080,16
C. Nicht durch Eigenkapital gedeckter Fehlbetrag		385.069,84
		36.915.791,14

PASSIVA

	EUR	EUR
A. Eigenkapital		
I. Gezeichnetes Kapital		25.000,00
II. Jahresfehlbetrag		-410.069,84
nicht gedeckter Fehlbetrag		385.069,84
buchmäßiges Eigenkapital		0,00
B. Rückstellungen		
1. sonstige Rückstellungen		35.246,29
C. Verbindlichkeiten		
1. erhaltene Anzahlungen auf Bestellungen	36.333.908,62	
- davon mit einer Restlaufzeit bis zu einem Jahr EUR 36.333.908,62		
2. Verbindlichkeiten aus Lieferungen und Leistungen	332,80	
- davon mit einer Restlaufzeit bis zu einem Jahr EUR 332,80		
3. Verbindlichkeiten gegenüber verbundenen Unternehmen	530.789,89	
- davon mit einer Restlaufzeit bis zu einem Jahr EUR 130.789,89		
- davon mit einer Restlaufzeit von mehr als einem Jahr EUR 400.000,00		
4. sonstige Verbindlichkeiten	15.513,54	36.880.544,85
- davon aus Steuern EUR 13.983,79		
- davon im Rahmen der sozialen Sicherheit EUR 1.529,75		
- davon mit einer Restlaufzeit bis zu einem Jahr EUR 15.513,54		
		36.915.791,14

Anhang für das Rumpfgeschäftsjahr vom 1. Oktober bis 31. Dezember 2016

der BioNTech RNA Synthesis GmbH

A. Allgemeine Angaben zum Jahresabschluss der BioNTech RNA Synthesis GmbH

Der Jahresabschluss der BioNTech RNA Synthesis GmbH wurde auf der Grundlage der Rechnungslegungsvorschriften des Handelsgesetzbuches (HGB) in EURO (EUR) aufgestellt. Ergänzend zu diesen Vorschriften waren die Regelungen des GmbH-Gesetzes zu beachten.

Soweit Wahlrechte für Angaben in der Bilanz, in der Gewinn- und Verlustrechnung oder im Anhang ausgeübt werden können, wurde der Vermerk in der Bilanz bzw. in der Gewinn- und Verlustrechnung gewählt.

Nach den in § 267 HGB angegebenen Größenklassen ist die Gesellschaft eine kleine Kapitalgesellschaft.

B. Angaben zu den Bilanzierungs- und Bewertungsmethoden

Immaterielle Vermögensgegenstände mit begrenzter Nutzungsdauer werden zu Anschaffungs- oder Herstellungskosten bilanziert und abhängig von ihrer geschätzten Nutzungsdauer planmäßig über einen Zeitraum von in der Regel 3 bis 20 Jahren linear abgeschrieben

Abnutzbare Sachanlagen werden zu Anschaffungs- oder Herstellungskosten abzüglich kumulierter Abschreibungen bewertet. Die Abschreibung erfolgt planmäßig linear über die betriebsgewöhnliche Nutzungsdauer. Geleistete Anzahlungen und Anlagen im Bau werden zu Anschaffungs-/Herstellungskosten bewertet.

Vorräte werden zu Anschaffungs- bzw. Herstellungskosten oder zum niedrigeren beizulegenden Zeitwert bewertet. Die Herstellungskosten umfassen neben Material- und Fertigungseinzelkosten auch auf Basis einer üblichen Kapazitätsauslastung zurechenbare Material- und Fertigungsgemeinkosten, wie auch Verwaltungskosten.

Die Forderungen und sonstigen Vermögensgegenstände werden zum Nennwert angesetzt. Die liquiden Mittel sind zum Nennwert angesetzt.

Die Rückstellungen enthalten alle erkennbaren Risiken und ungewissen Verbindlichkeiten. Die Bewertung erfolgt mit dem nach vernünftiger kaufmännischer Beurteilung notwendigen Erfüllungsbetrag. Künftige Preis- und Kostensteigerungen werden dabei berücksichtigt.

Zum Bilanzstichtag bestehen keine Rückstellungen mit einer Restlaufzeit größer 5 Jahre.

Verbindlichkeiten werden mit dem Erfüllungsbetrag angesetzt.

C. Erläuterungen zur Bilanz und Gewinn- und Verlustrechnung

1. Anlagevermögen

Es besteht lediglich eine Darlehensforderung gegenüber der Muttergesellschaft BioNTech AG, Mainz, in Höhe von 25.000 TEUR.

2. Forderungen und sonstige Vermögensgegenstände

	31.12.2016
Forderungen aus Lieferungen und Leistungen	0
Forderungen gegenüber verbundenen Unternehmen	19.517
Übrige sonstige Vermögensgegenstände	124
	19.641

Es bestehen keine Forderungen größer 5 Jahre

Die Forderungen und sonstigen Vermögensgegenstände haben eine Restlaufzeit von unter einem Jahr.

3. Zahlungsmittel und Zahlungsmitteläquivalente

Zum Bilanzstichtag weist die Gesellschaft liquide Mittel in Höhe von 11.511 TEUR aus.

4. Eigenkapital

Der Jahresfehlbetrag 2016 in Höhe von 410.069,84 führt zu einem nicht durch Eigenkapital gedeckten Fehlbetrag in Höhe von 385.069,84 EUR.

5. Sonstige Rückstellungen

Die sonstigen Rückstellungen berücksichtigen alle das Rumpfgeschäftsjahr betreffenden ausstehenden Verpflichtungen.

6. Verbindlichkeiten

Die Verbindlichkeiten gegenüber verbundenen Unternehmen enthalten 400.000 EUR mit einer Restlaufzeit von mehr als 1 Jahr. Alle übrigen Verbindlichkeiten haben eine Restlaufzeit bis zu 1 Jahr. Sicherheiten für Verbindlichkeiten wurden nicht bestellt.

Nachfolgend die Aufgliederung der sonstigen Verbindlichkeiten.

	31.12.2016
erhaltene Anzahlungen auf Bestellungen	36.333.909
Verbindlichkeiten aus Lieferungen und Leistungen	333
Verbindlichkeiten gegenüber verbundende Unternehmen	530.790
sonstige Verbindlichkeiten	15.514
	36.880.546

7. Haftungsverhältnisse und sonstige finanzielle Verpflichtungen

Zum Bilanzstichtag sind keine schwebenden Verfahren bekannt, aus denen zukünftige Haftungsverhältnisse entstehen könnten. Es bestehen keine nennenswerten sonstige finanzielle Verpflichtungen.

8. Sonstige Angaben / Organe der Gesellschaft

Zum Geschäftsführer der Gesellschaft wurde Herr Dr. Sierk Poetting bestellt.

9. Veröffentlichung

Der Jahresabschluss wird im Bundesanzeiger bekannt gemacht.

10. Anzahl der Arbeitnehmer im Durchschnitt

	2016
Arbeitnehmer	23

Mainz, den 31.03.2017

BioNTech RNA Synthesis GmbH
Geschäftsführung

Feststellung des Jahresabschlusses

Der Jahresabschluss zum 31. Dezember 2016 wurde am 18. Dezember 2017 festgestellt.

Notes: The example reproduces the report published by BioNTech GmbH (later AG), the German biotech firm which recently developed the first FDA and EMA approved COVID-19 vaccine in collaboration with Pfizer, for fiscal year 2016 in the *Bundesanzeiger* (i.e., the German Federal Gazette). For the fiscal year 2016, the private limited-liability firm qualified for "small" firm reporting exemptions and hence it provides only an abbreviated balance sheet (Bilanz) and brief notes (Anhang), but no income statement.

Full Reporting

Name	Bereich	Information	V-Datum
BioNTech AG Mainz	Rechnungslegung/ Finanzberichte	Jahresabschluss zum Geschäftsjahr vom 01.01.2017 bis zum 31.12.2017	21.02.2019

BioNTech AG

Mainz

Jahresabschluss zum Geschäftsjahr vom 01.01.2017 bis zum 31.12.2017

Lagebericht für das Geschäftsjahr 2017

A. Geschäftstätigkeit und unternehmerisches Umfeld

Organisationstruktur

Die BioNTech AG und ihre Tochtergesellschaften, entwickeln innovative Immuntherapien, sowie auf Biomarkern basierende diagnostische Ansätze zur individualisierten Behandlung von Krebs und anderen schweren Erkrankungen.

Ziel ist es, möglichst für jeden Patienten eine maßgeschneiderte, hochwirksame und gut verträgliche Immuntherapie bereitzustellen.

Die Grundlage ist ein breites Technologie- und Patentportfolio, welches in einem Zeitraum von über 20 Jahre aufgebaut und mit Ausgründung aus der Johannes-Gutenberg-Universität 2008 in die BioNTech AG überführt wurde. Die BioNTech AG und ihre Tochtergesellschaften bilden die komplette Wertschöpfungskette ab: Von der Innovation über die Leitstrukturentwicklung, GMP-Herstellung und klinische Testung bis hin zum Wirksamkeitsnachweis. Daneben bietet die Unternehmensgruppe auch ein Diagnostik-Produkt und verschiedene Dienstleistungen an.

Die BioNTech AG dient hier als Beteiligungsgesellschaft für diverse Technologiegesellschaften und als Finanz- und Patent-Gesellschaft.

Rechtliche Struktur

Die BioNTech AG, die als Holdinggesellschaft fungiert, hält insgesamt zehn Tochter- bzw. Enkelgesellschaften, die an vier verschiedenen Standorten vertreten sind. Die BioNTech AG übte früher zentrale Konzernfunktionen wie Rechnungswesen, Controlling, Einkauf, Personal, Recht, Patentwesen und Unternehmenskommunikation selbst aus, hat die vorgenannten Funktionen jedoch mit Wirkung zum 1. Juli 2017 in eine Servicegesellschaft ausgegliedert. Die Holding fungiert darüber hinaus auch als Dachgesellschaft für einen Forschungs- und Entwicklungsbereich, der die unternehmenseigenen Technologien weiterentwickelt, neue Technologien erforscht und darüber hinaus auch interne Dienstleistungen im naturwissenschaftlichen Bereich anbietet.

Zwischen der BioNTech AG und den meisten Tochter- und Enkelgesellschaften bestehen Ergebnisabführungsverträge, teilweise auch Beherrschungs- und Gewinnabführungsverträge. Die BioNTech AG finanziert sich durch private Investoren.

Geschäftsaktivitäten

1. Technologien der BioNTech AG und ihrer Tochtergesellschaften, inkl. Forschungskooperationen

Die Optimierung und Weiterentwicklung der unternehmenseigenen Plattform-Technologien wurde im Berichtszeitraum in allen Tochterfirmen mit Erfolg vorangetrieben.

Das Jahr 2017 war geprägt von der Umsetzung der mit Genentech Ende 2016 geschlossenen Kooperation zur gemeinsamen Entwicklung, Herstellung und Vermarktung neuartiger, auf Messenger RNA (mRNA) basierender, individualisierter Krebsimpfstoffe. Den mRNA-basierten Impfstoffen liegt BioNTechs klinische IVAC Mutanom Plattform zugrunde, die potentiell zur Behandlung verschiedener Krebsarten eingesetzt werden kann. In diesem Zusammenhang haben wir 2017 erfolgreich einen halbautomatischen Fertigungsprozesses für individualisierte mRNA Impfstoffe entwickelt und implementiert. am Standort Idar-Oberstein konnten wir bereits eine Herstellerlaubnis erhalten, am Standort Mainz wurde die Herstellungserlaubnis im Mai 2018 erteilt, nachdem die zuvor erfolgte Prüfung durch die Zulassungsbehörden nur geringe Beanstandungen ergeben hatten. Im Zuge der Entwicklung des Produktionsprozesses wurden die Rekrutierung und das Training von Mitarbeitern in der Produktion, sowie in unterstützenden und leitenden Funktionen ausgeweitet. Für die erste klinische Phase I Studie, die innerhalb dieser Kooperation in den USA, Kanada und Europa durchgeführt wird, konnte die jeweilige Behördenzulassung in den USA, Kanada, Großbritannien, den Niederlanden, Spanien, Schweden und Belgien erfolgreich erlangt werden. Die Studie sollt in bis zu 60 Studienzentren in Nordamerika und Europa durchgeführt werden. Im Dezember 2017 konnten die ersten beiden Patienten dieser klinischen Studie bereits mit der individualisierten Immuntherapie behandelt werden.

Unsere klinische Studie Lipo-MERIT für die Indikation Melanom wurde in 2017 weitergeführt und liegt im Zeitplan. Ebenso fortlaufend sind die Studien HARE-40 (Indikation Kopf-Hals-Krebs) und TNBC-MERIT (Indikation dreifacher negativer Brustkrebs).

Im Rahmen der in 2015 abgeschlossenen Lizenz- und F+E-Kooperationsverträge mit Sanofi bzw. Genmab werden jeweils mehrere Produktkandidaten entwickelt. Die ersten dieser Kandidaten werden 2018 (Sanofi) bzw. 2019 (Genmab) in die klinische Phase eintreten.

Bei allen Kooperationen konnten in 2017 wesentliche Fortschritte in der Forschung und Entwicklung erzielt und Meilensteine erreicht werden.

2. Die BioNTech AG im Markt für Therapeutika, inkl. Wettbewerbsumfeld

Die Dynamik der letzten Jahre im Bereich der Krebs-Immuntherapie setzte sich in 2017 fort. Die Kooperation mit Genentech, sowie die weiteren wissenschaftlichen Veröffentlichungen trugen, neben vielen anderen Aspekten, dazu bei, dass BioNTech als ein führendes immuntherapeutisches Unternehmen wahrgenommen wird.

Die beschränkten Finanzierungsmöglichkeiten in 2016 sind einem investitionsfreundlichen Klima gewichen, was sich neben Fortschritten in Forschung und Entwicklung auch in der Entwicklung einiger Mitbewerber widerspiegelt:

- Moderna Therapeutics, USA, (auf dem Gebiet der mRNA Therapien tätig) verfügt zum Jahresende 2017 über Liquiditätsreserven Höhe von USD 910 Mio. 2017 sind USD 55 Mio. aus Kostenerstattungen, Meilensteinzahlungen und Kapitaleinlagen zugeflossen, während USD 455 Mio. investiert wurden. Moderna plant im Sommer 2018 eine pharmazeutische Produktionsanlage zur automatisierten Herstellung von mRNA in Betrieb zu nehmen, in die USD 110 Mio. investiert wurden.

- CureVac, Deutschland, (ebenfalls auf dem Gebiet der mRNA Therapien tätig) baut seine Produktionskapazitäten weiter aus mit dem Ziel, 2018 bis zu 10 Mio. Patientendosen GMP-konform herstellen zu können.

- Der Wettbewerber Neon Therapeutics, USA, erwartet in der ersten Jahreshälfte 2018 erste klinische Daten aus seiner Phase I Studie, in der eine individualisierte, peptidbasierte Krebsimmuntherapie getestet wird.

Die großen Pharmafirmen sind nach wie vor sehr daran interessiert, gezielt in neue und zukunftsweisende Technologien und Programme zu investieren. BioNTech wird das eigene Partnering-Programm dementsprechend vorantreiben und evaluiert laufend Kooperationsoptionen mit potentiellen Partnern.

3. Weitere Fortschritte der BioNTech AG und ihrer Tochtergesellschaften im Jahr 2017

1. Ausbau der Vertriebsaktivitäten für das Brustkrebs-Diagnostikums MammaTyper® (zusammen mit Kit RNXtract®).

2. Publikation zusammen mit dem TRON im Wissenschaftsmagazin „Nature" über Beobachtungsdaten von 13 Patienten über einen Zeitraum von bis zu zwei Jahren, welche die Prämisse stützen, dass mRNA basierte Medikamente das Tumorwachstum stoppen oder zur Rückbildung des Tumors führen

3. Verleihung des WuXi App Tec Biotech Company of the Year Awards 2017 an BioNTech

4. Eingliederung der RNA Synthesis GmbH in die RNA Pharmaceuticals GmbH, um die Aktivitäten um den IVAC Produktionsprozess in einer Gesellschaft zu bündeln.

5. Umfirmierung der EUFETS GmbH in BioNTech Innovative Manufacturing Services GmbH mit Rebranding des Außenauftritts, um die Zugehörigkeit und Anbindung an die BioNTech Gruppe auch optisch herauszustellen.

6. Weiterhin starkes Wachstum bei den externen Dienstleistungen bei der BioNTech Innovative Manufacturing Services GmbH (ehemals EUFETS GmbH).

7. Nachhaltig ein positives Ergebnis bei der JPT GmbH.

8. Gründung der BioNTech Business Services GmbH, verbunden mit der Auslagerung zentraler Dienstleistungen aus der BioNTech AG in diese Gesellschaft

B. Strategie und Leistungsmanagement

Strategie

BioNTech entwickelt innovative Technologien und hat den Anspruch, die daraus hervorgehenden Produktkandidaten in die Klinik und auf den Markt zu bringen. Die Gesellschaft befindet sich im Umbruch von einem rein forschungsbasierten Unternehmen hin zu einem Biotechunternehmen, das sich auf den potentiellen Markteintritt seiner Produkte vorbereitet.

Bereits aufgebaute Plattformen für RNA-basierte Therapien und Zell- und Gentherapien haben einen hohen Reifegrad erreicht, so dass durch Verpartnerung und Auslizenzierung dieser Technologien über Partnerschaften mit Pharma- und Biotechnologieunternehmen finanzieller Freiraum für eine zusätzliche Wertsteigerung durch die Entwicklung von firmeneigenen Produktkandidaten geschaffen werden konnte.

BioNTech entwickelt im Rahmen der Pharma-Partnerschaften nur ausgewählte Produkte. Die bei der BioNTech verbleibende Technologie kann weiterhin zur Entwicklung eigener Produkte genutzt werden, um diese auf den Markt zu bringen.

Die Tochterfirmen BioNTech Innovative Manufacturing Services GmbH, JPT Peptide Technologies GmbH und BioNTech Diagnostics GmbH unterstützen einerseits die Therapieplattformen durch die Herstellung von Zwischenprodukten und die Bereitstellung von diagnostischen Methoden und generieren andererseits Drittumsätze und finanzieren so die Forschungsaktivitäten der Gruppe.

Im Hinblick auf die künftige Geschäftsentwicklung beobachtet BioNTech die internationale Biotechnologiebranche sehr intensiv, um durch sich bietende Akquisitionsmöglichkeiten und durch Einlizenzierungen nachhaltiges Wachstum sicherzustellen.

Leistungsmanagement

Als Finanzindikatoren im Hinblick auf die operative Unternehmensleistung dienen vor allem Kennziffern wie Umsatzerlöse, sonstige betriebliche Erträge (Zuschüsse) und das Ergebnis der gewöhnlichen Geschäftstätigkeit. Für alle Unternehmen wird die Leistung auf monatlicher Basis ermittelt: die Budgetplanung des laufenden Geschäftsjahres wird ggfs. halbjährig aktualisiert. Darüber hinaus wird einmal im Jahr eine mittelfristige, die nächsten zwei Jahre abdeckende, Planung erstellt. Eine eingehende Kostenanalyse, anhand derer das Unternehmen die Einhaltung von Finanzzielen überwacht und einen Vergleich zu Vorperioden vornimmt, erfolgt auf fortlaufender Basis. Daneben ist die Cashflowplanung und -überwachung ein weiteres bedeutendes Steuerungsinstrument.

Nicht finanzielle Leistungsindikatoren

Die Überwachung nicht-finanzieller Indikatoren ist bei einem Forschungsunternehmen entscheidend für den Unternehmenserfolg. Für uns betrifft dies insbesondere die Erreichung der selbst oder im Rahmen einer Kooperation gesteckten Forschungs- und Entwicklungsziele.

Bestens ausgebildete und hoch motivierte Mitarbeiter sind die Voraussetzung dafür, in der auf Forschung und Entwicklung basierenden Biotechnologiebranche langfristig erfolgreich bestehen zu können. Daher kommt dem Personalmanagement eine strategische Schlüsselrolle zu. Ziel ist es, vielversprechende Talente für die BioNTech AG zu begeistern, Leistungsträger an die Gesellschaft zu binden sowie Mitarbeiter kontinuierlich und gezielt weiterzuentwickeln. Ein Ausdruck für den Erfolg des Personalmanagements in den vergangenen Jahren ist die hoch qualifizierte und erfahrene Belegschaft.

C. Entwicklung des unternehmerischen Umfelds

Branchenspezifische Rahmenbedingungen

Der weltweite Gesamtumsatz mit Therapeutika in onkologischen Indikationen und damit verbundenen Medikamenten belief sich im Jahr 2015 auf USD 107 Mrd., was einem Anstieg gegenüber dem Vorjahr von 11,5% entspricht. Experten prognostizieren ein jährliches Wachstum in einer Spanne von 7,5-10,5% jährlich, so dass 2020 USD 150 Mrd. erreicht werden (Global Oncology Trend Report des IMS Institute for Healthcare Informatics, Juni 2016). Treiber dieses Wachstums sind einerseits das häufigere Auftreten von Krebs und andererseits die gestiegenen monatlichen Behandlungskosten (GLOBAL & USA CANCER IMMUNOTHERAPY MARKET ANALYSIS TO 2020: Antibody Drug Conjugates, Biospecific Monoclonal Antibodies, Cancer Vaccines, Cytokines, Interferons, Chimeric).

Diese bereits eindrucksvolle Steigerung im Gesamtmarkt onkologischer Therapeutika wird noch überflügelt vom erwarteten Wachstum im Bereich der Krebsimmuntherapien. The Investmentbank Coven and Company bezifferte im Februar 2017 den weltweiten Krebsimmuntherapiemarkt auf USD 6,4 Mrd. für 2016 und erwartet eine Steigerung auf USD 29,9 Mrd. bis 2021. Wir gehen sogar von einer noch höheren Beschleunigung des Wachstums aus, sobald neue Therapien wie unsere mRNA-basierte Immuntherapie die Marktzulassung erhält.

Der Pharamarkt ist auch weiterhin bedingt durch das Auslaufen des Patentschutzes für umsatzstarke Produkte und den Wettbewerb durch Generika im Umbruch. Daher sucht die Pharmaindustrie verstärkt nach Partnerschaften mit innovativen Unternehmen, was insbesondere Biotechnologiefirmen wie der BioNTech mit der Vielzahl seiner Technologien weitere Partnerschaften- und dadurch Zugang zu Kapital, ermöglichen wird.

Die Entwicklung der immuntherapeutischen Industrie

Im Markt sind derzeit drei „Wellen" der onkologischen Immuntherapie zu beobachten:

- Welle 1: Die sogenannten „Checkpoint Inhibitoren" (anti-PD1, anti-PD-L1, anti-CTLA4) sind eher klassische, nach dem etablierten Pharmamodell entwickelte Immuntherapien (Antikörper). Die ersten Medikamente (z.B. Bristol-Myers Squibbs Opdivo oder Mercks Keytruda) haben bereits Marktzulassungen, etwa gegen Hautkrebs und Lungenkrebs (weitere onkologische Indikationen befinden sich in der klinischen Prüfung), bekommen und verzeichnen vielversprechende Erfolge bei der Behandlung von Krebs. Es wird erwartet, dass eine Reihe von Indikationen in naher Zukunft ebenfalls Zulassungen bekommen Die großen Pharmafirmen wie Bristol-Myers Squibb, Merck und Genentech werden mit ihren Pipelines von Checkpoint-Inhibitoren in einem dichten Markt gegeneinander um Anteile kämpfen.

- Welle 2: Therapien, die auf Chimären-Antigen-Rezeptoren (CAR) und auf T-Zell-Rezeptoren (TZR) basieren, befinden sich gerade in den ersten klinischen Entwicklungsphasen, die bereits sehr vielversprechende Erfolge erzielt haben. Dieses sich schnell entwickelnde Feld (mit vielen Börsengängen und Lizenzdeals) ist davon geprägt, dass die Mitbewerber entweder früh aus dem universitären Umfeld entstanden sind (z.B. ist Juno Therapeutics aus einer Kollaboration des Fred Hutchinson Cancer Research Center, des Memorial Sloan-Kettering Cancer Center und des Seattle Children's Research Institute entstanden) oder etablierte Pharmafirmen direkt mit Universitäten kollaborieren (z.B. Novartis mit der University of Pennsylvania).

- Welle 3: Wir erwarten, dass sich eine neue Klasse von Produkten formieren wird, die personalisierte, bzw. individualisierte Immuntherapien gegen Krebs ermöglichen. BioNTech ist auf diesem Gebiet weltweit führend. Das Feld entwickelt sich schnell und der Prozess der individualisierten Krebstherapie könnte für ca. 70% aller soliden Tumorarten anwendbar sein. Momentan befindet sich die Entwicklung noch in der klinischen Phase I, wird aber durch die Kollaboration zwischen BioNTech und Genentech aggressiv Richtung Marktreife getrieben. Weitere Biotechnologieunternehmen (bspw. Gritstone and Neon Therapeutics) haben sich dieser Welle Ende 2015 angeschlossen. Mittlerweile ist das Behandlungskonzept der individualisierten Krebstherapie anerkannt und wird in Partnerschaften zwischen Pharmafirmen und Biotechnologiefirmen weiterentwickelt. BioNTech entwickelt Produktkandidaten für die Wellen 2 und 3, allerdings liegt der Fokus auf der dritten Welle und somit auf den voll individualisierten Krebsimmuntherapien. Durch die diversifizierten Technologie-Plattformen von BioNTech und die Entwicklung eigener Produkte, die einzeln oder als Kombinationstherapien verwendet werden können, ist die Firma hervorragend positioniert, um seine führende Rolle auf dem Gebiet der Krebsimmuntherapien zu behaupten und weiter auszubauen.

Regulatorisches Umfeld

Marktzulassung, Preisgestaltung und Kostenerstattung sind im Gesundheitssektor stark reguliert. Zum einen ist es politischer Wille der Regierungen Patienten mit Krebserkrankung schnell mit modernen, hochwirksamen und sicheren Krebsmedikamenten zu versorgen, zum anderen nimmt seit Jahren der Kostendruck im Gesundheitswesen zu. Dies resultiert darin, dass Hersteller innovativer Medikamente nicht nur die Wirksamkeit und Sicherheit der Präparate bei den Zulassungsbehörden nachweisen müssen. Im Anschluss muss auch der sog. Zusatznutzen belegt werden, wenn eine Kostenübernahme der Präparate durch die Krankenkassen angestrebt wird bzw. ein Preis oberhalb verfügbarer Altpräparate in der Indikation geplant ist. Letztlich bestimmt dann das Ausmaß des zuerkannten Zusatznutzens das Medikaments den Erstattungspreis. Positiv betrachtet können diese Herausforderungen, mit denen die Pharmakonzerne konfrontiert sind, als förderlich für die Risiko- und Innovationsbereitschaft bewertet werden. Biotechnologiefirmen mit hohem Innovationspotential und neuen, disruptiven Technologien werden zunehmend Wunschpartner für bereits etablierte Pharmafirmen werden.

D. Forschung und Entwicklung

BioNTech ist Spezialist für innovative Technologien und Produkte im Bereich der Medikamentenentwicklung. Der bisherige wirtschaftliche Erfolg beruht maßgeblich auf nachhaltiger Forschungs- und Entwicklungsarbeit. BioNTechs Technologieplattformen werden kontinuierlich verbessert und durch weitere Module ergänzt.

Nach dem Umzug in 2014 in ein ca. 10.000 qm großes Labor- und Forschungsgebäude in Mainz, welches der BioNTech AG als Zentrale dient, wurden 2016 umfangreiche Umbaumaßnahmen abgeschlossen, um dort Ausgangsstoffe für klinische Prüfpräparate zu erzeugen. Weiterhin wurde Anfang 2016 mit der Erweiterung des Labor- und Forschungsgebäudes begonnen. Ende 2017 wurde der zweite Bauabschnitts („East Wing"), der ebenfalls der Herstellung klinischer Prüfpräparate dienen soll, fertiggestellt.

Im Dezember 2017 fiel der Startschuss für die Erweiterung der Produktionskapazitäten der BioNTech Innovative Manufacturing Services GmbH in Idar-Oberstein. Das Investitionsvolumen wird ca. EUR 27 Millionen betragen. Damit werden zwei neue Gebäude, eines mit Reinräumen für die Herstellung der Cell & Gene Produktion und eines mit Laboren für die Qualitätskontrolle, errichtet.

Um die weiter steigende Nachfrage nach Peptiden nachhaltig bedienen zu können, bereitet die JPT Peptides Technologies GmbH den Kauf eines Grundstücks in Berlin im 2. Quartal 2018 vor und arbeitet bereits an der Planung eines neuen Produktionsgebäudes. Das vorläufige Investitionsbudget wird auf EUR 25 Millionen veranschlagt.

Forschung und Entwicklung mit Partnern

Neben der fortlaufenden akademischen Kooperationen mit der Universitätsmedizin Mainz und der TRON gGmbH, , die sowohl die Entdeckung und Weiterentwicklung von Technologien, als auch Kooperationen im präklinischen und klinischen Bereich umfasst, wird das BioNTech Produkt- und Patentportfolio ergänzt durch externe Forschungskooperationen. Lizenzabkommen mit Eli Lilly zur Erforschung neuartiger Krebsimmuntherapien durch Identifizierung von Tumorzielstrukturen sowie die dazugehörigen T-Zell-Rezeptoren (TZRs): 2017 wurden parallel zu der weiteren Sammlung von Patientenproben erfolgreich T-Zell-Rezeptoren gegen ausgewählte tumorspezifischen Zielstrukturen identifiziert und auf Reaktivität validiert.

- Genmab Kollaboration: Die Research Phase wurde aufgrund vielversprechender präklinischer Ergebnisse zu den verschiedenen Produktkonzepten und der erfolgreichen Zusammenarbeit bereits um ein weiteres Jahr verlängert. Zwei der entwickelten bispezifischen Antikörper wurden 2017 als Kandidaten für die Klinik nominiert und werden Anfang 2019 jeweils in die klinische Phase eintreten.

- Kooperations- und Lizenzabkommen mit Sanofi : In 2017 wurde der erste Leitkandidat final definiert, der präklinische proof-of concept erbracht und das Konzept mit dem Paul-Ehrlich-Institut als zuständige Bundesoberbehörde erfolgreich diskutiert. Ferner wurde die Sicherheit und Verträglichkeit des Therapieansatzes in zwei GLP-Toxikologiestudien erbracht und die Antragsdokumente für die Zulassung zu einer klinischen Prüfung vorbereitet, die den Eintritt in die klinische Prüfung in 2018 ermöglichen.

- 2016 konnte eine weltweite strategische Zusammenarbeit mit der Roche-Tochter Genentech geschlossen werden. Gemeinsames Ziel ist es, neuartige, auf Messenger RNA (mRNA) basierende, individualisierte Krebsimpfstoffe zu entwickeln, herzustellen und zu vermarkten.

F&E Aktivitäten

Die klinische Translation von Immuntherapien stellt den Fokus der Entwicklung im therapeutischen Bereich dar. Hierzu erfolgten folgende Aktivitäten:

RB_0001-01 (MERIT) wurde im Jahr 2017 erfolgreich beendet. Zusammenfassend konnte in der Studie eine sehr gute Sicherheit und Verträglichkeit der intranodal applizierten RNA Vaksine gezeigt werden.

In der RB_0004-01 (IVAC Mutanome) Studie wurden insgesamt 13 Patienten mit einem personalisierten Impfstoff behandelt, womit die BioNTech AG eine weltweite Vorreiterposition im Bereich der Mutanome-Impfstoffe erreichen konnte (first in concept). Im Februar 2017 wurde die letzte Injektion im Rahmen der Studie verabreicht. Sowohl Prüfärzte als auch Patienten sind sehr interessiert an dem innovativen Produkt. Bisherige Ergebnisse zeigen eine sehr gute Verträglichkeit des Impfstoffes. Das begleitende Biomarker Programm konnte darüber hinaus zeigen, dass durch die Vaksine mutationsspezifische T-Zell Antworten hervorgerufen wurden. Zum 31. Dezember 2017 war der Studienabschlussbericht bereits weit fortgeschritten und wird planmäßig in 2018 fertiggestellt. Darüber hinaus konnte in 2017 die klinische Testung der neu entwickelten Lipid-Formulierung für RNA Impfstoffe (Lipo-MERIT: RB_0003-01) weiter vorangetrieben werden. bis zum 31. Dezember 2017 wurden 52 Patienten behandelt. Insgesamt konnte bereits jetzt eine gute Verträglichkeit der neuen Lipid-Formulierung gezeigt werden. Aufgrund der guten Verträglichkeit und der preliminären guten Ergebnisse wurde die Studie um zusätzliche Dosiskohorten sowie Expansionskohorten erweitert, sodass sich die Gesamtzahl der einzuschließenden Patienten auf 115 erhöht. Damit wird die Studie auch in 2018 noch weiter vorangetrieben um die notwendigen Patienten einzuschließen und zu behandeln. Die klinische Anwendung der Kombination aus Warentuhaus und Mutanome (TNBC-MERIT: RB_0002-01) konnte in 2017 weiter vorangetrieben werden. In „Arm 1" haben 5 Patientinnen bis Dezember 17 die Studie abgeschlossen. In „Arm 2" startete die erste Patientin ihre Behandlung. Produktion und Behandlung mit dem personalisierten patientenindividuellen Mutanom-Prüfpräparat sind für Q1 2018 vorgesehen.

Im Dezember 2017 wurde außerdem der erste Patient in die klinische Studie eingeschlossen, die gemeinsam mit Genentech durchgeführt wird (RO7198457). Hierbei werden BioNTechs individualisierte mRNA-basierte Immuntherapien intravenös in verschiedenen Indikationen sowohl als alleinstehende Medikation als auch in Kombination mit Atezolizumab. verabreicht. Die klinische Phase I Studie wird in Studienzentren in den USA und in verschiedenen europäischen Ländern durchgeführt.

Im Rahmen der RB_0005-01/HARE-40 klinischen Studie soll die Sicherheit, Verträglichkeit und klinische Effektivität der Lipid-Formulierung zur Targetierung von zwei viralen Onkogenen (E6/E7) in Patienten mit Human Papilloma Virus (HPV) positiven Tumoren getestet werden. In 2017 konnten 6 Patienten im adjuvanten Setting mit dem E6/E7 RNA Vakzin bei guter Verträglichkeit behandelt werden. 2018 wird die Studie weiter fortgeführt und weitere Patienten eingeschlossen und behandelt.

E. Personal

Motivierte, kreative und hervorragend ausgebildete Mitarbeiter bilden die Basis für den Unternehmenserfolg der BioNTech AG. Am 31. Dezember 2017 waren 156 Mitarbeiter bei BioNTech AG beschäftigt (31. Dezember 2016: 173). Im Jahresdurchschnitt 2017 beschäftigte die Gesellschaft 170 Personen (2016: 163).

F. Analyse des Geschäftsverlaufs/Vermögens-, Finanz- und Ertragslage

Umsatzerlöse

Im Vergleich zum Vorjahr haben sich die Umsatzerlöse aus fortgeführten Geschäftsbereichen von 12,7 Mio. EUR um 7,3 Mio. EUR auf 20,0 Mio. EUR erhöht. Die Erhöhung der Umsätze resultiert insbesondere aus Kooperationen mit konzernfremden Unternehmen.

Betriebliche Aufwendungen

Die betrieblichen Aufwendungen stiegen in 2017 um EUR 32,9 Mio. auf EUR 54,6 Mio. (2016: EUR 21,7 Mio.). Diese Erhöhung ist insbesondere auf um EUR 20,0 Mio. höhere Aufwendungen für Forschungs- und Entwicklungskosten (2016: 14,4 Mio. EUR) zurückzuführen.

Die Aufwendungen für Vertrieb sind deutlich um EUR 5,3 Mio. auf EUR 6,8 Mio. angestiegen. Die Verwaltungskosten erhöhten sich um EUR 7,6 Mio. auf EUR 13,5 Mio. und resultieren insbesondere aus dem Mitarbeiterbeteiligungsprogramm.

Sonstige betriebliche Erträge

Die sonstigen betrieblichen Erträge beliefen sich auf 0,7 Mio. EUR (2016: 1,4 Mio. EUR) und setzen sich hauptsächlich aus Fördermittelprojekten und Weiterbelastungen von Dienstleistungen an die Tochterunternehmen zusammen.

Jahresergebnis

Im Geschäftsjahr 2017 wird ein negatives Ergebnis nach Steuern von -60,1 Mio. EUR (2016: -0,9 Mio. EUR) ausgewiesen.

Finanzlage

GRUNDLAGEN DES FINANZMANAGEMENTS

Es ist die Aufgabe des Finanzmanagements bei der BioNTech AG, die für die Forschungsaktivitäten der Tochtergesellschaften notwendigen finanziellen Mittel zur Verfügung zu stellen. Die Gesellschaft finanziert sich in im Wesentlichen durch die im Rahmen der eingegangenen Kooperationen erhaltenen Upfrontzahlungen sowie durch Eigenkapital. Darüber hinaus werden öffentliche Fördermittel angeworben. Die Konzerngesellschaften JPT und IMFS erzielen Cashflowüberschüsse aus ihrer operativen Geschäftstätigkeit. Zur Ermittlung des Liquiditätsbedarfs werden Szenario- und Cash-Flow-Planungen angestellt. Diese dienen auch der dauernden Kontrolle der Liquidität und Solvenz.

INVESTITIONEN

Der Gesamtinvestitionsbetrag in 2017 betrug 3,7 Mio. EUR (2016: 2,4 Mio. EUR). Die Investitionen in das Sachanlagevermögen betrugen 3,2 Mio. EUR (2016: 1,6 Mio. EUR) und in das immaterielle Vermögen 0,5 Mio. EUR (2016: 0,8 Mio. EUR).

Die planmäßigen Abschreibungen auf Sachanlagen beliefen sich in 2017 auf 2,2 Mio. EUR (2016: 0,9 Mio. EUR). Die planmäßigen Abschreibungen auf immaterielle Vermögensgegenstände betrugen wie im Vorjahr 0,6 Mio. EUR.

LIQUIDITÄT

Am 31. Dezember 2017 verfügte das Unternehmen über Zahlungsmittel in Höhe von 10,4 Mio. EUR, verglichen mit 57,5 Mio. EUR am Jahresende 2016.

Bilanz

AKTIVA

Die Bilanzsumme lag am 31. Dezember 2017 mit 94,6 Mio. EUR um 17,8 Mio. EUR unter dem Wert vom 31. Dezember 2016 (112,4 Mio. EUR).

Der Zugang der langfristigen Vermögensgegenstände um 7,3 Mio. EUR auf 39,5 Mio. EUR zum 31. Dezember 2017 lag insbesondere daran, dass sich die Ausleihungen von verbundenen Unternehmen erhöhten.

Der Rückgang des kurzfristigen Vermögens um 47,7 Mio. EUR auf 32,0 Mio. EUR ist im Wesentlichen auf die Abnahme der liquiden Mittel zurückzuführen.

EIGENKAPITAL

Am 31. Dezember 2017 wird ein nicht durch Eigenkapital gedeckter Fehlbetrag in Höhe von EUR 22,4 Mio. ausgewiesen.

Das gezeichnete Kapital erhöhte sich durch Umwandlung aus Gesellschaftsmitteln um EUR 9,1 Mio. auf EUR 9,3 Mio. Die Kapitalrücklage reduzierte sich im Geschäftsjahr durch diese Umwandlung entsprechend auf EUR 140,8 Mio.

Durch den Jahresfehlbetrag in Höhe von EUR 60,1 Mio. ergab sich ein negatives Eigenkapital.

RÜCKSTELLUNGEN UND VERBINDLICHKEITEN

Die Rückstellungen erhöhten sich um 0,6 Mio. EUR auf 2,2 Mio. EUR am 31. Dezember 2017. Die Verbindlichkeiten erhöhten sich von 71,5 Mio. EUR um 20,8 Mio. EUR auf 92,3 Mio. EUR in 2017, hauptsächlich bedingt durch höhere Verbindlichkeiten gegenüber verbundenen Unternehmen sowie Verbindlichkeiten aus dem Mitarbeiterbeteiligungsprogramm.

PASSIVE RECHNUNGSABGRENZUNG

Der passive Rechnungsabgrenzungsposten konnte im Berichtsjahr in voller Höhe aufgelöst werden.

G. Risiken- und Chancen-Bericht

BioNTech ist Teil einer Industrie, die von stetem Wandel und Fortschritt geprägt ist. Die Herausforderungen und Chancen in der Gesundheitsindustrie werden von sehr unterschiedlichen Faktoren beeinflusst. Die weltweiten demografischen Veränderungen, medizinischer Fortschritt und der Wunsch nach steigender Lebensqualität in den aufstrebenden Schwellenländern bilden eine solide Wachstumsperspektive für die Pharma- und Biotechnologiebranche. Steigende regulatorische Auflagen im Bereich der Medikamentenentwicklung und insbesondere der Kostendruck auf die Gesundheitssysteme müssen jedoch ebenso berücksichtigt werden.

BioNTech versucht, systematisch neue Chancen zu erkennen und für den Geschäftserfolg zu nutzen, um langfristig den Unternehmenswert zu steigern. Unternehmerischer Erfolg ist jedoch ohne das bewusste Eingehen von Risiken nicht möglich.

Verantwortlichkeiten im Risiken- und Chancen-Management

Der Vorstand der BioNTech AG ist für das Risiken-und-Chancen-Managementsystem verantwortlich. Er stellt sicher, dass sämtliche Chancen und Risiken umfassend dargestellt, bewertet und überwacht werden.

Chancen und Risiken aus Unternehmensentscheidungen werden dem Aufsichtsrat regelmäßig zur Zustimmung vorgelegt. Für Investments über Euro 150.000 und Beraterverträge über Euro 100.000 sind entsprechend Genehmigungen des Aufsichtsrats einzuholen. Bestellungen über EUR 10.000,00 sind durch den Vorstand zu genehmigen. Die Abteilung Finanzen evaluiert einzelne Maßnahmen und Entscheidungen.

Im Zuge des Geschäftsmodells der BioNTech ergeben sich für die BioNTech folgende Chancen und Risiken:

Aus Sicht der Gesellschaft besteht das größte Risiko darin, den vorhandenen Technologievorsprung von den Wettbewerbern zu verlieren. Diesem Risiko wird durch den unvermindert großen Einsatz aller Mitarbeiter und die Bereitstellung der für die Erfüllung der anstehenden Aufgaben notwendigen Ressourcen Rechnung getragen.

Ein wesentliches finanzielles Risiko stellt das Währungsrisiko in der Entwicklung des US-Dollars dar. Es wird versucht diesem Risiko durch natürliches Hedging entgegenzuwirken indem weitere Ausgaben in USD generiert werden.

BioNTech versucht durch detaillierte Planung und Budgetierung, sowie durch Ausgaben-Controlling das Risiko der Projekte zu minimieren. Verträge mit finanziellen Verpflichtungen, welche die vorstehend genannten Volumina übersteigen, werden dem Aufsichtsrat zur Genehmigung vorgelegt. Der monatliche Cash-Forecast stellt sicher, dass die Finanzierung des operativen Geschäfts permanent gewährleistet ist. Bei Engpässen werden Projekte ggf. re-priorisiert, so dass der strategische Fokus im Projektportfolio immer gewährleistet ist. Die Cash-Reserven werden als Termingelder angelegt und zentral von der Holdinggesellschaft „BioNTech AG" verwaltet.

Operative/Organisatorische Risiken betreffen Risiken im Hinblick auf Forschung und Entwicklung von eigenen Medikamentenkandidaten (Präklinik und Klinik), aber auch sogenannten Compliance Risiken, die sich durch Nichteinhaltung der Vorschriften der US-amerikanischen FDA und der europäischen EMA und von Qualitätsmanagementrichtlinien ergeben. Operative Risiken bestehen im Beschaffungsbereich, sowie darin, geeignetes Personal zu rekrutieren.

Ein Scheitern von klinischen Studien vor der Auslizenzierung an Partner kann sich ergeben, wenn die Studiendaten nicht die erwarteten Ergebnisse oder aber unerwartete, unerwünschte Nebenwirkungen zeigen. Durch den Entwurf von Entwicklungsplänen und -protokollen, das Hinzuziehen von internen und externen Fachleuten, Einführung von Komitees/speziellen Meetings wird versucht, das Übervachen des Fortschritts stets zu garantieren.

Durch den weiteren Aufbau unserer internen Qualitätssicherungsabteilung, der kontinuierlichen Weiterentwicklung unseres Qualitätsmanagements und der unterstützenden Software (SOP-Guard) reduzieren wir Compliance-Risiken. Positive Qualitätsüberprüfungen durch Behörden bestätigen diese Entwicklung.

Risiken im Personal sind in erster Linie Herausforderungen in der Personalbeschaffung (das Gewinnen von Mitarbeitern mit den richtigen Qualifikationen). Durch einen professionellen Recruitingprozess und die Einschaltung interne Einstellungskomitees wird dieses Risiko mitigiert.

IT Risiken werden durch tägliche Datensicherungen (Verlustrisiko) sowie durch den Einsatz von äußerst zuverlässigen Firewall- und Virenscan-Systemen (Abwehr von Angriffe von außen) reduziert.

Strategische Risiken (z. B. Beteiligungen, Forschung & Entwicklung, überlegene Konkurrenzprodukte) werden dahingehend minimiert, dass sie sowohl mit dem Aufsichtsrat als auch mit den Investoren diskutiert werden. Darüber hinaus ist ein wissenschaftlicher Beirat installiert, der in diese Diskussionen einbezogen wird.

Externe Risiken ergeben sich für BioNTech überwiegend im Zusammenhang mit ihrem geistigen Eigentum. Um die Risiken auf diesem Gebiet zu mindern, werden veröffentlichte Patente und Patentanmeldungen ausgewertet.

Mit dieser Strategie erzielte BioNTech im Laufe der Jahre zunehmenden Erfolg und konnte ihre Handlungsfreiheit in Bezug auf die firmeneigenen Technologieplattformen auf lange Sicht sichern. Ein weiterer Bereich, in dem externe Risiken auftreten können, sind Veränderungen in den regulatorischen Rahmenbedingungen, die eine Anpassung der Entwicklungspläne und Aktivitäten bei BioNTech notwendig machen könnten. Hier werden fortwährend Veränderungen in den Organen und auf allen Management Levels diskutiert und evaluiert.

Zum Zeitpunkt der Erstellung dieses Berichts hält der Vorstand die Gesamtrisiken für beherrschbar und den Fortbestand der BioNTech-AG für nicht gefährdet.

Chancen

BioNTech verfügt über führende Schlüsseltechnologien, die patentrechtlich geschützt sind und zurzeit zunehmend auf ein sehr großes externes Interesse stoßen. Neben der Entwicklung eigener Produktkandidaten, hat das Unternehmen die Möglichkeit, eigene Technologien an externe Partner auszulizenzieren. Auch hier ist eine erhebliche Diversifizierung im therapeutischen Geschäftsbereich erfolgt.

Darüber hinaus bietet die Unternehmensgruppe ebenso im diagnostischen als auch im Service Bereich Leistungen an, die zu einem umfänglichen Geschäftsmodell, mit der Möglichkeit, positive Cash Beiträge zu generieren, beitragen.

Es wird damit gerechnet, dass die steigende Lebenserwartung der Bevölkerung in den Industriestaaten und die Veränderungen hinsichtlich Einkommenssituation und Lebensstil in den Schwellenländern die Nachfrage nach zusätzlichen und innovativen Behandlungsverfahren sowie leistungsfähigen Technologien fördern werden.

BioNTech ist der Ansicht, dass die Produkte im Rahmen seiner Diversifizierungsstrategie die einen erheblichen, bislang ungedeckten medizinischen Bedarf adressieren im Markt verwertet werden können.

BioNTech investiert weiter in seine bestehenden und in neue Technologien, um seinen Spitzenplatz als technologisch führendes Unternehmen zu wahren. Neue Technologiemodule könnten auch neue Krankheitsbereiche erschließen.

Die Technologieentwicklung wird von einem Team von Wissenschaftlern vorangetrieben, das sich auf die Weiterentwicklung der BioNTech-Technologien konzentriert. Außer auf die interne Technologieentwicklung setzt BioNTech aber auch auf externe Quellen, um sich technologisch zu verstärken.

H. Abhängigkeitsbericht (Angaben gemäß § 312 AktG)

Der Vorstand der BioNTech AG war zur Aufstellung eines Berichts über die Beziehungen zu verbundenen Unternehmen gemäß § 312 AktG verpflichtet. In diesem Bericht wurden die Beziehungen zur AT Impf GmbH sowie zu den Tochtergesellschaften der BioNTech AG dargestellt.

Der Vorstand erklärt gemäß § 312 Abs. 3 AktG, dass die BioNTech AG bei den aufgeführten Rechtsgeschäften und Maßnahmen nach den Umständen, die zum Zeitpunkt bekannt waren, bei dem die Rechtsgeschäfte vorgenommen oder die Maßnahme getroffen wurden, bei jedem Rechtsgeschäft eine angemessene Gegenleistung erhalten und ist dadurch, dass Maßnahmen getroffen oder unterlassen wurden, nicht benachteiligt oder bevorzugt worden.

I. Ausblick/Voraussichtliche Entwicklung

Im Jahr 2016 haben wir mit Genentech eine Entwicklungspartnerschaft im Bereich individualisierte IVAC MUTANOME Impfstoffe vereinbart und durch die hierbei erhaltenen Upfronttzahlungen auch unsererseits die weiter Finanzierung dieses Projekts mittelfristig gesichert. Im Jahr 2017 haben wir die für die klinische Testung erforderlichen Produktionskapazitäten aufgebaut und mittlerweile auch die entsprechenden behördlichen Zulassungen erhalten bzw. erwarten diese kurzfristig. Im Jahr 2018 werden wir hauptsächlich am Ausbau und an der Optimierung der Technologie zur (halb) automatisierten Herstellung der individualisierten Impfstoffe arbeiten, um die bereits angelaufene klinische Studie mit Impfstoffen zu versorgen. Die dabei gewonnenen klinischen Daten werden für den Erfolg dieses Projekts entscheidend sein.

Die Entwicklung der anderen (nicht-mRNA) Plattform-Technologien wurde in 2017 vorangetrieben, vor allem im Rahmen der Kooperationen mit Eli Lilly und Genmab. Bei den Kooperationsprojekten ist es essentiell, gute Forschungsergebnisse zu erzielen, um die vereinbarten Meilensteinzahlungen für

Projektfortschritte zu erhalten.

Um das angestrebte Wachstum in den kommenden Jahren finanzieren zu können, werden die Business-Development-Aktivitäten forciert. Die Nachfrage- und Wettbewerbslage ist für BioNTechs Technologien weiterhin sehr günstig und es werden fortlaufend Gespräche mit potentiellen Partnern geführt.

Der Cashburn ist in 2017 wie prognostiziert stark angestiegen und lag bei ca. 20 Mio pro Monat. Ursächlich hierfür war der Aufbau der Produktion für IVAC MUTANOME und die Kollaboration mit Genentech, welche eine 50:50 Teilung aller Kosten vorsieht. In Folge der stark ansteigenden Patientenzahlen in der klinischen Studie gehen wir von weiteren Steigerungen des monatlichen Cashburns aus.

Es ist uns gelungen, kurz vor Jahresende eine Finanzierungsrunde zu vereinbaren, an der sich neben dem bestehenden Hauptaktionär auch neue Investoren beteiligt haben. Insgesamt sind der Gesellschaft auf diesem Wege im Januar 2018 EUR 228,8 Mio. an Liquidität zugeflossen. Dadurch ist die Finanzierung der Gesellschaft nach derzeitiger Planung bis einschließlich Q1, 2020 gesichert. Damit ist auch der in der Bilanz zum 31. Dezember 2017 ausgewiesene nicht durch Eigenkapital gedeckte Fehlbetrag ausgeglichen und das Eigenkapital wieder deutlich positiv.

Mainz, den 21. Juni 2018

BioNTech AG
Der Vorstand

Bilanz zum 31. Dezember 2017

AKTIVA

	31.12.2017 EUR	EUR	31.12.2016 EUR
A. Anlagevermögen			
I. Immaterielle Vermögensgegenstände			
1. Konzessionen, gewerbliche Schutzrechte u.ä. Rechte und Werte sowie Lizenzen an solchen Rechten und Werten	5.439.150,01		5.350.098,54
2. Geleistete Anzahlungen immaterielle Vermögensgegenstände	299.794,45		561.197,53
		5.738.944,46	5.911.296,07
II. Sachanlagen			
1. Andere Anlagen, Betriebs- und Geschäftsausstattung	5.516.491,57		4.153.907,00
2. Geleistete Anzahlungen andere Anlagen, Betriebs- und Geschäftsausstattung	320.607,31		25.833,67
		5.837.098,88	4.179.740,67
III. Finanzanlagen			
1. Anteile an verbundenen Unternehmen	5.714.268,12		5.689.268,12
2. Ausleihungen an verbundene Unternehmen	22.235.999,00		15.785.999,00
3. Beteiligungen	0,00		611.365,00
		27.950.267,12	22.086.632,12
		39.526.310,46	32.177.668,86
B. Umlaufvermögen			
I. Vorräte			
1. Roh-, Hilfs- und Betriebsstoffe	379.043,61		373.274,33
2. Geleistete Anzahlungen	35.148,32		73.011,97
		414.191,93	446.286,30
II. Forderungen und sonstige Vermögensgegenstände			
1. Forderungen aus Lieferungen und Leistungen	269.948,15		149.006,05
2. Forderungen gegen verbundene Unternehmen	16.174.290,44		19.335.949,00
3. Sonstige Vermögensgegenstände	4.658.203,02		2.259.354,86
		21.102.441,61	21.744.309,91
III. Kassenbestand, Guthaben bei Kreditinstituten und Schecks		10.439.215,51	57.458.772,03
		31.955.849,05	79.649.368,24
C. Rechnungsabgrenzungsposten		663.120,19	562.811,20
D. Nicht durch Eigenkapital gedeckter Fehlbetrag		22.427.158,66	0,00
		94.572.438,36	112.389.848,30

PASSIVA

	31.12.2017 EUR	EUR	31.12.2016 EUR
A. Eigenkapital			
I. Gezeichnetes Kapital		9.264.660,00	181.660,00
II. Kapitalrücklage		140.833.842,00	149.916.842,00
III. Bilanzverlust			
1. Verlustvortrag	-112.381.318,66		-111.439.327,78
2. Jahresfehlbetrag	-60.144.342,00		-941.990,88
		-172.525.660,66	-112.381.318,66
		-22.427.158,66	37.717.183,34
IV. Nicht durch Eigenkapital gedeckter Fehlbetrag		22.427.158,66	0,00
		0,00	37.717.183,34
B. Rückstellungen			
Sonstige Rückstellungen		2.225.362,17	1.619.991,20
C. Verbindlichkeiten			
1. Verbindlichkeiten gegenüber Kreditinstituten	2,34		0,00
2. Verbindlichkeiten aus Lieferungen und Leistungen	3.916.931,70		1.775.788,52
3. Verbindlichkeiten gegenüber verbundenen Unternehmen	75.418.792,64		67.709.380,50
4. Sonstige Verbindlichkeiten	13.011.349,51		2.041.532,68
		92.347.076,19	71.526.701,70
D. Rechnungsabgrenzungsposten		0,00	1.525.972,06
		94.572.438,36	112.389.848,30

Gewinn- und Verlustrechnung für die Zeit vom 1. Januar bis 31. Dezember 2017

	1.1.-31.12.2017 EUR	1.1.-31.12.2016 EUR
1. Umsatzerlöse	19.983.804,41	12.721.897,63
2. Herstellungskosten der zur Erzielung der Umsatzerlöse erbrachten Leistungen	0,00	3.028.590,63
3. Bruttoergebnis vom Umsatz	19.983.804,41	9.693.306,80
4. Forschungs- und Entwicklungskosten	34.366.324,38	14.390.572,04
5. Vertriebskosten	6.766.438,57	1.438.666,72
6. Verwaltungskosten	13.484.849,54	5.915.860,07
7. sonstige betriebliche Erträge	693.370,11	1.385.098,83
8. Sonstige betriebliche Aufwendungen	519.453,16	32.088,90
9. Erträge aus der Ergebnisübernahme	946.570,89	11.944.484,65
davon aus verbundenen Unternehmen EUR 946.570,89 (Vj: EUR 11.944.484,65)		
10. Sonstige Zinsen und ähnliche Erträge	761.571,48	1.471.393,37
davon aus verbundenen Unternehmen EUR 760.238,58 (Vj: EUR 1.470.265,72)		
11. Abschreibungen auf Finanzanlagevermögen und auf Wertpapiere des Umlaufvermögens	611.365,00	0,00
12. Zinsen und ähnliche Aufwendungen	1.999.816,86	1.798.628,91
davon an verbundene Unternehmen EUR 1.991.704,07 (Vj: EUR 1.790.426,63)		
13. Aufwendungen aus der Verlustübernahme	24.783.383,38	1.860.457,89
davon aus verbundenen Unternehmen EUR 24.783.383,38 (Vj: EUR 1.860.457,89)		
14. Ergebnis vor Steuern	-60.144.314,00	-941.990,88
15. Sonstige Steuern	28,0028	0,00
16. Jahresfehlbetrag	-60.144.342,00	-941.990,88

Anhang für das Geschäftsjahr 2017

A. Allgemeine Angaben zum Jahresabschluss

Die BioNTech AG ist eine mittelgroße Kapitalgesellschaft i.S.d. § 267 Abs. 2 Handelsgesetzbuches mit Sitz in Mainz.

Die Gesellschaft ist im Handelsregister B des Amtsgerichts Mainz unter der Nummer HRB 41865 geführt.

Der vorliegende Jahresabschluss wurde gemäß § 242 ff und § 264 ff HGB sowie nach den einschlägigen Vorschriften des Aktiengesetztes aufgestellt. Der Jahresabschluss wird in Euro (EUR) aufgestellt. Beträge in Tausend Euro (TEUR) sind entsprechend angegeben.

Die Gewinn- und Verlustrechnung wurde gemäß § 275 Abs. 3 HGB nach dem Umsatzkostenverfahren aufgestellt.

B. Angaben zu den Bilanzierungs- und Bewertungsmethoden

Immaterielle Vermögensgegenstände mit begrenzter Nutzungsdauer werden zu Anschaffungs- oder Herstellungskosten bilanziert und abhängig von ihrer geschätzten Nutzungsdauer planmäßig über einen Zeitraum von in der Regel 3 bis 20 Jahren linear abgeschrieben.

Abnutzbare Sachanlagen werden zu Anschaffungs- oder Herstellungskosten abzüglich kumulierter Abschreibungen bewertet. Die Abschreibung erfolgt planmäßig linear über die betriebsgewöhnliche Nutzungsdauer. Geleistete Anzahlungen und Anlagen im Bau werden zu Anschaffungs-/Herstellungskosten bewertet.

Bei den Finanzanlagen werden die Anteilsrechte zu Anschaffungskosten bzw. niedrigeren beizulegenden Werten und die Ausleihungen zum Nennwert bzw. niedrigeren beizulegenden Werten angesetzt.

Roh-, Hilfs- und Betriebsstoffe werden zu Anschaffungs- bzw. Herstellungskosten oder zum niedrigeren beizulegenden Zeitwert bewertet. Allen risikobehafteten Posten ist durch die Bildung angemessener Einzelwertberichtigungen Rechnung getragen. Die Forderungen und sonstigen Vermögensgegenstände werden zum Nennwert angesetzt.

Die liquiden Mittel sind zum Nennwert angesetzt.

In den aktiven Rechnungsabgrenzungsposten werden Ausgaben vor dem Bilanzstichtag ausgewiesen, soweit sie Aufwand für eine bestimmte Zeit nach dem Bilanzstichtag darstellen.

Die Rückstellungen enthalten alle erkennbaren Risiken und ungewissen Verbindlichkeiten. Die Bewertung erfolgt mit dem nach vernünftiger kaufmännischer Beurteilung notwendigen Erfüllungsbetrag. Künftige Preis- und Kostensteigerungen werden dabei berücksichtigt.

Verbindlichkeiten werden mit dem Erfüllungsbetrag angesetzt.

Erhaltene Vorauszahlungen für EU-Fördermittelprojekte werden im Geschäftsjahr unter der Bilanzposition „sonstige Verbindlichkeiten" gezeigt.

Der passive Rechnungsabgrenzungsposten beinhaltet Vorauszahlungen von Kunden und Kooperationspartner für in zukünftigen Perioden zu erbringende Leistungen. Der Posten wird in der Periode erfolgswirksam aufgelöst, in der die Leistungserbringung erfolgt.

Auf fremde Währung lautende Vermögensgegenstände und Verbindlichkeiten wurden grundsätzlich mit dem Devisenkassamittelkurs zum Abschlussstichtag umgerechnet. Bei einer Restlaufzeit von mehr als einem Jahr wurde dabei das Realisationsprinzip (§ 252 Abs. 1 Nr. 4 Halbsatz 2 HGB) und das Anschaffungskostenprinzip (§ 253 Abs. 1 Satz 1 HGB) beachtet.

Umsätze aus Warenverkäufen werden ausgewiesen, sobald die wesentlichen Chancen und Risiken des Eigentums auf den Käufer übergegangen sind und die Höhe der realisierbaren Umsätze verlässlich ermittelt werden kann. Umsätze aus Dienstleistungen werden erfasst, sobald die Leistung erbracht wurde. Keine Umsätze werden ausgewiesen, wenn wesentliche Risiken bezüglich des Erhalts der Gegenleistung oder einer möglichen Warenrückgabe bestehen. Im Übrigen werden Umsätze unter Abzug von Erlösschmälerungen wie Boni, Skonti oder Rabatte ausgewiesen.

Zuwendungen der öffentlichen Hand werden nur erfasst, wenn eine angemessene Sicherheit dafür besteht, dass die damit verbundenen Bedingungen erfüllt und die Zuwendungen gewährt werden. Investitionszuwendungen werden als Reduzierung der Anschaffungs- und Herstellungskosten der betreffenden Vermögensgegenstände erfasst und führen zu einer entsprechenden Reduzierung der planmäßigen Abschreibungen in Folgeperioden. Zuwendungen, die nicht auf Investitionen bezogen sind, werden als sonstige betriebliche Erträge in den Zeiträumen erfasst, in denen die Aufwendungen anfallen, die durch die Zuwendung kompensiert werden sollen.

Die Zuwendungen betreffen Förderungen des Landes Rheinland-Pfalz, des Landes Berlin, des Bundesministerium für Bildung und Forschung (BMBF) sowie Förderungen durch die Europäische Union.

Aufwendungen für Forschung und Entwicklung werden sofort erfolgswirksam erfasst.

C. Erläuterungen zur Bilanz und Gewinn- und Verlustrechnung

1. Immaterielle Vermögensgegenstände und Sachanlagevermögen

	Stand 01.01.2017	Zugänge	Abgänge	Umgliederungen	Abschreibungen	Stand 31.12.2017
I. Immaterielle Vermögensgegenstände						
1. Konzessionen, gewerbliche Schutzrechte u.ä. Rechte und Werte sowie Lizenzen an solchen Rechten und Werten	5.350.098	526.701	0	150.000	587.649	5.439.150
2. Geleistete Anzahlungen	561.198	169.409	0	-150.000	280.812	299.795
II. Sachanlagen						
1. andere Anlagen, Betriebs- und Geschäftsausstattung	4.153.907	2.687.137	2.600	25.834	1.347.786	5.516.492
2. Geleistete Anzahlungen und Anlagen im Bau	25.834	320.607	0	-25.834	0	320.607
	10.091.037	3.703.854	2.600	0	2.216.247	11.576.043

Die oben genannten Anlagen werden anhand der folgenden Aufstellung linear abgeschrieben:

Abschreibungsdauer nach Anlagenklassen

Immaterielle Vermögensgegenstände		
Patente, Schutzrechte	3-20	Jahre
Geschäfts- und Firmenwert	5	Jahre
Sachanlagevermögen		Jahre
IT Anlagen	5-8	Jahre
PC Hardware	3	Jahre
IT Software, Lizenzen	3-5	Jahre
Laborgeräte groß	8-10	Jahre
Laborgeräte klein	3-5	Jahre
Büroeinrichtung	10-15	Jahre

Geringwertige Vermögensgegenstände bis EUR 410,00 werden im Jahr der Anschaffung abgeschrieben.

2. Finanzanlagen

Finanzanlagen	Stand 01.01.2017	Zugänge	Abgänge	Umgliederungen	Abschreibungen	Stand 31.12.2017
1. Anteile an verbundenen Unternehmen	5.689.268	25.000	0	0	0	5.714.268
2. Ausleihungen an verbundene Unternehmen	15.785.999	9.000.000	2.550.000	0	0	22.235.999
3. Beteiligungen	611.365	0	0	0	611.365	0
	22.086.632	9.025.000	2.550.000	0	611.365	27.950.267

3. Vorräte

	31.12.2017	31.12.2016
Roh-, Hilfs- und Betriebsstoffe	379.044	373.274
Geleistete Anzahlungen	35.148	73.012
	414.192	446.286

4. Forderungen und sonstige Vermögensgegenstände

	31.12.2017	31.12.2016
Forderungen aus Lieferungen und Leistungen	269.948	149.006
Forderungen gegen verbundene Unternehmen	16.174.290	19.335.949
Forderungen aus Steuern	4.515.141	2.168.397
Übrige sonstige Vermögensgegenstände	143.062	90.958
	21.102.442	21.744.310

Die Forderungen aus Steuern betreffen im Wesentlichen Umsatzsteuerforderungen. Sämtliche Forderungen und sonstigen Vermögensgegenstände haben, wie im Vorjahr, eine Restlaufzeit von unter einem Jahr.

5. Zahlungsmittel und Zahlungsmitteläquivalente

Zum Bilanzstichtag weist die Gesellschaft liquide Mittel in Höhe von TEUR 10.439 (Vorjahr: TEUR 57.459) aus.

6. Aktiver Rechnungsabgrenzungsposten

Der aktive Rechnungsabgrenzungsposten umfasst Ausgaben vor den Abschlussstichtag, soweit sie Aufwand für eine bestimmte Zeit nach diesem Tag darstellen.

Zum 31. Dezember 2017 ist wie im Vorjahr kein Disagio unter dem aktiven Rechnungsabgrenzungsposten ausgewiesen.

7. Eigenkapital

Im Bilanzverlust ist ein Verlustvortrag von TEUR 112.381 enthalten; der Jahresfehlbetrag 2016 wurde auf neue Rechnung vorgetragen. Mit dem Jahresfehlbetrag in Höhe von TEUR 60.144 ergibt sich ein nicht durch Eigenkapital gedeckter Fehlbetrag in Höhe von TEUR 22.427 der auf der Aktivseite der Bilanz ausgewiesen wird.

Das Grundkapital wurde gemäß Beschluss der Hauptversammlung vom 18. August 2017 von EUR 181.660 um EUR 9.083.000 auf EUR 9.264.660 aus Gesellschaftsmitteln erhöht. Das Grundkapital setzt sich aus 9.264.660 auf den Inhaber lautende Stückaktien zusammen.

Die Kapitalrücklage betrug im Geschäftsjahr TEUR 140.834.

8. Ergebnisverwendungsvorschlag 2017

Der Vorstand schlägt vor das Jahresergebnis in Höhe von TEUR - 60.144 auf neue Rechnung vorzutragen.

9. Sonstige Rückstellungen

	31.12.2017	31.12.2016
Ausstehende Rechnungen	425.308	735.327
Bonusverpflichtungen	242.120	402.459
Resturlaub	523.034	366.701
Jahresabschlusskosten	53.000	18.500
Archivierungskosten	7.777	7.777
Beiträge zur Berufsgenossenschaft	37.472	63.627
Mitarbeiterbeteiligungsprogramm	859.938	0
Übrige sonstige Rückstellungen	76.713	25.600
	2.225.362	1.619.991

10. Verbindlichkeiten

Sämtliche Verbindlichkeiten haben insgesamt, wie im Vorjahr, eine Restlaufzeit bis zu 1 Jahr. Sicherheiten für Verbindlichkeiten wurden nicht bestellt.

Nachfolgend die Aufgliederung der sonstigen Verbindlichkeiten.

	31.12.2017	31.12.2016
Verbindlichkeiten aus Steuern	3.498.232	173.730
Verbindlichkeiten im Rahmen der sozialen Sicherheit	327.399	15.302
Erhaltene Vorauszahlungen für EU-Fördermittelprojekte	1.382.976	1.627.140
Übrige sonstige Verbindlichkeiten	7.802.742	225.361
	13.011.350	2.041.533

11. Haftungsverhältnisse und sonstige finanzielle Verpflichtungen

Zum Bilanzstichtag sind keine schwebenden Verfahren bekannt, aus denen zukünftige Haftungsverhältnisse entstehen könnten.

Die sonstigen finanziellen Verpflichtungen beinhalten folgende Miet- und Leasingverpflichtungen:

	2018	2019	2020	2021-2027
Mietverträge	4.066.307	3.821.057	3.739.307	15.046.972
Leasing- und Nutzungsverträge	1.115.316	10.116	2.975	0
	5.181.623	3.831.173	3.742.282	15.046.972

Es bestanden keine Verpflichtungen gegenüber verbundenen Unternehmen.

12. Umsatzerlöse

Die Umsatzerlöse werden im Wesentlichen in den Bereichen Kooperationen und Dienstleistungen TEUR 19.984 (Vorjahr: TEUR 12.722) erzielt.

13. Herstellungskosten

Nicht einzelnen Umsatzgrößen zuzuordnenden Kosten wie z.B. Tierstall und Biosampling stellen in 2017 keine Umsatzkosten dar und sind daher im Geschäftsjahr 2017 unter den Forschungs- und Entwicklungskosten ausgewiesen (im Vorjahr erfolgte der Ausweis unter den Herstellungskosten).

14. Materialaufwand

	2017	2016
Aufwendungen für Roh-, Hilfs- und Betriebsstoffe und für bezogene Waren	2.066.428	981.651
Aufwendungen für bezogene Leistungen	9.272.128	2.125.884
	11.338.556	3.107.533

15. Personalaufwand

	2017	2016
Löhne und Gehälter	18.776.818	9.284.361
Soziale Abgaben und Aufwendungen für Altersversorgung und Unterstützung	1.928.698	1.561.971
	20.705.516	10.846.332

16. Sonstige betriebliche Erträge

	2017	2016
Erträge aus Fördermitteln	572.732	862.425
Erträge aus der Auflösung von Rückstellungen	0	358.411
Erträge aus Kursdifferenzen	31.277	68.187
übrige sonstige betriebliche Erträge	91.362	96.076
	695.370	1.385.099

17. Sonstige betriebliche Aufwendungen

Die sonstigen betrieblichen Aufwendungen betrugen im Geschäftsjahr TEUR 519 (Vorjahr: TEUR 32) und beinhalten im Wesentlichen Aufwendungen aus Kursdifferenzen in Höhe von TEUR 234 (Vorjahr: TEUR 3).

18. Finanzergebnis

	2017	2016
Sonstige Zinsen und ähnliche Erträge	761.571	1.471.393
davon aus verbundenen Unternehmen	760.239	1.470.266
Zinsen und ähnliche Aufwendungen	1.999.817	1.798.629
davon an verbundene Unternehmen	1.991.704	1.790.427
	-1.238.246	-327.236

Die Beteiligung an der AptaIT GmbH wurde im Geschäftsjahr aufgrund nachhaltig zu erwartender Verluste in voller Höhe wertberichtigt.

19. Steuern

	2017	2016
Sonstige Steuern	-28	0
	-28	0

20. Sonstige Angaben/Organe der Gesellschaft

1. Vorstand

Während des abgelaufenen Geschäftsjahres gehörten folgende Personen dem Vorstand an:

Prof. Dr. Ugur Sahin	Universitätsprofessor
Dr. Sierk Poetting	M.Sc. Optical Sciences
Sean Marett	MBA

2. Aufsichtsrat

Dem Aufsichtsrat gehörten folgende Personen an:

Helmut Jeggle (Vorsitzender)	Dipl. Betriebswirt
Prof. Dr. Christoph Huber	Universitätsprofessor
Michael Motschmann	Dipl. Kaufmann

Auf die Angaben zu den Vorstands- und Aufsichtsratsbezügen wird mit dem Verweis auf § 286 Abs. 4 HGB verzichtet.

3. Veröffentlichung

Der Jahresabschluss wird im Bundesanzeiger bekannt gemacht.

4. Honorar des Abschlussprüfers

	2017
Abschlussprüfungsleistungen	51.232
andere Beratungsleistungen	39.935
Steuerberatungsleistungen	3.060
	94.227

5. Anzahl der Arbeitnehmer im Durchschnitt

	2017
Angestellte	165

6. Angaben über den Anteilsbesitz an anderen Unternehmen von mind. 20 Prozent der Anteile

Gemäß § 285 Nr. 11 HGB wird über nachstehende Unternehmen berichtet:

Firmenname/Sitz	Anteilshöhe	Jahresergebnis nach Ergebnisübernahme	Eigenkapital
BioNTech RNA Pharmaceuticals GmbH, Mainz *)	100%	0	-385.070
BioNTech Protein Therapeutics GmbH, Mainz *)	100%	0	25.000

Firmenname/Sitz	Anteilshöhe	Jahresergebnis nach Ergebnisübernahme	Eigenkapital
BioNTech Diagnostics GmbH, Mainz *)	100%	0	5.525.000
BioNTech Small Molecules GmbH, Mainz *)	100%	0	-1.684.467
BioNTech Business Services GmbH *)	100%	0	25.000
BioNTech Austria Beteiligungen GmbH, Wien	100%	-3.143	24.370
BioNTech Innovative Manufacturing Services GmbH, Idar-Oberstein *)	100%	0	3.749.500
JPT GmbH, Berlin *)	100%	0	5.825.000
TheraCode JPT Inc., Acton, USA	100%	25.132	189.869
BioNTech Cell & Gene Therapies GmbH, Mainz	94,50%	-5.399.811	19.849.819
AptaIT GmbH, München	49,99%	-52.055	75.417

*) Mit diesen Tochtergesellschaften besteht jeweils ein Beherrschungs- und Ergebnisabführungsvertrag. Aufgrund dessen wurde das Jahresergebnis der Tochtergesellschaften von der BioNTech AG als Muttergesellschaft übernommen.

7. Nahestehende Unternehmen

Nachfolgend werden die Geschäfte mit nahestehenden Unternehmen dargestellt.

Gewinn- und Verlust-Positionen

Geschäfte mit verbundenen Unternehmen	JPT GmbH	BioNTech Diagnostics GmbH	BioNTech Innovative Manufacturing Services GmbH	BioNTech Protein Therapeutics GmbH	BioNTech RNA Pharmaceuticals GmbH	BioNTech Cell & Gene Therapies GmbH
Umsatzerlöse	0	148.891	0	154.211	6.861.534	569.223
sonstige Erträge im Rahmen der gewöhnlichen der gewöhnlichen Geschäftstätigkeit	0	0	0	0	0	0
Aufwendungen Laborbedarf	-21.383	-23.420	0	0	0	0
Aufwendungen für bezogene Leistungen	0	0	-773.503	0	-456.418	-8.668
sonstige Zinsen und ähnliche Erträge	0	193.205	363.211	57.867	467	0
Zinsen und ähnliche Aufwendungen	-70.000	-96.074	0	0	-1.825.630	0
Aufwand/Erträge aus Ergebnisübernahme	0	-1.079.380	955.603	-1.308.918	-16.748.348	0

Geschäfte mit verbundenen Unternehmen	TheraCode JPT Inc., Acton, USA	BioNtech Small Molecules GmbH, Mainz	BioNTech Austria Beteiligungen GmbH, Wien	BioNTech Business Services GmbH, Mainz	Summe
Umsatzerlöse	0	25.446	0	10.169.927	17.929.233
sonstige Erträge im Rahmen der gewöhnlichen der gewöhnlichen Geschäftstätigkeit	0	0	0	0	0
Aufwendungen Laborbedarf	0	0	0	0	-44.803
Aufwendungen für bezogene Leistungen	0	0	0	0	-1.238.589
sonstige Zinsen und ähnliche Erträge	0	131.649	35	13.806	760.239
Zinsen und ähnliche Aufwendungen	0	0	0	0	-1.991.704
Aufwand/Erträge aus Ergebnisübernahme	0	-3.027.272	0	-2.760.756	-23.969.272

Bilanzpositionen

Geschäfte mit verbundenen Unternehmen	JPT GmbH	BioNTech Diagnostics GmbH	BioNTech Innovative Manufacturing Services GmbH	BioNTech Protein Therapeutics GmbH	BioNTech RNA Pharmaceuticals GmbH
Anteile an verbundenen Unternehmen	0	5.525.000	29.268	25.000	25.000
Ausleihungen an verbundene Unternehmen	0	2.550.000	9.934.999	1.200.000	0
Forderungen gegen verbundene Unternehmen	2.676	185.983	1.091.567	158.166	4.219.225
Verbindlichkeiten gegenüber verbundenen Unternehmen	2.062.334	1.457.342	704.203	1.324.196	57.989.512

Geschäfte mit verbundenen Unternehmen	BioNTech Cell & Gene Therapies GmbH	TheraCode JPT Inc., Acton, USA	BioNtech Small Molecules GmbH, Mainz	BioNTech Austria Beteiligungen GmbH, Wien	BioNTech Business Services GmbH, Mainz	Summe
Anteile an verbundenen Unternehmen	25.000	0	35.000	35.000	25.000	5.724.268
Ausleihungen an verbundene Unternehmen	0	0	5.700.000	0	2.850.000	22.234.999
Forderungen gegen verbundene Unternehmen	284.433	0	53.487	35	10.187.750	16.183.322
Verbindlichkeiten gegenüber verbundenen Unternehmen	152.839	0	3.164.376	0	8.705.483	75.560.284

8. Abhängigkeitsbericht

Die BioNTech AG war im Geschäftsjahr 2017 ein nach § 17 AktG von der AT Impf GmbH abhängiges Unternehmen. Aufgrund dieses Abhängigkeitsverhältnisses hat die Gesellschaft gem. § 312 AktG einen Bericht über die Beziehungen zu verbundenen Unternehmen für den Zeitraum vom 01. Januar bis 31. Dezember 2017 erstellt. In diesem Bericht wurde folgende Erklärung für das Geschäftsjahr 2017 abgegeben:

"Die BioNTech AG hat bei den aufgeführten Rechtsgeschäften und Maßnahmen nach den Umständen, die uns zum Zeitpunkt bekannt waren, in dem die Rechtsgeschäfte vorgenommen oder die Maßnahmen getroffen wurden, bei jedem Rechtsgeschäft eine angemessene Gegenleistung erhalten und ist dadurch, dass Maßnahmen getroffen oder unterlassen wurden, nicht benachteiligt oder bevorzugt worden."

9. Mitteilung § 20 AktG

Am 17. Mai 2010 ging der BioNTech AG die Meldung von der AT Impf GmbH über den Erwerb einer Mehrheitsbeteiligung an der BioNTech AG zu: die AT Impf GmbH hält seitdem 62,77% der Anteile.

Des Weiteren ging der BioNTech AG am 3. August 2010 die Meldung von der Medine GmbH über den Erwerb von mehr als 25,00 % der Anteile an der BioNTech AG. Die Medine GmbH hielt zunächst 25,99% der Anteile. Die Gesellschaft übertrug am 9. September 2016 1.805 Anteile an die RLG GmbH i.Gr. und Tofino GmbH, so dass die Medine GmbH seit dem 31. Dezember 2017 25,00% der Anteile hält.

10. Nachtragsbericht

Kurz vor Jahresende 2017 wurde eine Finanzierungsrunde vereinbart, an der sich neben dem bestehenden Hauptaktionär auch neue Investoren beteiligt haben. Insgesamt sind der Gesellschaft auf diesem Wege im Januar 2018 EUR 228,8 Mio. an Liquidität zuflossen. Damit ist der in der Bilanz zum 31. Dezember 2017 ausgewiesene nicht durch Eigenkapital gedeckte Fehlbetrag ausgeglichen und das Eigenkapital wieder deutlich positiv.

Weitere Entwicklungen und Ereignisse von wesentlicher Bedeutung sind nach dem Bilanzstichtag 31. Dezember 2017 bis zum Zeitpunkt der Fertigstellung dieses Berichts nicht eingetreten.

Mainz, den 21. Juni 2018

BioNTech AG

Der Vorstand

Bestätigungsvermerk des Abschlussprüfers

Wir haben den Jahresabschluss - bestehend aus Bilanz, Gewinn- und Verlustrechnung sowie Anhang, - unter Einbeziehung der Buchführung und den Lagebericht der BioNTech AG, Mainz für das Geschäftsjahr vom 1. Januar 2017 bis 31. Dezember 2017 geprüft. Die Buchführung und die Aufstellung von Jahresabschluss und Lagebericht nach den deutschen handelsrechtlichen Vorschriften liegen in der Verantwortung der gesetzlichen Vertreter der Gesellschaft. Unsere Aufgabe ist es, auf der Grundlage der von uns durchgeführten Prüfung eine Beurteilung über den Jahresabschluss unter Einbeziehung der Buchführung und über den Lagebericht abzugeben.

Wir haben unsere Jahresabschlussprüfung nach § 317 HGB unter Beachtung der vom Institut der Wirtschaftsprüfer (IDW) festgestellten deutschen Grundsätze ordnungsmäßiger Abschlussprüfung vorgenommen. Danach ist die Prüfung so zu planen und durchzuführen, dass Unrichtigkeiten und Verstöße, die sich auf die Darstellung des durch den Jahresabschluss unter Beachtung der Grundsätze ordnungsmäßiger Buchführung und durch den Lagebericht vermittelten Bildes der Vermögens-, Finanz- und Ertragslage wesentlich auswirken, mit hinreichender Sicherheit erkannt werden. Bei der Festlegung der Prüfungshandlungen werden die Kenntnisse über die Geschäftstätigkeit und über das wirtschaftliche und rechtliche Umfeld der Gesellschaft sowie die Erwartungen über mögliche Fehler berücksichtigt. Im Rahmen der Prüfung werden die Wirksamkeit des rechnungslegungsbezogenen internen Kontrollsystems sowie Nachweise für die Angaben in Buchführung, Jahresabschluss und Lagebericht überwiegend auf der Basis von Stichproben beurteilt. Die Prüfung umfasst die Beurteilung der angewandten Bilanzierungsgrundsätze und der wesentlichen Einschätzungen der gesetzlichen Vertreter sowie die Würdigung der Gesamtdarstellung des Jahresabschlusses und des Lageberichts. Wir sind der Auffassung, dass unsere Prüfung eine hinreichend sichere Grundlage für unsere Beurteilung bildet.

Unsere Prüfung hat zu keinen Einwendungen geführt.

Nach unserer Beurteilung aufgrund der bei der Prüfung gewonnenen Erkenntnisse entspricht der Jahresabschluss den gesetzlichen Vorschriften und vermittelt unter Beachtung der Grundsätze ordnungsmäßiger Buchführung ein den tatsächlichen Verhältnissen entsprechendes Bild der Vermögens-, Finanz- und Ertragslage der Gesellschaft. Der Lagebericht steht in Einklang mit dem Jahresabschluss, entspricht den gesetzlichen Vorschriften, vermittelt insgesamt ein zutreffendes Bild von der Lage der Gesellschaft und stellt die Chancen und Risiken der zukünftigen Entwicklung zutreffend dar.

Stuttgart, den 21. Juni 2018

Baker Tilly GmbH & Co. KG
Wirtschaftsprüfungsgesellschaft
(Düsseldorf)

Prof. Dr. Andreas Diesch, Wirtschaftsprüfer

Marieke Huber, Wirtschaftsprüferin

Feststellung des Jahresabschlusses

Der Jahresabschluss zum 31. Dezember 2017 wurde vom Aufsichtsrat am 3. August 2018 gebilligt und damit festgestellt.

Bericht des Aufsichtsrats zum Geschäftsjahr 2017

Der Aufsichtsrat hat im vergangenen Geschäftsjahr die Geschäftsführung des Vorstands fortwährend überwacht und beratend begleitet. Der Vorstand hat dem Aufsichtsrat während der Berichtszeit regelmäßig und umfänglich, schriftlich und mündlich über die Lage der Gesellschaft sowie über Unternehmenspolitik und wesentliche Geschäftsvorgänge unterrichtet. Die Entwicklung des Unternehmens wurde gemeinsam mit dem Vorstand während der Aufsichtsratssitzungen im Geschäftsjahr 2017 besprochen, das heißt am 16. März 2017, 15. Mai 2017, 4. Juli 2017, 22. September 2017 und 19. Dezember 2017, sowie in einer außerordentlichen Sitzung am 10. August 2017. Darüber hinaus fanden regelmäßig Telefonate, Telefonkonferenzen oder persönliche Treffen statt. Gegenstand der Beratungen waren in der Berichtszeit insbesondere der Status Quo des Kooperationsprojektes mit Genentech, hier insb. die Aufstellung der Herstellung, die Expansionsbestrebungen an den Standorten Mainz, Idar-Oberstein und Berlin, die Sicherung der Finanzierung des Unternehmens, der Status der Forschungs- und Entwicklungsaktivitäten und die strategische Ausrichtung der BioNTech AG inklusive ihrer Tochtergesellschaften. Außerdem wurde die Entwicklung des laufenden Geschäfts mit dem Vorstand erörtert. Namentlich bei wichtigen Einzelfragen hat der Aufsichtsrat beratend mitgewirkt. Beschlüsse durch den Aufsichtsrat wurden sowohl in den Sitzungen als auch im schriftlichen Umlaufverfahren gefasst.

Der vom Vorstand am 21. Juni 2018 aufgestellte Jahresabschluss für das Geschäftsjahr 2017, der am 20. Juli 2018 final aufgestellte Konzernabschluss 2017 sowie der Lagebericht und der Konzernlagebericht haben allen Mitgliedern des Aufsichtsrats vorgelegen. Ebenso haben uns die mit dem uneingeschränkten Bestätigungsvermerk versehenen Prüfungsberichte über die Buchführung, den Jahresabschluss, den Konzernabschluss und die Lageberichte des durch die Hauptversammlung gewählten Abschlussprüfers, der Baker Tilly GmbH & Co. KG Wirtschaftsprüfungsgesellschaft (Stuttgart), vorgelegen. Der Bericht des Abschlussprüfers wurde im Aufsichtsrat mit dem Vorstand und den Wirtschaftsprüfern erörtert.

Wir haben unsererseits den Jahresabschluss für das Geschäftsjahr 2017, den Konzernabschluss 2017, den Lagebericht und den Konzernlagebericht geprüft.

Nach dem abschließenden Ergebnis unserer Prüfung des Jahresabschlusses, sowie des Konzernabschlusses haben wir keine Einwendungen zu erheben; wir halten die Würdigung des Jahresabschluss durch den Abschlussprüfer also für zutreffend. Wir billigen den vom Vorstand aufgestellten Jahresabschluss sowie den vom Vorstand aufgestellten Konzernabschluss. Diese sind damit festgestellt. Mit dem Lagebericht ist der Aufsichtsrat ebenfalls einverstanden.

Mainz, den 3. August 2018

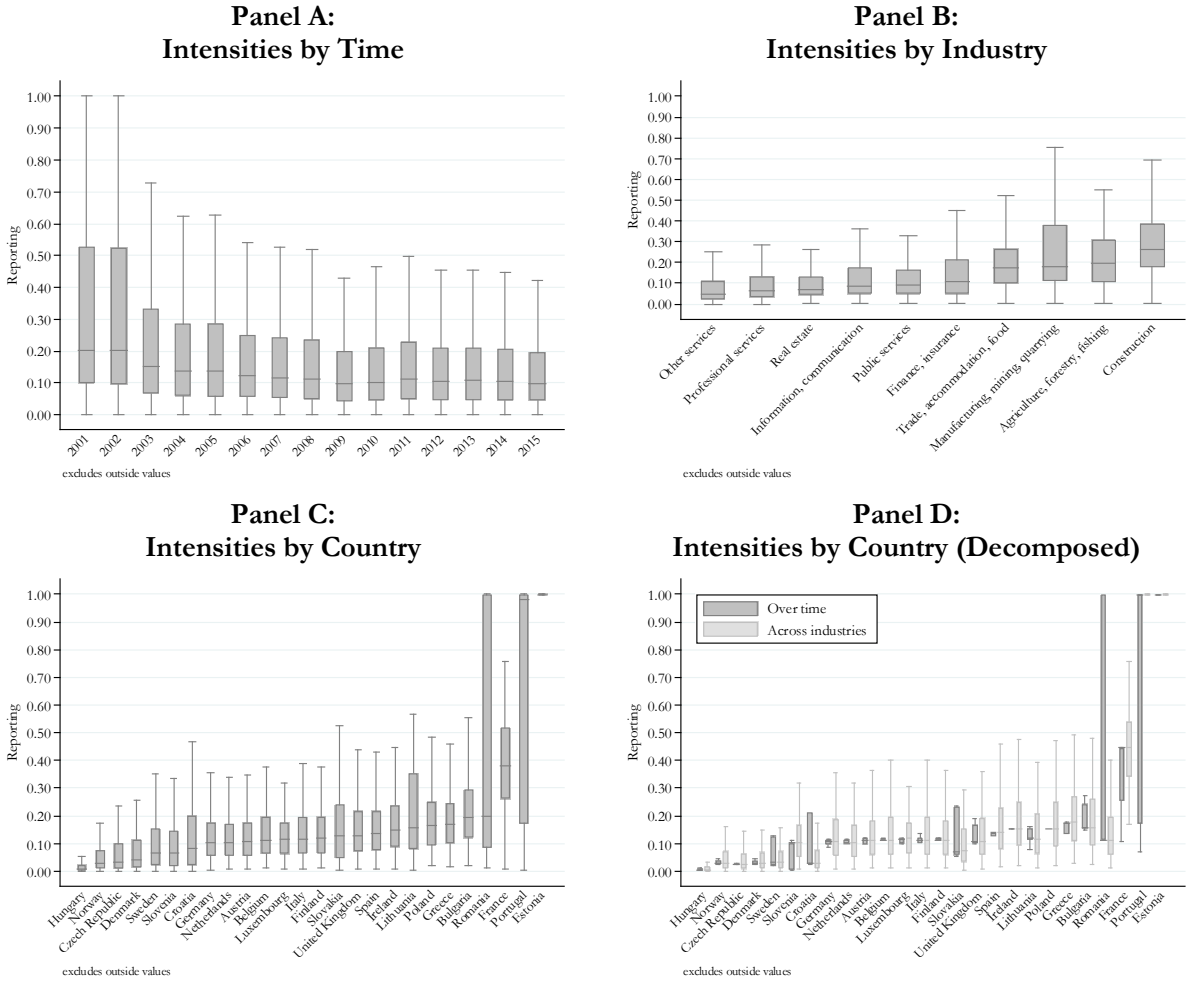
Helmut Jeggle, Aufsichtsratsvorsitzender

Notes: The example reproduces the report published by BioNTech AG for fiscal year 2017 in the *Bundesanzeiger* (i.e., the German Federal Gazette). For the fiscal year 2017, the private (i.e., unlisted) limited-liability firm no longer qualified for the "small" firm reporting exemption due to its increased size and hence provides a full report. Full reporting features a management report (Lagebericht) discussing (A) the economic and competitive environment, (B) strategy, (C) business

development, (D) research and development activities (including product-level progress reports and investment plans), (E) personnel, (F) financial position and performance, (G) business risks and opportunities, and (H) connected entities. In terms of financial statements for fiscal year 2017, BioNTech AG provides an extended balance sheet (Bilanz), income statement (Gewinn- und Verlustrechnung), detailed notes (Anhang), which include additional information on balance sheet and income statement items and a statement of changes in tangible and intangible assets (Anlagespiegel), and an audit opinion (Bestätigungsvermerk).

Figure A1

DISTRIBUTION OF REPORTING INTENSITIES



Notes: The figure summarizes the distribution of reporting intensities. Panel A plots the distribution of reporting intensities by year. Panel B plots the distribution of reporting intensities by (one-digit) industry. Panel C plots the distribution of the reporting intensities by country. Panel D shows a decomposition of the reporting intensities by country, plotting variation related to changes over time (i.e., the distribution of the median country-year intensities) and variation from industry differences (i.e., the distribution of the median country-industry intensities). The box plots provide the median (horizontal line within the boxes), the 25th and 75th percentile (lower and upper bound of the boxes), and adjacent values (end points of vertical lines/whiskers). Adjacent values are defined as the lowest and highest observations that are still inside the region spanned by the following limits: 25th (75th) percentile – (+) 1.5 × (75th – 25th percentile). Values outside are excluded from the plots.

The figure illustrates that there is substantial variation in reporting intensities. The vast majority of this variation comes from differences in firm sizes across industries (even within coarse one-digit industries) and differences in thresholds across countries. By contrast, the reporting intensities vary little over time, as only few countries' reporting thresholds change much over time and firm-size changes are purged, by construction, from the reporting intensities. Our research design deliberately focuses on the rich cross-sectional variation arising from the interaction of country-level differences in thresholds and industry-level differences in firm sizes, instead of the relatively scarce and possibly confounded time-series variation (e.g., concurrent with a country's EU accession or other major changes at the country level).

Table A1

REPORTING REGULATION AND INNOVATION:
INNOVATION SPENDING MARGINS

Panel A: Market Level				
Outcome	Innovation Spending			
Margin	Extensive		Intensive	
Market Level	Simple Average	Total	Simple Average	Total
Column	(1)	(2)	(3)	(4)
Limited Share×Post	-0.180***	-0.347***	-0.590	-0.741*
	(-3.18)	(-3.65)	(-1.50)	(-1.80)
County-Industry FE	X	X	X	X
County-Year FE	X	X	X	X
Industry-Year FE	X	X	X	X
Observations	26,780	26,779	14,105	14,106
Clusters (County-Industry)	5,864	5,860	3,579	3,579
Adj. R^2	0.491	0.500	0.555	0.549
Panel B: Firm Level				
Outcome	Innovation Spending			
Margin	Extensive		Intensive	
Column	(1)	(2)	(3)	(4)
Limited×Post	-0.060		-0.029	
	(-1.62)		(-0.13)	
Private×Post		-0.058		-0.337**
		(-1.58)		(-2.18)
Controls	X	X	X	X
Firm FE	X	X	X	X
County-Year	X	X	X	X
Industry-Year FE (4-digit)	X	X	X	X
Observations	36,896	36,771	15,228	15,783
Clusters (Firm)	9,755	9,599	4,592	4,696
Adj. R^2	0.692	0.697	0.846	0.864

Notes: Panel A presents estimates from regressions of the extensive and intensive margins of market-level innovation spending on the intensity of enforcement of reporting mandates. The market level outcomes represent simple average at the county, industry, and year. The enforcement intensity is instrumented by the interaction of the share of affected (limited-liability) firms in the pre-enforcement period in a given county and industry ("Limited Share") and a post-enforcement reform indicator ("Post"). The regressions include county-industry, county-year, and industry-year fixed effects (where the industries are defined using two-digit NACE classifications). *t*-statistics (in parentheses) are based on standard errors clustered at the county-industry level. Panel B presents estimates from regressions of the extensive and intensive margins of firm-level innovation spending on two different treatment indicators. "Limited" is an indicator taking the value of one for affected (limited-liability) firms, and zero for unaffected (unlimited-liability) firms. "Private" is an indicator taking the value of one for affected (private limited-liability) firms, and zero for unaffected (publicly-listed limited-liability) firms. "Post" is an indicator taking the value of one for the post-enforcement reform period. The regressions include firm, county-year, and industry-year fixed effects (where the industries are defined using four-digit NACE classifications). We truncate the outcomes at the 1st and 99th percentile of their distributions, after accounting for the fixed effects. *t*-statistics (in parentheses) are based on standard errors clustered at the firm level. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level (two-tailed), respectively.

Table A2

REPORTING REGULATION AND INNOVATION:
ROBUSTNESS TO CRISIS EXPOSURE

Panel A: County-Industry Level (Average: 2-digit NACE)

Outcome	Innovation Spending	Innovating Firm	New-To-Market Innovations	Product Innovation	Process Innovation
Market Level	Simple Average	Simple Average	Simple Average	Simple Average	Simple Average
Column	(1)	(2)	(3)	(4)	(5)
Limited Share×Post	-3.006***	-0.128***	-0.074	-0.125***	-0.087**
	(-4.04)	(-3.37)	(-1.30)	(-3.27)	(-2.34)
Commerzbank Share×Post	-0.519	-0.062	0.013	-0.025	0.022
	(-0.74)	(-1.54)	(0.22)	(-0.58)	(0.56)
County-Industry FE	X	X	X	X	X
County-Year FE	X	X	X	X	X
Industry-Year FE	X	X	X	X	X
Observations	26,774	47,283	23,597	46,680	46,592
Clusters (County-Industry)	5,857	8,193	5,459	8,163	8,156
Adj. R^2	0.528	0.393	0.412	0.415	0.322

Panel B: County-Industry Level (Aggregate: 2-digit NACE)					
Outcome	Innovation Spending	Innovating Firm	New-To-Market Innovations	Product Innovation	Process Innovation
Market Level	Total	Total	Total	Total	Total
Column	(1)	(2)	(3)	(4)	(5)
Limited Share×Post	-3.027***	-0.506***	-0.212***	-0.457***	-0.343***
	(-4.00)	(-6.02)	(-2.72)	(-5.80)	(-4.96)
Commerzbank Share×Post	-0.610	-0.066	-0.010	-0.098	0.051
	(-0.83)	(-0.74)	(-0.12)	(-1.22)	(0.70)
County-Industry FE	X	X	X	X	X
County-Year FE	X	X	X	X	X
Industry-Year FE	X	X	X	X	X
Observations	26,778	47,279	23,597	46,672	46,589
Clusters (County-Industry)	5,861	8,178	5,460	8,150	8,148
Adj. R^2	0.528	0.561	0.376	0.550	0.440

Notes: The table assesses the robustness of our German enforcement results to controlling for firms' exposures to a large, distressed German bank during the financial crises. Note first that the county-year fixed effects are likely to absorb much of the crisis impact on innovation. So this robustness analysis primarily checks if there is any residual impact that is not purged by our main design. Following Huber (2018), we use the share of firms with bank relationships with Commerzbank as our crisis exposure measure ("Commerzbank Share"). We calculate the share as the average Commerzbank dependence of firms in a given county-industry using only pre-crisis data from 2006 and 2007. (Given scarce bank data before the enforcement, we set missing Commerzbank share values at the county-industry level to zero. Irrespective of the treatment of missing values, the Commerzbank share is only little correlated with the Limited share (correlation coefficient of about 0.1).) Our enforcement results (coefficients of interest) are largely unaffected by the additional control for crisis exposure. In Panel A the innovation measures are simple averages calculated for a given county, industry, and year. In Panel B, the innovation measures are totals calculated for a given county, industry, and year. The enforcement intensity is captured by the interaction of the share of affected (limited-liability) firms in the pre-enforcement period in a given county and industry ("Limited Share") and a post-enforcement reform indicator ("Post"). The regressions include county-industry, county-year, and industry-year fixed effects. We truncate the outcomes at the 1st and 99th percentile of their distributions, after accounting for the fixed effects. *t*-statistics (in parentheses) are based on standard errors clustered at the county-industry level. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level (two-tailed), respectively.