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ORIGINAL PAPER

Expensing performance-vested executive stock options: is there underreporting under IFRS 2?

Alexander Merz[1]

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Abstract
This study generates new empirical evidence on the issue of underreporting of executive stock options. It is the first under the mandatory expense setting of International Financial Reporting Standard (IFRS) 2 and to include performance-vested options. I use a hand-collected data sample from Germany, where performance vesting has a longer history than in other countries. I find that many firms fail to disclose all required parameters and underreport the values of the options. Besides inexperience with preparing IFRS reports, incentives to hide higher pay are associated with this reporting behavior. Additionally, firms with more complex options underreport more. Since the German setting shares many institutional similarities with other (European) IFRS countries, the results are of interest to shareholders, standard setters, and enforcement authorities in such countries.

Keywords Executive stock options · Option expensing · Underreporting · IFRS 2

JEL Classification M12 · M48 · G34

1 Introduction

The introduction of Statement of Financial Accounting Standard (SFAS) 123 enabled several new insights into the use of executive stock options (ESO).[1] The standard required footnote disclosure of fair values along with several input parameters used in calculating that value, but it left firms the choice of recognizing an expense or merely disclosing it. In this setting, several studies show that firms underreport the value of stock options to make executives' pay appear

[1] For a more comprehensive summary of insights generated from SFAS 123(r) and IFRS 2, see Merz (2017).

✉ Alexander Merz
amerz@uni-goettingen.de

[1] Georg-August-Universität Göttingen, Platz der Göttinger Sieben 3, 37073 Göttingen, Germany

lower. This effect is greater for firms that voluntarily expensed the options prior to 2005 (e.g., Aboody et al. 2006; Johnston 2006) and even greater still for firms that were forced to expense options after the standard was revised in 2005 (Cheng and Smith 2013). The introduction of International Financial Reporting Standard (IFRS) 2 has likewise created a regime with mandatory disclosure and recognition of ESO expenses in a variety of countries, many of which previously did not require any form of disclosure, let alone recognition of expenses.

In the US, the new accounting rules have led to a reduction in the use of stock options (Carter et al. 2007; Skantz 2012), but also to a departure from standard plain-vanilla at-the-money options towards performance-vested ones (Bettis et al. 2018). Theoretical literature has often touted such exercise conditions as highly useful in conveying meaningful incentives to managers (e.g., Johnson and Tian 2000). Firms using options with better incentives might not face an underreporting problem; if they are able to provide superior incentives, they may be able to prevent managers from underreporting the values. Because of the increased complexity, however, valuation of such options becomes much more complicated. As a consequence, managers might be able to more easily camouflage ESO fair values. This could exacerbate the underreporting problem, if executives feel that they have a new avenue that is harder for outsiders to detect. No study so far has analyzed the effect of performance vesting on underreporting.

A country well suited for such an analysis is Germany for two reasons: First, SFAS 123r and IFRS 2 lay out the same rules when it comes to disclosure and valuation of ESO and the enforcement and corporate governance regime is comparable to that of many other European countries. Second, ESO have always had to include a performance target, thus giving performance vesting a much longer history in Germany than in, for example, the US (Winter 2003; Langmann 2007).

Another advantage of this setting is its significance to other countries. Prior results, even European ones, are not easily transferable for several reasons. The Danish sample in Bechmann and Hjortshøj (2009), for example, was not fully governed by IFRS and the enforcement regimes exhibited vastly different effectiveness levels during their sample period (Brown et al. 2014). Currently, however, IFRS are required in 144 and permitted in 12 jurisdictions. Even though other factors play a large role in eventual financial reporting outcomes (Holthausen 2009), the settings are much more comparable now. Concurrent with the introduction of IFRS, the German enforcement regime has been changed (Hitz et al. 2012) and is now comparable in strength to that of other IFRS countries, such as Denmark, the UK, and Australia (Brown et al. 2014). Additionally, Germany has received corporate governance scores comparable to those of other continental European countries (Aggarwal et al. 2009). As a consequence, insights from this study are of interest to firms, shareholders, and standard setters not only in other IFRS countries, but also in countries that see a rise of performance-vested stock options.

By using a hand-collected data set of German ESO, this paper is the first to address the research gap of potential underreporting of performance-vested options in Germany, thereby making two contributions to the literature. First, it provides new association-based evidence on firms' reporting behavior of ESO in an IFRS setting with mandatory expensing. Second, it is the first to look at performance-vested

options in the context of underreporting, providing evidence on the use of complex targets in ESO.

I investigate two general research questions, namely whether firms adhere to IFRS 2 and publish all relevant information, and whether they provide fair values that are close to what an outside investor would calculate when valuing the ESO. Results show that ESO expenses are material for German firms and that there are a number of firms that do not provide the information required by IFRS 2. Missing values range from one of the required input parameters to failing to provide all of the inputs or the fair values, which is comparable to lacking ESO disclosures in other countries[2] and general IAS/IFRS disclosure rates documented in Germany (e.g., Street and Gray 2002). In line with previous literature (e.g., Glaum et al. 2013), my findings suggest that firms' inexperience with IFRS reporting plays a large role as do incentives to hide large executive pay.

For the firms that do provide sufficient information to calculate fair values, I find statistically significant underreporting in 4 of the 7 years in my sample period (2005–2011). Results, which hold for a variety of robustness checks, suggest that firms with higher compensation, larger option grants, and larger boards tend to underreport more. This is in contrast to the study by Bechmann and Hjortshøj (2009), the one closest to mine, who find no evidence that incentives to underreport actually drive underreporting in Denmark. Having a banker on the board, a common feature in German corporate governance, appears to lessen underreporting. With regard to the influence of performance vesting, I find evidence that firms with complicated performance conditions tend to underreport more, yet are more likely to fully disclose. Why firms use complex conditions, however, cannot be conclusively answered. Given the proliferation of performance-vested ESO also in other countries, further research is clearly needed.

Overall, my findings indicate a continued lack of full disclosure in Germany when it comes to ESO. Moreover, there are concerns that firms underreport ESO values, in some cases substantially so. Since this behavior is more prevalent in firms with high overall pay, this result is of special concern to shareholders.

This paper contributes to the literature in two important ways. Firstly, it is the first underreporting study that uses a full IFRS sample. Prior ones are at least partly based on local GAAP and different enforcement regimes, leaving doubts about the generalizability of their results. Indeed, the findings are different to the ones presented in this study, a fact that can likely be attributed to different institutional environments. In particular, this study highlights the effects of incentives for underreporting and the usefulness of financial expertise on the board in preventing it. Secondly, this is the first study to analyze the effect of performance vesting in the context of underreporting. Theoretical literature has long advocated in favor of performance vesting, as it can be shown to provide superior managerial incentives. That is why it is conceivable that they face less of an underreporting problem. My results, however, provide empirical evidence that performance vesting is being misused by

[2] See, for example, Bechmann and Hjortshøj (2009) for Denmark and Melis and Carta (2010) for Italy or Bassett et al. (2007) for Australia.

managers who have incentives to hide the true extent of their pay. Since these features are becoming more and more popular, especially in the UK and US, the findings cast doubt on the generally perceived superiority of complex ESO.

The remainder of this paper is structured as follows. Section 2 outlines the use and development of ESO in Germany and the requirements listed in IFRS 2. Moreover, it describes the institutional background in Germany. Section 3 discusses the related literature. Section 4 describes the data set and Sect. 5 contains the empirical analysis and results. Section 6 concludes the paper.

2 ESO and institutional background in Germany

2.1 ESO in Germany

While overall compensation and ESO use in Germany has always been far below that in the US (Elston and Goldberg 2003), it still accounts for a substantial part of firms' earnings (Haid and Yurtoglu 2006). Compared to the US, ESO have a relatively short history in Germany; only since a reform of the Stock Corporation Act (*Aktiengesetz*) in 1998 have firms been allowed to issue options for compensation purposes. The popularity of equity-based compensation has increased among listed corporations since then, yet remains lower than in the UK (Conyon and Schwalbach 2000). In other continental European countries, however, the situation is comparable, supporting the transferability of the German results.[3]

In addition, ESO have always had to include some form of performance conditions, which is a new trend in other countries, such as the US. Broadly speaking, these conditions fall into four categories. The first contains absolute performance targets related to share price, such as out-of-the money options[4] or up-and-in barrier options, where the stock price needs to cross a certain price barrier during the life of the option before it can be exercised. Another common type is the absolute performance option, usually granted at the money, yet can be exercised only when the stock price is at or above a predetermined threshold. In other words, this is a portfolio consisting of an out-of-the-money option with an exercise price equal to the performance target and a digital option that pays the difference between the performance goal and S_0.

The second category includes relative performance goals; that is, the development of the stock price is related to either a stock index or a customized index. Specific targets can take the form of either a hurdle, in which case the option can only be exercised if the stock price outperforms the index, or an exchange option, where

[3] In Italy, options were likewise introduced in the late 1990 and have rarely been used (Melis and Carta 2010). In France, there were only 46 ESO issues between 2005 and 2014 (Belze et al. 2015). Finally, in Denmark, only 64 of the 200 listed firms used ESO in 2005 (Bechmann and Hjortshøj 2009).

[4] These are also referred to as premium options, and while being out of the money is technically not a vesting condition, it has the same effect. This is why I will use performance condition and exercise condition synonymously. In the robustness section, I will account for the distinction.

the exercise price of the option depends on outperformance over the index, and is therefore variable.

A third category, rarely used in Germany, contains accounting-based conditions, such as earnings per share (EPS) increases. Finally, conditions can be combined, either with an 'and' condition, where all targets have to be met, or an 'or' condition, where only one must be met.

Absolute performance targets have traditionally outweighed other types, including relative and combined targets, by a ratio of more than three-to-one (Winter 2003). This gap has narrowed in the past, as Langmann (2007) reports that absolute targets make up 37.5% of German ESO, while relative targets are included in 32% of plans; a combination of targets is found in 22.2%, and accounting conditions make up the smallest part with just 8.3%.

Langmann (2007) also shows that ESO in Germany have long been more complex than the standard plain-vanilla options typically issued in the US. Adding more exercise conditions makes it first of all harder to understand how the options actually work. Second, it makes valuation more complex and more information is needed to value them. Therefore, there is a potential side effect: Rent-seeking managers may find it easier to bias fair values downward, because it is harder for an outsider to reproduce the valuation of complex options. More recently, US firms have also begun to include more performance-vesting conditions in their options (e.g., Bettis et al. 2018). Thus, whether there is underreporting with these types of options becomes a pressing research concern. Because of its longer history of performance vesting, Germany represents an interesting research setting for such an analysis, especially for other European countries.

2.2 Accounting for stock options under IFRS 2

Concurrent with the expanded use of ESO, accounting for share-based payment has seen a fundamental change in Germany with the introduction of IFRS 2, which made expensing of all forms of stock options mandatory. Prior to IFRS 2, the German Commercial Code (HGB, *Handelsgesetzbuch*) made no mention of ESO and there was neither disclosure nor recognition of values. Firms merely had to provide general information on their ESO plans. IFRS 2 thus creates an entirely new situation of transparency, since it not only made expensing mandatory, it also requires a detailed description of the options and disclosure of both the fair value and important valuation parameters. In this respect, IFRS 2 has the same rules as SFAS 123r, yet the transition was immediate without any period with disclosure such as in the US, Italy or Denmark.

In its appendix IFRS 2 specifies how the input parameters are to be determined. Of these parameters, the share price and the exercise price are assumed to be observable in the market or stated in the option contract, respectively. For the interest rate, dividend yield, volatility of the underlying, and the expected life of the option the standard contains detailed instructions.

The *risk-free interest rate* is supposed to be derived using the implied yield of a government zero-coupon bond. The bond's time to maturity should be equal to

the contractual option life, but firms may take into account factors leading to early exercise. For the *dividend yield*, the firm must estimate the yield (or the level of the dividend, depending on the valuation model), by relying on both historical dividend patterns and on expected payments in the future, yet it may only use publicly available information.[5] *Expected volatility* is the annualized standard deviation of the underlying stock, based on continuously compounded rates of return. Firms should use implied volatilities from traded options similar to the ESO, or, if these are not available, historical volatility for a period corresponding to the remaining expected option life. Finally, IFRS 2 details how *expected early exercise* (i.e., expected option life) is to be estimated. The standard recognizes that employees often do not hold options until maturity and allows for shorter time periods to be used. Firms' estimates of the expected time to maturity may take into account the moneyness of the option, volatility of the stock, and previous exercise behavior of similar options. The expected life of the option may, however, not be shorter than the vesting period.

2.3 Enforcement and corporate governance in Germany

Germany offers an institutional setting that is distinctly different from the US, yet is comparable to that of many other IFRS countries. Traditionally, it has been characterized as a country with limited enforcement of accounting standards.[6] Around the introduction of IFRS, however, the European Union has taken steps to reform the enforcement process. In Germany, the most important building block of these reforms was the establishment of a two-tier reporting enforcement system, comprising the private Financial Reporting Enforcement Panel (DPR—*Deutsche Prüfstelle für Rechnungslegung e.V.*) and the governmental Federal Financial Supervisory Authority (BaFin—*Bundesanstalt für Finanzdienstleistungsaufsicht*).[7] Research shows that this 'name and shame' principle, where violations are made public, is followed by negative market reaction, indicating capital markets punishing the firm (Hitz et al. 2012).[8] Brown et al. (2014) compare the enforcement regimes of 51 countries and find that effectiveness was very different, even in European countries, before the introduction of IFRS. Since then, however, the German regime has received a score in 2008 that is comparable to that of the UK, Australia, Italy, and Denmark. This further supports the usefulness of the German setting for other IFRS countries.

Besides the enforcement regime, corporate governance significantly influences financial reporting outcomes, especially disclosure of required information (Verriest et al. 2013). Elston and Goldberg (2003) identify two major governance differences

[5] If options are dividend protected, dividends need not be considered for the valuation.

[6] See La Porta et al. (1997, 1998, 2006).

[7] More details on the reforms and their economic consequences can be found in Ernstberger et al. (2012).

[8] These changes notwithstanding, the DPR announced in 2007 to focus more on compliance with IFRS 2, which signals that noncompliance had already been noted. However, by the end of 2011 (the end of my sample), only one firm had been cited in the national registry.

that affect compensation and distinguish German firms from US ones: the two-tier board structure and the involvement of bankers in supervisory boards. German listed firms are required to have a two-tier board system with a supervisory board (*Aufsichtsrat*) and a management board (*Vorstand*). The latter is charged with running the day-to-day operations, while the supervisory board, among other tasks, hires and fires managers and sets their pay. Further, executives cannot simultaneously hold a seat on the supervisory board, making all members of the supervisory board 'outside directors.' It is, however, common for CEOs to transfer to the supervisory board upon retirement, which has been shown to lead to a pay increase for executives (Andres et al. 2014).

Secondly, banks oftentimes send one or two representatives to the board, where they take on a monitoring role when it comes to executive compensation (Elston and Goldberg 2003). While banks' equity ownership has declined lately, bankers have been shown to serve as financial experts in non-financial firms (Dittmann et al. 2010). Overall, the German governance system has been found to be comparable in strength to that of other European countries (Aggarwal et al. 2009), again supporting the usefulness of the German setting for other countries.

3 Related literature and research questions

Stock options are often touted as a tool to mitigate the agency problem between management and owners (e.g., Haugen and Senbet 1981). If options are part of an optimal contract, expensing them should not change anything about their use, nor should increased transparency. Nonetheless, trying to change the accounting rules has been one of the most controversial projects of both the US and the international standard setters, with the strongest resistance coming from firms that award more options (Dechow et al. 1996; Giner and Arce 2012). This suggests that rent-seeking managers may have used options to hide the true extent of their pay, as suspected by Bebchuk et al. (2002). These authors argue that rent seeking occurs if managers are powerful compared to shareholders and when they have an incentive to hide excessive pay. Under accounting rules with more transparency, there would thus be a need for powerful managers to find other means of 'camouflaging' the true value of their ESO. Potentially, this could be achieved in three different ways: (1) provide incomplete information, (2) provide the information but either manipulate the input parameters or the valuation model such that a lower fair value results, (3) construct options so complex that it becomes nearly impossible to calculate the fair value from the disclosed inputs, even when they are reported correctly.

Investigating the first possibility in the US, Botosan and Plumlee (2001) find that about one in ten high-growth firms do not provide all the information required by SFAS 123 in the first year after the standard's introduction. They surmise that this is the result of unfamiliarity with the new standard. For Australia, Bassett et al. (2007) and Nelson et al. (2010) report that only 76% of firms publish the required ESO

information.[9] In Italy disclosure rates were below 50% for stock options before IFRS 2, but increased somewhat in 2005 (Melis and Carta 2010). Finally, only one-third of Danish firms provide all the model inputs required under Danish GAAP (Bechmann and Hjortshøj 2009).

Those studies have in common that they are investigating the situation under local GAAP and have at most 1 year of IFRS 2 data. So it is doubtful if the results transfer to Germany. Danish and Italian GAAP, for example, already required certain disclosures, while the international accounting rules present a fundamentally different system for German firms[10] and it has already been shown that their overall IAS/IFRS disclosure rates are lacking (e.g., Street and Gray 2002). Moreover, the enforcement regimes were vastly different at that time (Brown et al. 2014).

Results in Bechmann and Hjortshøj (2009) suggest that the reason for incomplete disclosure is lack of experience, which has been identified as a major reason underlying incomplete disclosure and overall quality of financial statements (e.g., Glaum et al. 2013). Those results notwithstanding, it could be a deliberate effort to hide ESO values. Consequently, I will examine if German firms provide the required disclosure and, if not, if a lack of disclosure is linked to incentives to hide ESO information or simply to a lack of experience with IFRS. The German setting is useful for this analysis, as it is comparable in terms of enforcement and corporate governance strength to other Continental European countries.

With respect to the second possibility, there is ample evidence that firms underreport the values of their ESO, both in reaction to disclosure rules (e.g., Yermack 1998; Balsam et al. 2003) and mandatory expensing rules (e.g., Cheng and Smith 2013). The underreporting actually becomes worse when firms expense options (Choudhary 2011). Research has identified two major explanations for the underreporting: First, firms wish to improve share price performance (Johnston 2006) and second they have an incentive to hide excessive pay (e.g., Aboody et al. 2006; Hodder et al. 2006). Firms with large option grants even accelerated ESO vesting to avoid having to record an expense (Choudhary et al. 2009).

The way that firms reduce ESO values has also been investigated. Some firms apply unilateral discounts to their pricing models (Yermack 1998; Belze et al. 2015) while others use the discretion they have over the input parameters to negatively impact the ESO values (Hodder et al. 2006). In particular, firms reduce the life of the option (Yermack 1998; Aboody et al. 2006), which, because of the long maturities of several years, is the parameter with the greatest impact on the value. Additionally, firms only use implied volatilities from traded options if it is lower than historical volatility and will thus lead to a lower value (Bartov et al. 2007).

Taken together, the literature reinforces the notion that camouflaging executive pay (in this case through underreporting option values) is more likely to occur when firms have an incentive to hide the true value of the ESO. Whether this also holds for Germany is questionable because German firms typically have a banker on their

[9] Disclosing information on the valuation was voluntary prior to IFRS 2 and only 20% of firms provided it (Bassett et al. 2007).

[10] See Ernstberger and Vogler (2008) for more on the differences between German GAAP and IFRS.

board (Dittmann et al. 2010). Given that they likely possess financial expertise, underreporting might be more difficult for these firms. Therefore, I will investigate if firms in Germany underreport their ESO values under IFRS 2 and, if they do, whether that is driven by incentives to camouflage pay.

Finally, firms may attach complex performance conditions to their options, because that makes it much harder for an outsider to value them. All previous US studies have calculated benchmark option values using the Black–Scholes model, since US firms relied predominantly on plain-vanilla options (Choudhary 2011). While a Black–Scholes value can be calculated rather easily, nontraditional options with performance conditions are much more difficult to value and might require not only additional information but an entirely different valuation model (Hull 2012). This is the first study to investigate the connection between underreporting and performance vesting. It is conceivable that such conditions are meant to make it appear that managers have to meet challenging goals to receive higher pay, when in fact they are merely meant to make it harder for outsiders to calculate the true value of the option. Abernethy et al. (2015) provide evidence that powerful managers in the UK add conditions to their ESO that only appear to be challenging. If I likewise find that powerful managers or those with an incentive to underreport favor such conditions, it could indicate that they are not used to provide incentives, but are actually detrimental to shareholders. Since these kinds of options are becoming more popular in countries, such as the UK and the US, Germany provides a useful setting for such an analysis.

4 Data set and descriptive statistics

To investigate whether firms underreport option values in Germany, I first identify all firms from the large-cap, mid-cap, or small-cap stock indexes (DAX, MDAX, SDAX, respectively)[11] that have issued executive stock options in at least 1 year between 2005 (the year in which IFRS 2 took effect) and 2011. I then hand collect data on the options, namely plan characteristics, valuation models, input parameters, and reported fair values from annual reports, creating a unique data set.

Table 1 presents an overview of the number of ESO tranches in my sample and the exercise conditions attached to them. First, it can be seen that relatively few firms give out options and the number declines even further over the years. Gillenkirch et al. (2019) analyze the connection between IFRS 2 and reduced option use in Germany. They describe a decline similar to that in other European countries,[12] yet firms with more intricate performance conditions are more likely to keep options and not switch to different equity-based pay. This underscores the importance of performance vesting for German ESO.

[11] Together the indexes account for roughly 90% of market capitalization in Germany.

[12] Similar trends can be observed in Denmark and France (Bechmann and Hjortshøj 2009; Belze et al. 2015).

Second, the table shows that there are a variety of different exercise conditions in use, which makes this data set distinctly different from those used in previous studies. The most popular conditions are out-of-the-money (premium) options and the absolute performance option. There are also many plans that have more than one vesting condition, comprising more than one quarter of the sample. These figures also confirm the trends previously reported by Winter (2003) and Langmann (2007): exchange options are less relevant than those that make exercise conditional on the outperformance of an index; accounting hurdles play almost no role in Germany; and plans tend to be generally more complex. This has important consequences for the question of ESO valuation, as these plans offer more possibilities to influence the fair value estimates and require more complex models. It also casts doubt on the transferability of results from previous studies, which predominantly use plain-vanilla options with no special performance conditions.

5 Empirical analysis

5.1 Empirical findings on disclosure practices

Disclosure of the relevant input parameters and the fair values of option tranches is depicted in Table 2. Panel A shows the instances in which a fair value and maturity, individually, and both these figures are published; they are separated from the other parameters, since these are the ones that are absolutely necessary to calculate a fair value. The other parameters, namely interest rate, volatility, and dividend yield (listed in panel B) can all be obtained from other sources. Panel C indicates the percentage of firms that provide all the information required by IFRS 2, while panel D gives an overview of the valuation models used.

Panel A shows that overall disclosure of the minimum values is quite good, with most individual values reported in 70% or more of cases, with only 2010 somewhat below this value. It is also evident that this level of reporting is rather stable over time. Similar results are obtained for the other parameters, except for dividend yield, which is reported in the context of ESO valuation surprisingly rarely. In 2011, for example, only 40% of firms report this value. It is possible that some firms do not pay dividends and therefore do not comment on this issue specifically in the footnotes of the annual report, which they nonetheless should have.

Panel D of Table 2 shows the valuation models employed by the sample firms. The Black–Scholes model is the most popular, especially considering that some firms state that they solve the Black–Scholes equation numerically via a Monte Carlo simulation. These instances are included under ‘Monte Carlo’ in the table; Monte Carlo is the second most popular model. Again, there are a number of firms that do not comply with IFRS 2, as they do not specifically name a model, but rather use formulations such as ‘used a generally accepted option valuation model.’ All previous studies employ samples in which the overwhelming majority of firms claim

Table 1 Descriptive statistics of ESO performance conditions

	2005	2006	2007	2008	2009	2010	2011	Total
Number of plans	34	34	30	31	26	22	20	197
Types of plans								
Absolute hurdles	20	22	18	19	16	13	11	119
(1) Premium option	10	11	8	7	8	6	7	57
(2) Barrier option	1	2	2	2	2	2	1	12
(3) Performance option	9	9	8	10	6	5	3	50
Relative hurdles	5	4	2	2	1	0	0	14
(4) Outperformance hurdle	4	3	2	2	1	0	0	12
(5) Exchange option	1	1	0	0	0	0	0	2
Accounting hurdle								
(6) EPS increase	0	1	1	1	1	1	1	6
Combined hurdles	9	7	9	9	8	8	8	58
(3) and (4)	5	4	4	4	5	4	4	30
(3) or (4)	0	0	1	1	1	1	1	5
(3) and (5)	1	1	1	1	0	0	0	4
(4) and (6)	1	0	1	1	0	1	1	5
(2) and (4)	2	2	2	2	2	2	2	14

The table shows the number of plans in each year and the kind of exercise condition attached to them. The first panel shows plans with only absolute hurdles, the second with only relative hurdles, the third with only accounting-based hurdles, and the bottom panel shows plans that have a combination of the different types of hurdles. Except for the plans including an EPS target, all plans are based on market conditions

to use the Black–Scholes Model.[13] Even Bechmann and Hjortshøj (2009) have only two firms in their sample that do not rely on that model. For my sample, the variety in models can most likely be attributed to the many different exercise conditions.

The low numbers reported here are comparable to Bechmann and Hjortshøj (2009), who also report complete disclosure for only about 40% of firms in their sample. One possible explanation is that ESO expenses are simply not material. This is most commonly evaluated based on the impact the ESO expense has on the return on assets (ROA) or EPS. The pro forma option expense has been found to be material for US high growth firms (Botosan and Plumlee 2001), foreign firms listed in the US (Street and Cereola 2004), and Australian firms (Chalmers and Godfrey 2005). Contrarily, Shiwakoti and Rutherford (2010) report that the effect has only been modest in the UK.

For my sample, I use the disclosed ESO values, when available, and correct the ROA and EPS for those amounts. Table 3 shows median values for both the raw and the adjusted ROA and EPS, respectively. Moreover, it reports the *p*-values for a Wilcoxon signed rank test. The differences are highly significant in all years and

[13] Several firms mention that they make adjustments to the Black–Scholes Model to incorporate specifics of their ESO plans, yet do not mention what those adjustments are.

Table 2 Disclosure of valuation and parameters over time

	2005	2006	2007	2008	2009	2010	2011	Average
Panel A: Minimum disclosure								
Fair value	0.82	0.91	0.87	0.86	0.85	0.73	0.80	0.83
Maturity	1.00	0.91	0.90	0.94	0.93	0.86	0.75	0.91
Both	0.82	0.85	0.80	0.81	0.77	0.68	0.70	0.79
Panel B: Parameters								
Interest rate	0.85	0.80	0.83	0.83	0.88	0.82	0.85	0.84
Volatility	0.85	0.80	0.83	0.84	0.88	0.82	0.85	0.84
Dividend yield	0.56	0.52	0.53	0.52	0.58	0.50	0.40	0.54
Panel C: Full disclosure								
Full disclosure	0.41	0.50	0.46	0.42	0.42	0.41	0.40	0.44
Panel D: Valuation model								
Black–Scholes	16	15	9	10	8	6	5	69
Binomial	4	7	9	10	8	5	5	48
Trinomial	1	1	0	0	0	0	0	2
Monte Carlo	8	8	10	9	8	9	9	61
Not specified	5	3	2	2	2	2	1	17

Panel A shows the percentage of firms that disclose the fair value and the maturity in a given year and over the entire sample period. These are the two parameters that are absolutely necessary for valuing the option grants. Panel B shows the same for the remaining valuation parameters listed in IFRS 2. "Dividend yield" also includes dividends given in levels and information about dividend protection of the options, in which case dividends no longer need to be included in the valuation. Panel C combines the information from the two previous panels to show the percentages of firms that provide all required information. Finally, panel D shows the option pricing models used by the firms. "Monte Carlo" includes those instances where a firm used Monte Carlo simulations to solve Black–Scholes models

Table 3 Materiality of underreporting

Year	ROA	ROA-adj.	Diff in ROA	EPS	EPS-adj.	Diff in EPS
2005	0.0341	0.0402	0.0001***	1.73	1.81	0.0001***
2006	0.0662	0.0668	0.0001***	2.45	2.50	0.0001***
2007	0.0565	0.0578	0.0001***	2.60	2.62	0.0002***
2008	0.0495	0.0523	0.0001***	2.63	2.73	0.0001***
2009	0.0174	0.0177	0.0007***	0.95	1.02	0.0007***
2010	0.0494	0.0518	0.0022***	1.90	1.95	0.0022***
2011	0.6000	0.0607	0.0051***	1.92	1.93	0.0051***
total	0.0495	0.0466	0.0000***	2.15	2.18	0.0000***

This table shows the medians of the return on assets (ROA), the return on assets adjusted for the recognized option expense (ROA-adj), the earnings per share (EPS), and the earnings per share adjusted for the option expense (EPS-adj). Moreover, columns four and seven show the *p*-values for Wilcoxon signed rank tests for differences in medians between the raw and adjusted values for the ROA and EPS, respectively

*, **, and ***Statistical significance at the 10%, 5%, and 1% level, respectively

the overall sample. So at least for those firms that report a fair value, the expense is material.

5.2 Empirical findings on underreporting

5.2.1 Calculating option values

To determine whether firms underreport option values in their annual reports, I first determine all necessary input variables as objectively as possible, that is, strictly according to the guidelines from IFRS 2. Choudhary (2011) similarly calculates her benchmark values according to 'authoritative guidance'. I require from the annual reports only general information, such as exercise conditions and caps as well as (expected) maturity. Further, I include only firms that report the fair value either at the grant date or at the end of the fiscal year.[14] This has the advantage that I do not have to eliminate option issues for which not all parameters are disclosed.

The other inputs are determined as follows. Since the expected dividend yield may be based only on publicly available information, I rely on I/B/E/S consensus estimates for the relevant years.[15] Historical annualized volatilities and correlations with an index, when necessary, are calculated based on continuously compounded daily returns over a period that corresponds to the expected life of the option or the maximum stock price history, whichever is shorter. Finally, I calculate risk-free interest rates from the term structure provided by the German Bundesbank.

With respect to the maturity, I use the one given by the firm in the annual report. This can either be the contractual time to maturity or the expected time to maturity if the firm anticipates early exercise. If no further information is given, it must be concluded that the firm used this number in its valuation. In these cases the time of exercise is known and all options are de facto European-style options, which simplifies valuation greatly. In five cases, firms state that they modeled the exercise behavior without giving either the time they use or information on the model. Since I cannot reproduce that model, I use the contractual time to maturity, which most likely leads to an overestimation of the ESO value for these five firms. I will, however, account for that throughout the remainder of my analysis.

The model used for the valuation is also important as it can also be used to minimize option values. Yermack (1998), for example, shows that firms apply discounts to the Black–Scholes formula without proper theoretical justification. Similarly, Belze et al. (2015) find that French firms use unjustified adjustments to the model to lower the fair value of redeemable warrants used for executive compensation and Bratten et al. (2015) find that firms switch from Black–Scholes to lattice models when it results in lower option values. So to obtain unbiased option values, I use a common framework, based on standard no-arbitrage pricing. This assumes that stock prices and, when necessary, index levels, follow correlated geometric

[14] Stock appreciation rights (SAR) must be revalued at the end of each fiscal year until exercised or expiration. In this case, I evaluate the underreporting at the end of the year in which they were first issued.

[15] When options are dividend-protected, they are treated accordingly in the valuation model.

Brownian motion processes under the risk-neutral measure. All exercise conditions and caps are considered, except for the accounting hurdles that exist for two plans.[16] Since this model works for all the different option types, it prevents introducing discrepancies in the valuation based on different models. The price computations use Monte Carlo simulations with daily time steps and 100,000 replications. The resulting option values are the ones to be expected under strict adherence to the IFRS rules. To test the validity of this valuation model, I compare the option values calculated with my model to those derived from other models, such as the Black–Scholes and the Margrabe model, for all options that can be valued with those models. The values are identical.

5.2.2 Underreporting

Based on the calculated values and those disclosed in the financial statements, I measure underreporting as

$$\frac{\text{disclosed value} - \text{expected value}}{\text{disclosed value}}. \tag{1}$$

This ratio will be below zero when the options are undervalued and above zero when they are overvalued. Results are presented in Table 4.

It can be seen in Panel A that the mean of the underreporting ratio is negative for the complete sample and in every year, except for 2009. Moreover, there are substantial differences by year, both in terms of standard deviation and in terms of minimum value (i.e., maximum underreporting). The greatest dispersion in underreporting values occurred in 2005 and 2008. Maximum values (i.e., overreporting) appear to be rather stable over the years. I perform *t*-tests to determine whether the underreporting is statistically significant. The null hypothesis that the mean is equal to zero can be rejected in favor of the alternative that it is below zero (one-sided tests) in 4 of the 7 years and for the overall sample. The two-sided tests with the alternative hypothesis that the mean is unequal to zero are significant in only 3 of the 7 years. Moreover, given the rather small sample size, I also conduct Wilcoxon signed rank tests for differences in medians. They are significant in 2009, in 2011, and for the sample as a whole.

In 2008, the low mean and high standard deviation are caused by two outliers with underreporting of −21.66 and −18.96%. Both are cases in which the respective firms reported extremely low fair values. One case can probably be attributed to a data error: the firm reports using a dividend yield of 16% in estimating the fair value. When I use a dividend yield of 1.6% along all the other parameters used by the firm, the result is quite close to the value I have determined with the objective market parameters. For the other outlier, there seems to be no apparent explanation.[17] To ensure that the results are not driven by any outliers, I winsorize the

[16] As stated by IFRS 2, only market-based performance goals are to be included in the valuation, which this approach accounts for through simulation.

[17] There is no obvious explanation for the high standard deviation observed in 2005.

underreporting ratio at the 2% and 98% level. Results are depicted in Panel B and they are qualitatively identical to Panel A. Since it is the objective of this study to identify underreporting regardless of cause, I do not exclude the outliers from further analysis, yet I address this in the robustness tests. Finally, in Panel C, I exclude the five firms that have modeled the exercise behavior, which I cannot reproduce because of insufficient information. While the significance is somewhat weaker, the results still hold, indicating that the findings are not likely to be driven by either the outliers or the assumption I had to make concerning the exercise date.

The findings in Table 4 thus show that underreporting is statistically significant in Germany. While these values appear to be comparable to those in Bechmann and Hjortshøj (2009), that only holds because the authors use the contractual time to maturity. When they use the expected time, as I do, they only find week evidence of underreporting. Thus, underreporting is more of a concern in this setting. This could be the result of the strong financial press in Denmark. I investigate potential causes of inadequate reporting next.

5.3 Determinants of inadequate reporting

5.3.1 Methodology and explanatory variables

5.3.1.1 Heckman correction Since several firms do not provide all required data in every year, regressing the underreporting ratio on some explanatory variables is subject to a potential selection bias. Firms that want to hide the true option values may be those that do not provide all required information in the first place. This is addressed by performing a two-stage Heckman (1979) correction, where first a probit regression is run to determine which characteristics explain whether a firm provides sufficient disclosure. The dependent variable (*NEC_DISC*) is coded 1 if all necessary parameters are disclosed, and zero if not. Necessary parameters in this case refers to those that cannot be obtained from other sources. From the probit regressions the inverse Mill's ratio (*MILLS*) is derived and included in the second stage, which contains the same explanatory variables, but the dependent variable is the underreporting ratio, defined above.[18]

Lennox et al. (2012) point out the importance of including such an exclusion restriction in the first stage that can be validly omitted from the second stage. That is, the variable should have explanatory value for disclosure, yet not for underreporting. Several studies highlight the importance of IFRS experience[19] in providing full disclosure in annual reports (e.g., Glaum et al. 2013). To measure this, I include *IFRS_EXP*, which is one if the firm has already published an IAS/IFRS report prior to the first application of IFRS 2. This variable would only have explanatory power on the second stage regression if previous IFRS experience (potentially from voluntary adoption even long before 2005) would lead to greater experience with option

[18] This procedure follows Bechmann and Hjortshøj (2009) and, for the second stage, Johnston (2006).

[19] Other variables that have been shown to affect disclosure patterns (e.g., being audited by a big-4 firm) have a much more direct link with option valuation.

Table 4 Underreporting by year

	2005	2006	2007	2008	2009	2010	2011	Total
Panel A: Overall sample								
Observations	22	23	20	21	16	12	11	125
Mean	−0.512	−0.139	−0.424	−0.247	0.007	−0.278	−0.518	−0.670
Median	0.054	0.007	−0.151	−0.075	0.082	−0.217	−0.427	−0.052
SD	1.453	0.626	0.714	6.060	0.450	0.892	0.549	2.690
Max	0.777	0.549	0.349	0.372	0.787	0.545	0.307	0.787
Min	−4.726	−2.433	−2.074	−21.66	−0.956	−2.819	−1.735	−21.66
T_{mean} (1-sided)	0.057*	0.149	0.008***	0.038**	0.525	0.152	0.005***	0.003***
T_{mean} (2-sided)	0.113	0.300	0.016**	0.077*	0.950	0.304	0.011**	0.006***
Z_{Wilcox}	0.592	0.627	0.062*	0.140	0.756	0.480	0.009***	0.002***
Panel B: Outliers winsorized								
Observations	22	23	20	21	16	12	11	125
Mean	−0.512	−0.139	−0.424	−0.985	0.007	−0.278	−0.518	−0.420
Median	0.054	0.007	−0.151	−0.075	0.082	−0.217	−0.427	−0.052
SD	1.453	0.626	0.714	1.705	0.450	0.892	0.549	1.091
Max	0.777	0.549	0.349	0.372	0.777	0.545	0.307	0.777
Min	−4.726	−2.433	−2.074	−4.726	−0.956	−2.819	−1.735	−4.726
T_{mean} (1-sided)	0.057*	0.149	0.008***	0.008***	0.525	0.152	0.005***	0.000***
T_{mean} (2-sided)	0.113	0.300	0.016**	0.015**	0.950	0.304	0.011**	0.000***
Z_{Wilcox}	0.592	0.627	0.062*	0.140	0.756	0.480	0.009***	0.002***
Panel C: Firms with modeled exercise behavior excluded								
Observations	17	19	17	17	13	9	9	101
Mean	−0.665	−0.192	−0.513	−1.708	−0.047	−0.311	−0.524	−0.604
Median	0.068	−0.022	−0.151	−0.075	0.044	−0.356	−0.495	−0.052
SD	1.628	0.673	0.732	4.616	0.417	1.041	0.611	2.104
Max	0.777	0.549	0.349	0.372	0.574	0.545	0.307	0.777
Min	−4.726	−2.433	−2.074	−18.956	−0.956	−2.819	−1.735	−18.956
T_{mean} (1-sided)	0.056*	0.115	0.005***	0.073**	0.345	0.199	0.014**	0.002***
T_{mean} (2-sided)	0.112	0.230	0.011**	0.147	0.689	0.398	0.029**	0.005***
Z_{Wilcox}	0.463	0.398	0.049**	0.210	0.972	0.594	0.028**	0.002***

This table shows the means and medians of the underreporting for each year, calculated as the difference between disclosed value and the expected value, divided by the disclosed value. SD refers to the standard deviation. Panel A includes all observations. For Panel B the underreporting values are winsorized at the 2% and 98% level. Panel C excludes the five firms that model the exercise behavior but do not disclose that model. *T*-tests are performed with the null hypothesis that the mean is equal to zero and the alternative hypothesis that the mean is below zero (one-sided) and unequal to zero (two-sided). Z_{Wilcox} is a standard Wilcoxon signed rank test for the median. Values are the *p*-values for said hypothesis tests

valuations. Yet firms were not required to deal with option valuation as a consequence of applying the standards. Before the introduction of IFRS 2, there was no standard governing the accounting of equity-based compensation in Germany and the variable can be omitted from the second stage. It is theoretically conceivable that *IFRS_EXP* could be correlated with some unobserved time-invariant ability in the

firm's accounting department. To ensure that this does not affect the results, I run a robustness check with the variable included in the second stage. The Heckman correction is still valid without an exclusion restriction (Li and Prabhala 2007), and if *IFRS_EXP* is insignificant in the second stage, it further supports the notion that it is a useful exclusion restriction.[20]

5.3.1.2 Explanatory variables Prior studies suggest that variables explaining inadequate reporting fall into two broad categories: managers must have the power to influence underreporting and they must have an incentive to do so.

5.3.1.3 Managerial power variables Managerial power has often been linked to both rent extraction and reduction of outrage costs through camouflage. A study by Abernethy et al. (2015), for example, finds that powerful managers use their influence to attach weak performance targets to their option grants. Morse et al. (2011) show that the more powerful managers are, the more their compensation hinges on measures on which the firm has traditionally performed well. In accordance with the literature, I use the following variables to capture managerial power:

A high free float (*FREE_FL*) is often synonymous with dispersed ownership, which has been shown to lead to less effective compensation control by shareholders, especially without large blockholders (Shleifer and Vishny 1986).[21] Elston and Goldberg (2003) confirm this relationship for Germany, where ownership is more concentrated than in the US and acts as a monitoring device for executive compensation. Since less oversight means more possibilities for managers to bias option valuations, high free float is expected to have a negative sign in both stages of the regression.

The positive role of institutional investors (*INST_INV*) in monitoring and influencing executive compensation is well established (e.g., Hartzell and Starks 2003). Moreover, Bechmann and Hjortshøj (2009) show that higher institutional ownership translates into better adherence to disclosure requirements. I collect the percentage ownership held by institutional investors from annual reports and expect it to counteract underreporting.

A more direct oversight function is carried out by the supervisory board, yet it has been found that larger boards more often experience communication and free-rider problems (Hermalin and Weisbach 2003; Yermack 1996), which can lead to rent extraction (Jensen 1993). Although most studies on this subject refer to one-tier board systems, there is no reason to doubt that these results can be transferred to the German two-tier system, especially because firms are free to go above the minimum number of supervisory board members dictated by law. Moreover, the Societas Europaea gives all European firms the option to have a two-tier board. I expect

[20] Dutordoir et al. (2018) and Hoi et al. (2013) make the same argument. Untabulated results show that *IFRS_EXP* is indeed insignificant on the second stage.

[21] The percentage held by the largest blockholder would be a more direct measure, yet this is hardly ever available for German firms and most studies use free float instead (e.g., Andres and Theissen, 2008).

board size (*BOARDSIZE*) to positively affect the likelihood of a firm not disclosing all required information and/or biasing fair values downward.

Because of the two-tier system, a CEO cannot concurrently serve as chairman of the board, yet a retiring CEO oftentimes will assume this position. Andres et al. (2014) have found that this represents a cost increase to firms, as former CEOs increase their former colleagues' pay. I therefore include the dummy variable *F_CEO_CHAIR*, which I expect to be conducive to underreporting.[22] In addition, CEOs amass more influence the longer they serve in that position (Bebchuk et al. 2002) and Hill and Phan (1991) show that this leads to pay that is more aligned with CEO preferences, which in turn may need to be hidden. Thus I expect *CEO_TEN* to be positively linked to inadequate reporting.

As another measure of the specific German institutional background, I include *BANKER*, which is one if the firm has at least one banker on the supervisory board. Given their role as financial experts, their presence should lead to better reporting, both disclosure- and valuation-wise. Considering the findings in Güner et al. (2008), however, their impact on either disclosure or compensation design is a priori ambiguous.

Finally, I include *SIZE*, measured as the natural log of market capitalization. Aboody et al. (2004) report that larger firms are more likely to voluntarily expense option values under SFAS 123 and Bechmann and Hjortshøj (2009) find that size is positively linked to the likelihood of complete disclosure in Denmark. They surmise that it is easier for larger firms to have specialized and more experienced accounting divisions and that they are more scrutinized by the public.

5.3.1.4 Managerial incentive variables Managers engage in underreporting if they feel that they have something to hide or they have reason to reduce information asymmetry. A logical first step in this category is the salary that executives are paid, because this may lead to outrage costs. *COMP* measures average yearly compensation of the members of the executive board, and is expected to be associated with weaker adherence to disclosure requirements. Similarly, if managers receive large option grants, they might want to hide valuation information or underreport the fair values. Aboody et al. (2006) and Cheng and Smith (2013) find that the magnitude of option-based compensation does in fact work this way for the US, while Bechmann and Hjortshøj (2009) do not find such an association for Denmark. I include *OPT_GR* as the number of options granted in a particular year, measured in millions of options.[23]

Executive compensation in general is often criticized in the media, especially when firms are performing poorly. In years with negative profits, it is much more difficult to argue in favor of high salaries. Aboody et al. (2004), Hodder et al. (2006) and Bechmann and Hjortshøj (2009) find that firms that experience negative profits

[22] Because of this variable, I exclude firms with a one-tier board system, which leads to a loss of four observations.

[23] While the value of the grant depends on more than the number of options, this is a standard proxy in the literature (e.g., Dechow et al. 1996; Hodder et al. 2006).

underreport more. For this reason, I include the dummy variable *LOSS*, which takes the value 1 if the firm has a negative net income.

Related to this point is the influence of the capital structure. Highly leveraged firms may wish to avoid the appearance of overpaying executives in the face of financial difficulties (Aboody et al. 2004). Therefore, I include *LEV*, measured as total debt divided by market capitalization. Aboody et al. (2004) point out that high leverage can also indicate that firms are active in capital markets, and it may be the case that firms strive to disclose fully to reduce information asymmetry. To capture this effect, I follow Bechmann and Hjortshøj (2009) and include the dummy *RAISED_CAPITAL*, which takes the value 1 in a year in which the firm has a seasoned equity offering, as a more direct measure of capital market activities. A strong capital market orientation may also affect the reporting behavior of firms. I therefore include *CROSS_LISTING*, which is one if a firm is listed on another major stock exchange (i.e., New York, Paris, London, Milan, or Tokyo).

I also include the book-to-market ratio *BTM* as book value of equity divided by market value of equity. Bechmann and Hjortshøj (2009) find that this is significant in explaining underreporting in their sample. Lastly, I use a dummy variable (*COMB_GOAL*) that takes the value 1 if the option plan has two combined exercise conditions. Such ESO are not only harder to understand, but also harder to value. The choice of such complex plans could be associated with either lower disclosure or underreporting.

5.3.2 Determinants of incomplete disclosure

I first estimate pooled probit regressions to determine which firms do not provide enough information on their ESO to calculate a fair value. To do this, I code firms with a 1 that provide at a minimum the grant date, fair value, exercise conditions, and maturity and run the following regression:

$$\begin{aligned} NEC\_DISC_{t,i} = {} & \beta_0 + \beta_1 FREE\_FL_{t,i} + \beta_2 INST\_INV_{t,i} + \beta_3 BOARDSIZE_{t,i} \\ & + \beta_4 F\_CEO\_CHAIR_{t,i} + \beta_5 CEO\_TEN_{t,i} + \beta_6 SIZE + \beta_7 COMP_{t,i} \\ & + \beta_8 OPT\_GR_{t,i} + \beta_9 LOSS_{t,i} + \beta_{10} LEV_{t,i} + \beta_{11} RAISED\_CAPITAL_{t,i} \\ & + \beta_{12} BTM_{t,i} + \beta_{13} CROSS\_LISTING_{t,i} + \beta_{14} IFRS\_EXP_{t,i} \end{aligned} \tag{2}$$

where i indexes the firm and t the year. Results are presented in Table 5, standard errors are always clustered at the firm level, as suggested in Lennox et al. (2012) and Petersen (2009).

The three models, all based on Eq. (2), contain all managerial power and incentive variables as well as the exclusion restriction. Compared to the base model (1), model (2) contains year dummies to filter out any time effects, and model (3) includes *COMB_GOAL*. Since probit regressions only show the direction of the effect, but not its magnitude, I have included marginal effects (ME) models for all three regressions. Results are stable over all specifications, except for *F_CEO_CHAIR* and *LOSS* that show up significant in model (2). *FREE_FL* has the expected sign, showing that firms with more dispersed ownership are less likely to disclose

Table 5 First stage Heckman: participation regression

	(1)		(2)		(3)	
	Coefficient	ME	Coefficient	ME	Coefficient	ME
FREE_FL	−0.0285** (0.0421)	−0.0043** (0.0352)	−0.0469*** (0.0001)	−0.0064*** (0.0004)	−0.0282** (0.0423)	−0.0043** (0.0344)
INST_INV	0.0139 (0.2525)	0.0021 (0.2616)	0.0313** (0.0168)	0.0043** (0.0276)	0.0130 (0.2657)	0.0020 (0.2745)
BOARDSIZE	0.4149*** (0.0006)	0.0626*** (0.0000)	0.5943*** (0.0000)	0.0815*** (0.0000)	0.4269*** (0.0008)	0.0643*** (0.0000)
F_CEO_CHAIR	0.8533 (0.2681)	0.1287 (0.2381)	1.7150*** (0.0064)	0.2353*** (0.0052)	0.9878 (0.2301)	0.1488 (0.1995)
CEO_TEN	0.0977 (0.1856)	0.0147 (0.1738)	0.0832 (0.1716)	0.0114 (0.1622)	0.0800 (0.2791)	0.0121 (0.2682)
BANKER	−1.3229* (0.0522)	−0.1996** (0.0303)	−1.7718** (0.0179)	−0.2431** (0.0119)	−1.3586* (0.0574)	−0.2047** (0.0330)
SIZE	−0.3035*** (0.0031)	−0.0458*** (0.0012)	−0.9156*** (0.0068)	−0.1256*** (0.0080)	−0.3152*** (0.0027)	−0.0475*** (0.0009)
COMP	−0.3761 (0.3624)	−0.0567 (0.3390)	−0.1178 (0.8029)	−0.0162 (0.8012)	−0.3647 (0.3592)	−0.0549 (0.3349)
OPT_GR	−1.3351*** (0.0001)	−0.2014*** (0.0000)	−1.8102*** (0.0000)	−0.2484*** (0.0000)	−1.4013*** (0.0001)	−0.2111*** (0.0000)
LOSS	1.0742 (0.1311)	0.1620 (0.1263)	1.4867** (0.0184)	0.2040** (0.0142)	1.1139 (0.1129)	0.1678 (0.1071)
LEV	0.6779 (0.1905)	0.1023 (0.1756)	0.9448 (0.1165)	0.1296 (0.1041)	0.7707 (0.1688)	0.1161 (0.1531)
RAISED_CAPITAL	−0.3761 (0.5475)	−0.3761 (0.5451)	−0.6269 (0.3245)	−0.0860 (0.3216)	−0.3882 (0.5451)	−0.0585 (0.5423)
BTM	−0.0583 (0.9392)	−0.0088 (0.9389)	0.2491 (0.7740)	0.0342 (0.7782)	−0.1031 (0.8961)	−0.0155 (0.8954)
CROSS_LISTING	6.9362*** (0.0000)	1.0463*** (0.0000)	9.6237*** (0.0001)	1.3205*** (0.0000)	7.3081*** (0.0000)	1.1009*** (0.0000)
IFRS_EXP	3.2440*** (0.0002)	0.4893*** (0.0000)	4.5426*** (0.0000)	0.6233*** (0.0000)	3.3224*** (0.0003)	0.5005*** (0.0000)
COMB_GOAL					0.3039 (0.6620)	0.0458 (0.6619)
Clustered SE	Yes		Yes		Yes	
Year Dummies	No		Yes		No	

Table 5 (continued)

	(1)		(2)		(3)	
	Coefficient	ME	Coefficient	ME	Coefficient	ME
Pseudo-R^2	50.0		46.2		57.7	
Observations	106		106		106	

This table reports the probit participation regressions. The dependent variable is a binary variable that takes the value 1 if firms report enough information to calculate a fair value for the ESO grant, and zero otherwise. Model (2) includes year dummies, and model (3) includes the type dummy. *FREE_FL* measures the percentage of shares not held by shareholders with an equity share exceeding 5%; *INST_INV* measures the percentage of shares held by institutional investors; *BOARDSIZE* is the number of people on the supervisory board; *F_CEO_CHAIR* is an indicator variable showing one if a former CEO is now chairperson of the board; *CEO_TEN* is the number of years the CEO has served in that position; *BANKER* is one if a banker has a seat on the board; *SIZE* is the natural log of total assets; *COMP* is the average total compensation of members of the executive board; *OPT_GR* is the total number of options granted in a year; *LOSS* is an indicator variable that is one if the firm has a negative net income in that year; *LEV* measures the market leverage defined total debt divided my market capitalization; *RAISED-CAPITAL* is an indicator variable that is one if the firm has raised external equity capital in that year; *BTM* is the book-to-market ratio; *CROSS_LISTING* is a dummy that is 1 if the firm is listed on a foreign stock exchange; *IFRS_EXP* is an indicator variable that is one if the firm has already prepared an IFRS annual report prior to the first application of IFRS 2; *COMB_GOAL* is an indicator variable that is one if the ESO contain a combination of two different exercise conditions. *p*-values are given in parentheses and are based on standard errors clustered at the firm level. The marginal effects (ME) are based on mean values of the independent variables and *p*-values are based on standard errors calculated with the delta method

*, **, and ***Statistical significance at the 10%, 5%, and 1% level, respectively

the necessary valuation parameters. Considering that a one percentage point increase in free float leads to a 0.4% reduction in the likelihood, the effect is rather small. *BOARDSIZE* has an unexpected sign as larger boards appear to make better disclosure more likely. In fact, the likelihood increases by 6.26% for every board member added. It could be possible that having larger boards simply means that there is more expertise, which could include more accounting expertise.[24] *BANKER*, which captures the special German corporate governance characteristic, similarly shows an unexpected sign, albeit at weaker significance levels. Bankers seem to reduce the level of disclosure. On the one hand, this is in line with Güner et al. (2008), who show that financial experts on boards only have a low impact on equity-based compensation and in some cases (inadvertently) promote rent seeking. On the other hand, financial expertise may simply be different from accounting expertise that is likely more relevant to the question of disclosure.

The effect of *SIZE* is highly significant, yet also with a negative sign, which is different from the Danish result. Bechmann and Hjortshøj (2009) attribute their finding to the strong financial press carrying out a monitoring function. Possibly the influence is not as strong in Germany or investors do not feel the need for detailed information from large firms, as much is known about them from general media and analyst attention. The finding is puzzling, yet the ME models show a limited impact. *OPT_GR*, on the other hand, does show the expected sign and is highly significant in all three models. Since it is measured in millions of options, the ME models show that adding a million options in a year (that is the average grant in my sample), would reduce the likelihood of sufficient disclosure by more than 20%. This may indicate that managers with higher pay may want to hide information on their ESO grants, which is in stark contrast to Bechmann and Hjortshøj (2009) who do not find that incentives to hide higher pay plays a role.

Finally, both *CROSS_LISTING* and *IFRS_EXP* are highly significant with the expected signs. Moreover, the marginal effects models show that the influence of these two variables is far greater than those of any other significant variable.[25] So all in all, these results suggest that there are incentives to hide large option grants, which is different from the Danish results. Yet the low disclosure also seems driven by firms' lack of IFRS experience and capital market orientation, which is in line with previous findings on IFRS disclosures (Glaum et al. 2013).

5.3.3 Determinants of underreporting

To analyze potential causes for underreporting, I run pooled regressions with the underreporting ratio (*UNDERR*) given by Eq. (1) as the dependent variable. *MILLS* is calculated from the corresponding participation regression presented

[24] Coles et al. (2008) argue that larger boards possess more expertise which is especially beneficial to larger, more complex firms.

[25] Note that the ME coefficients for *CROSS_LISTING* are greater than one. This can occur, because the marginal effects are approximated via the first derivative at the mean, which can have a slope greater than one.

in Table 5 and the exclusion restriction *IFRS_EXP* is no longer included. $\Sigma(EXERCISEt,i)$ represents the five dummy variables that take the value 1 for each respective firm that models the exercise behavior. The following regression model is given by

$$\begin{aligned} UNDERR_{t,i} = {} & \beta_0 + \beta_1 FREE\_FL_{t,i} + \beta_2 INST\_INV_{t,i} + \beta_3 BOARDSIZE_{t,i} \\ & + \beta_4 F\_CEO\_CHAIR_{t,i} + \beta_5 CEO\_TEN_{t,i} + \beta_6 SIZE + \beta_7 COMP_{t,i} \\ & + \beta_8 OPT\_GR_{t,i} + \beta_9 LOSS_{t,i} + \beta_{10} LEV_{t,i} + \beta_{11} RAISED\_CAPITAL_{t,i} \\ & + \beta_{12} BTM_{t,i} + \beta_{13} CROSS\_LISTING_{t,i} + \beta_{14} MILLS_{t,i} + \beta \Sigma(EXERCISE_{t,i}) \end{aligned} \tag{3}$$

where *i* indexes the firm and *t* the year. Results are reported in Table 6.

First, the inverse Mill's ratio is not significant in any of the models so it appears that there is no selection effect. Multicollinearity is always an issue in a two-stage Heckman correction and can sometimes cause falsely insignificant results. I test this by looking at the variance inflation factors for *MILLS* and they are all below five, the critical value suggested in Lennox et al. (2012).

Surprisingly, *FREE_FL* shows up significant and positive, indicating that firms with more dispersed ownership tend to engage in less underreporting. A possible explanation for the German market is provided by Leuz (2003). He argues that higher free float is an inverse proxy of insider presence and thus an inverse proxy of information asymmetries. In a similar vein, higher free float could signal lower managerial ownership and thus lower potential for rent extraction. This could also explain the negative sign on *INST_INV*, which could be a proxy not for a strong controlling shareholder, but an insider who does not have to rely on the same information as true outsiders. Thus both variables could capture an information asymmetry aspect.

LOSS has a likewise unexpected sign, although it is only marginally significant in only two regressions. After firms incur a loss they often experience an increase in the bid-ask spread (Eritmur 2004). So possibly they improve their reporting to avoid such an increase, which would also explain the positive coefficient on *LOSS* in model (2) (Table 5).

The other significant variables all have the expected signs. *BOARDSIZE* and *F_CEO_CHAIR*, both proxying for managerial power, are significant and negative in all three models, suggesting that powerful managers have a tendency to underreport their option grants. *BANKER* is significant and positive, pointing towards firms with a banker on the board underreporting less. The financial expertise that they possess is likely more closely linked to option valuation than to disclosure requirements of IFRS 2. It also underlines the importance of financial expertise as part of the governance systems.

Larger firms also seem to underreport less, as shown by the significant positive coefficient on *SIZE*. This supports previous findings that larger firms underreport less, probably because they are more likely to have specialized departments for such questions and are more in the public eye. The two variables capturing the extent of management pay, *COMP* and *OPT_GR*, are also both significant, and have a negative sign. This is in line with results from previous studies that

Table 6 Second stage Heckman: explaining underreporting

	(1a)	(2a)	(3a)
FREE_FL	0.0768*** (0.0014)	0.0816*** (0.0033)	0.0840*** (0.0014)
INST_INV	−0.1199*** (0.0062)	−0.1234*** (0.0081)	−0.1321*** (0.0027)
BOARDSIZE	−0.7601** (0.0340)	−0.7571** (0.0368)	−0.7920** (0.0306)
F_CEO_CHAIR	−2.3955** (0.0248)	−2.4328** (0.0265)	−3.4853** (0.0203)
CEO_TEN	−0.0579 (0.6713)	−0.0975 (0.5068)	−0.0287 (0.8310)
BANKER	3.5352* (0.0961)	3.4446* (0.0923)	3.2173* (0.0848)
SIZE	3.8952** (0.0132)	3.8735** (0.0147)	4.3901** (0.0108)
COMP	−2.3446** (0.0309)	−2.3318** (0.0319)	−2.8533** (0.0135)
OPT_GR	−1.4185* (0.0897)	−1.1061 (0.1503)	−1.4900* (0.0747)
LOSS	3.9266* (0.0691)	3.7292 (0.1145)	3.9327* (0.0738)
LEV	0.0098 (0.8237)	0.0203 (0.6939)	0.0538 (0.4080)
RAISED_CAPITAL	−0.7109 (0.2835)	−1.1698 (0.1324)	−0.7936 (0.2174)
BTM	0.1895 (0.6575)	0.3856 (0.5084)	0.1459 (0.7423)
CROSS_LISTING	0.9864 (0.2513)	0.6469 (0.5532)	0.5499 (0.5663)
MILLS	−0.7727 (0.5779)	−1.3153 (0.3619)	−1.0756 (0.4449)
COMB_GOAL			−1.6972* (0.0967)
Exercise dummies	Yes	Yes	Yes
Clustered SE	Yes	Yes	Yes
Year dummies	No	Yes	No
Pseudo-R^2	61.8	63.9	62.7
Observations	73	73	73

This table shows regression results for the second stage of the Heckman correction. The dependent variable is the underreporting ratio. Regressions (1a) through (3a) are pooled models corresponding to models (1) through (3) from Table 5. *FREE_FL* measures the percentage of shares not held by shareholders with an equity share exceeding 5%; *INST_INV* measures the percentage of shares held by institutional investors; *BOARDSIZE* is the number of people on the supervisory board; *F_CEO_CHAIR* is an indicator variable showing one if a former CEO is now chairperson of the board; *CEO_TEN* is the number of years the CEO has served in that position; *BANKER* is one if a banker has a seat on the board; *SIZE* is the natural log of total assets; *COMP* is the average total compensation of members of the executive board; *OPT_GR* is the total number of options granted in a year; *LOSS* is an indicator variable that is one if the firm has a negative net income in that year; *LEV* measures the market leverage defined total debt divided my market capitalization; *RAISED_CAPITAL* is an indicator variable that is one if the firm has raised external equity capital in that year; BTM is the book-to-market ratio; *CROSS_LISTING* is a dummy that is 1 if the firm is listed on a foreign stock exchange; $EXERCISE_i$ are dummy variables that take the value 1 if firm *i* models exercise behavior; *MILL'S* is the inverse Mill's ratio obtained from the first stage participation regression; *COMB_GOAL* is an indicator variable that is one if the ESO contain a combination of two different exercise conditions. *p*-values are given in parentheses and are based on standard errors clustered at the firm level

*, **, and ***Statistical significance at the 10%, 5%, and 1% level, respectively

managers may want to conceal excessive pay. Since *OPT_GR* was also significant on the first stage, it highlights the role incentives play in the German setting.

Finally, the coefficient on *COMB_GOAL* is significant and negative in model (3a), albeit only at the 10% level. This implies that firms with complex performance vesting conditions tend to underreport their ESO values more. Whether this is

Table 7 Explaining the choice of combined goals

	(4)		(5)		(6)	
	Coefficient	ME	Coefficient	ME	Coefficient	ME
FREE_FL	0.0109 (0.3136)	0.0027 (0.3054)	0.0105 (0.3240)	0.0026 (0.3168)	0.0106 (0.3246)	0.0027 (0.3175)
INST_INV	−0.0237* (0.0993)	−0.0060* (0.0972)	−0.0248 (0.1058)	−0.0062 (0.1016)	−0.0235 (0.1008)	−0.0059* (0.0995)
BOARDSIZE	−0.0871 (0.1614)	−0.0219 (0.1532)	−0.0874 (0.1665)	−0.0219 (0.1561)	−0.0841 (0.1769)	−0.0211 (0.1700)
F_CEO_CHAIR	−1.9173*** (0.0039)	−0.4824*** (0.0022)	−1.9692*** (0.0051)	−0.4924*** (0.0023)	−1.9197*** (0.0040)	−0.4827*** (0.0021)
CEO_TEN	0.1235*** (0.0020)	0.0311*** (0.0002)	0.1221*** (0.0019)	0.0305*** (0.0002)	0.1238*** (0.0020)	0.0311*** (0.0002)
BANKER	0.7367 (0.1211)	0.1853 (0.1169)	0.7542 (0.1304)	0.1886 (0.1221)	0.7584 (0.1378)	0.1907 (0.1307)
SIZE	0.6906** (0.0148)	0.1737** (0.0142)	0.7291** (0.0163)	0.1823** (0.0136)	0.6806** (0.0173)	0.1712** (0.0172)
COMP	−0.5269* (0.0981)	−0.1326* (0.0974)	−0.5387 (0.1244)	−0.1347 (0.1184)	−0.5285 (0.1004)	−0.1329* (0.0987)
OPT_GR	0.4290 (0.1542)	0.1079 (0.1724)	0.3797 (0.2378)	0.0950 (0.2579)	0.4220 (0.1664)	0.1061 (0.1859)
LOSS	−0.1458 (0.6782)	−0.0367 (0.6827)	−0.0327 (0.9390)	−0.0082 (0.9391)	−0.1421 (0.6841)	−0.0357 (0.6886)
LEV	0.0799** (0.0320)	0.0201** (0.0169)	0.0784** (0.0498)	0.0196** (0.0331)	0.0790** (0.0349)	0.0199** (0.0196)
RAISED_CAPITAL	−0.2072 (0.6856)	−0.0521 (0.6819)	−0.0863 (0.8367)	−0.0216 (0.8358)	−0.1798 (0.7020)	−0.0452 (0.6985)
BTM	−0.0376 (0.9035)	−0.0095 (0.9033)	−0.1369 (0.6963)	−0.0342 (0.6945)	−0.0473 (0.8799)	−0.0119 (0.8797)
CROSS_LISTING	−0.0785 (0.8811)	−0.0198 (0.8811)	−0.0252 (0.9652)	−0.0063 (0.9652)	−0.0540 (0.9229)	−0.0136 (0.9229)
TREND					0.0216 (0.8178)	0.0054 (0.8169)
Clustered SE	Yes		Yes		Yes	
Year dummies	No		Yes		No	
Pseudo-R^2	29.6		29.4		29.1	
Observations	106		106		106	

Table 7 (continued)

The table shows regression results for pooled probit and marginal effects models with *COMB_GOAL* as the dependent variable. *FREE_FL* measures the percentage of shares not held by shareholders with an equity share exceeding 5%; *INST_INV* measures the percentage of shares held by institutional investors; *BOARDSIZE* is the number of people on the supervisory board; *F_CEO_CHAIR* is an indicator variable showing one if a former CEO is now chairperson of the board; *CEO_TEN* is the number of years the CEO has served in that position; is one if a banker has a seat on the board; *SIZE* is the natural log of total assets; *COMP* is the average total compensation of members of the executive board; *OPT_GR* is the total number of options granted in a year; *LOSS* is an indicator variable that is one if the firm has a negative net income in that year; *LEV* measures the market leverage defined total debt divided my market capitalization; *RAISED_CAPITAL* is an indicator variable that is one if the firm has raised external equity capital in that year; *BTM* is the book-to-market ratio; *CROSS_LISTING* is a dummy that is 1 if the firm is listed on a foreign stock exchange; *TREND* is a simple time trend variable. *p*-values are given in parentheses and are based on standard errors clustered at the firm level. The marginal effects (ME) are based on mean values of the independent variables and *p*-values are based on standard errors calculated with the delta method

*, **, and ***Statistical significance at the 10%, 5%, and 1% level, respectively

caused by firms' inability to correctly value the options or by a deliberate attempt to make it harder for outsiders to reproduce the value is unclear. The fact that *COMP*, *OPT_GR*, and *F_CEO_C* are all significant and negative, could point to the latter explanation. To gain more insight, I run new pooled probit models with the same explanatory variable, but this time I use *COMB_GOAL* as the dependent variable. Results are presented in Table 7.

F_CEO_C is significant and negative in all models and has the greatest marginal effects. To the extent that combined goals really do pose more challenging targets, this could signal that former CEOs may want to protect their former colleagues on the management board from tougher targets. At the same time, *CEO_TEN* is significantly positive. This could support Abernethy et al.'s (2015) finding that powerful managers attach less stringent conditions to their ESO. Models (5) and (6) include year dummies and a time trend variable (*TREND*), respectively. Neither model indicates that there is a time dimension to the decision to adopt a combined goal. Given the proliferation of performance vesting, more research is clearly needed on the issue.

5.3.4 Performance-vesting robustness checks

To further analyze the effects of performance vesting, I change the definition of complex options, replacing the variable *COMB_GOAL*. First, I define only those options as complex (*COMPLEX*), where both vesting conditions have to be met (i.e., have an "and" connection), as the other types can be valued separately for each goal. Second, I define all options with actual vesting conditions as complex (*VESTING*), which only considers the out-of-the-money (premium) options as non-complex. They represent the only option type where the performance criterion does not lead to a more complex valuation. Results for the first and second stage Heckman models are presented in Table 8.

With *COMPLEX* is included, results are mostly robust. Interestingly the variable itself is positive and highly significant in the first stage, indicating that firms with more complex options have a higher tendency to provide full disclosure. On the second stage, the variable is negative (indicating greater underreporting), yet it is not significant (p-value of 0.1718). *VESTING*, on the other hand, is significant in both stages. This seems to suggest that firms that use performance vesting provide more disclosure, yet at the same time, underreport more. It is possible that they feel the added complexity allows them to adhere to the disclosure requirements, as the options are harder to value, even with full disclosure.

5.3.5 Further robustness checks

I submit my results to several more robustness tests and begin by estimating a random effects (RE) panel model to account for unobserved heterogeneity. This approach is not without caveats, though. The RE model requires that the effects be uncorrelated with the explanatory variables, which is likely not the case. Fixed effects, however, produce inconsistent estimates in binary choice models, especially if the sample size is small (Greene 2002). Thus, I opt for the RE estimator for the

Table 8 Complexity robustness

	(7) First stage	(7a) Second stage	(8) First stage	(8a) Second stage
FREE_FL	−0.0336*** (0.0032)	0.0186 (0.4874)	−0.0143 (0.2908)	0.0208 (0.4044)
INST_INV	0.0155 (0.1484)	−0.1027*** (0.0091)	0.0255** (0.0245)	−0.1129*** (0.0073)
BOARDSIZE	0.4742*** (0.0000)	−0.4010 (0.1373)	0.3797*** (0.0014)	−0.4880* (0.0992)
F_CEO_CHAIR	0.8623 (0.1598)	0.0729 (0.9441)	0.1676 (0.7959)	0.1008 (0.9263)
CEO_TEN	0.0185 (0.7959)	0.0543 (0.5895)	−0.0138 (0.8408)	0.0772 (0.4364)
BANKER	−0.7964 (0.1899)	3.1674** (0.0448)	−1.8493*** (0.0070)	4.4955** (0.0205)
SIZE	−0.3764*** (0.0001)	3.2175** (0.0317)	−0.7495*** (0.0000)	3.5366** (0.0299)
COMP	−0.3039 (0.4108)	−3.0893** (0.0155)	0.8150* (0.0904)	−3.8108** (0.0150)
OPT_GR	−1.7777*** (0.0000)	−1.9040* (0.0751)	−1.3970*** (0.0000)	−1.6551 (0.1247)
LOSS	1.5307** (0.0240)	4.0165 (0.1341)	0.9932 (0.3038)	3.7505 (0.1243)
LEV	1.2374** (0.0142)	−0.0832* (0.0506)	0.9315* (0.0903)	−0.0191 (0.6428)
RAISED_CAPITAL	−0.5216 (0.4929)	0.5504 (0.4529)	0.6790 (0.5133)	0.0996 (0.9121)
BTM	−0.3174 (0.6800)	0.5280 (0.3079)	1.1381 (0.1910)	−1.3645* (0.0825)
CROSS_LISTING	9.9647*** (0.0000)	0.9620 (0.2581)	7.5510*** (0.0000)	0.2436 (0.7779)
IFRS_EXP	3.8098*** (0.0003)		2.8261*** (0.0046)	
COMPLEX	1.8191*** (0.0070)	−1.0061 (0.1718)		
VESTING			4.4751*** (0.0041)	−9.6923*** (0.0060)
MILLS		−0.0141 (0.9916)		−3.8233** (0.0258)
Exercise dummies	Yes	Yes	Yes	Yes
Clustered SE	Yes	Yes	Yes	Yes
Pseudo-R^2	60.16	46.9	64.0	51.8
Observations	106	73	106	73

The table shows regression results for the first and second stage of the Heckman correction. The dependent variable in models (7) and (8) is the disclosure dummy and the underreporting ratio in models (7a) and (8a). *FREE_FL* measures the percentage of shares not held by shareholders with an equity share exceeding 5%; *INST_INV* measures the percentage of shares held by institutional investors; *BOARDSIZE* is the number of people on the supervisory board; *F_CEO_CHAIR* is a dummy variable that is one if a former CEO is now chairperson of the board; *CEO_TEN* is the number of years the CEO has served in that position; *BANKER* is one if a banker has a seat on the board; *SIZE* is the natural log of total assets; *COMP* is the average total compensation of members of the executive board; *OPT_GR* is the total number of options granted in a year; *LOSS* is an indicator variable that is one if the firm has a negative net income in that year; *LEV* measures the market leverage defined as total debt divided my market capitalization; *RAISED_CAPITAL* is an indicator variable that is one if the firm has raised external equity capital in that year; *BTM* is the book-to-market ratio; *CROSS_LISTING* is a dummy that is 1 if the firm is listed on a foreign stock exchange; *IFRS_EXP* is an indicator variable that is one if the firm has already prepared an IFRS annual report prior to the first application of IFRS 2; *COMPLEX* is a dummy that is one if the firm has two vesting conditions that have to be valued together; *VESTING* is a dummy that is one if the firm has a vesting condition that needs to be incorporated in the valuation; *MILL'S* is the inverse Mill's ratio *EXERCISE* are dummy variables that take the value 1 if firm *i* models exercise behavior. *p*-values are given in parentheses

*, **, and ***Statistical significance at the 10%, 5%, and 1% level, respectively

Heckman correction and in addition run the second stage with industry fixed effects. Results that are presented in Table 9, yet should be viewed with caution.

Results on the first stage are weaker, yet overall they support the pooled models. The *OPT_GR*, *IFRS_EXP* and *CROSS_LISTING* appear to be the main reasons for

Table 9 Panel estimation

	(9) First stage RE	(9a) Second stage RE	(10) Second stage FE
FREE_FL	−0.0056 (0.9214)	0.0737*** (0.0000)	0.0760* (0.0938)
INST_INV	0.0471 (0.3784)	−0.1102*** (0.0027)	−0.1248*** (0.0040)
BOARDSIZE	0.7604 (0.1132)	−0.7713** (0.0153)	−0.6350 (0.1482)
F_CEO_CHAIR	1.5916 (0.5579)	−2.8453*** (0.0086)	−3.9557** (0.0264)
CEO_TEN	0.2326 (0.5072)	−0.0524 (0.6609)	−0.0469 (0.7374)
BANKER	0.3372 (0.9119)	3.2149* (0.0953)	3.7205* (0.0638)
SIZE	−0.9714 (0.1209)	4.1186*** (0.0039)	4.7247** (0.0188)
COMP	0.9850 (0.4405)	−2.6551** (0.0155)	−2.6721** (0.0408)
OPT_GR	−3.8742** (0.0109)	−1.4752* (0.0503)	−1.4195** (0.0334)
LOSS	4.7774 (0.2099)	3.9494** (0.0432)	4.6159** (0.0357)
LEV	0.8357 (0.7012)	0.0132 (0.7489)	−0.0107 (0.8366)
RAISED_CAPITAL	−0.7650 (0.8200)	−0.6798 (0.1856)	−0.1025 (0.9107)
BTM	−1.1498 (0.6937)	0.2698 (0.4824)	1.0950* (0.0570)
CROSS_LISTING	21.0744** (0.0112)	0.7972 (0.3023)	0.3535 (0.6037)
IFRS_EXP	8.7801** (0.0166)		
MILLS		−1.8384*** (0.0005)	
Exercise dummies		Yes	Yes
RE/FE effects	Random effects	Random effects	Industry fixed effects
Clustered SE	Yes	Yes	Yes
Pseudo-R^2	24.8	59.7	64.0
Observations	106	73	73

The table shows panel data regression results for the first and second stage of the Heckman correction. The dependent variable in model (8) is the disclosure dummy and the underreporting ratio in model (9a) and (10). *FREE_FL* measures the percentage of shares not held by shareholders with an equity share exceeding 5%; *INST_INV* measures the percentage of shares held by institutional investors; *BOARDSIZE* is the number of people on the supervisory board; *F_CEO_CHAIR* is a dummy variable that is one if a former CEO is now chairperson of the board; *CEO_TEN* is the number of years the CEO has served in that position; *BANKER* is one if a banker has a seat on the board; *SIZE* is the natural log of total assets; *COMP* is the average total compensation of members of the executive board; *OPT_GR* is the total number of options granted in a year; *LOSS* is an indicator variable that is one if the firm has a negative net income in that year; *LEV* measures the market leverage defined total debt divided my market capitalization; *RAISED_CAPITAL* is an indicator variable that is one if the firm has raised external equity capital in that year; *BTM* is the book-to-market ratio; *CROSS_LISTING* is a dummy that is 1 if the firm is listed on a foreign stock exchange; *IFRS_EXP* is an indicator variable that is one if the firm has already prepared an IFRS annual report prior to the first application of IFRS 2; *EXERCISE* are dummy variables that take the value 1 if firm *i* models exercise behavior; *MILL'S* is the inverse Mill's ratio obtained from model (9). Models (9) and (9a) contain random effects; model (10) industry-fixed effects. *p*-values are given in parentheses

*, **, and ***Statistical significance at the 10%, 5%, and 1% level, respectively

the disclosure findings. On the second stage, results are virtually identical, with the exception that *MILLS* is now significant. Model (10) contains industry fixed effects and shows that the results for the second stage are virtually unchanged.

To make sure that my results are not driven by the underreporting outliers, I run the regressions again with the winsorized ratio described in Panel B in Table 4. Results[26] are virtually identical. Next, it is possible that the exercise dummies included in the second stage do not correctly capture the overestimation of the ESO values. Therefore, I repeat the regressions without those five firms and again, results are qualitatively the same. To better control for any time effects, I include a trend variable as in model (6) in the first and second stage, yet it is not significant. Next, I replace *BANKER* by *FIN_EXPERT* because of the unintuitive results on the first stage. The new variable also includes venture capitalists and private equity managers, who are arguably financial experts as well. Results remain unchanged.

As mentioned in Sect. 5.3.1 it is possible that *IFRS_EXP* is correlated with unobserved ability in the accounting department, which is related to greater proficiency at valuing options. In that case, the variable would not be a good exclusion restriction. I follow Hoi et al. (2013) and keep it in the second stage where it is insignificant, supporting the notion that it IFRS experience is not related to option valuations.

6 Conclusion

The analysis presented here is the first to investigate the ESO reporting behavior of German firms under IFRS 2. The evidence provides new insights into the effectiveness of the new standard and since the enforcement regime and corporate governance structures are similar to other (European) IFRS countries, the results can be of interest for other jurisdictions as well. Moreover, it is the first study to explicitly include performance vesting in a study on underreporting.

Disclosure on ESO is far from complete, yet in line with previous findings both on overall IFRS disclosure rates and disclosures concerning ESO in other countries. The main drivers seem to be inexperience with IFRS, limited capital market exposure, and incentives to hide higher pay. ESO expenses are material for German firms and underreporting of option values is significant in this sample. Regression results suggests that managers with larger option grants and higher pay have a tendency to bias ESO values downward, while larger firms with fewer information asymmetries appear to engage less in underreporting. Having a banker on the board, a common feature for German firms, also leads to a reduction in underreporting. This may point to the usefulness of having a person with financial expertise on the board when it comes to providing correct ESO values to the shareholders.

There is also evidence that firms that attach more complex performance conditions to their ESO have better disclosure, yet underreport more. With performance vesting becoming more and more important in countries such as the US and the UK, this finding should be interesting for shareholders and standard setters alike.

[26] All untabulated results described in this section are available upon request.

Moreover, the German institutional environment is comparable to that of many other IFRS countries in terms of enforcement and corporate governance strength. Therefore the overall results are likely not limited to German firms. One particular feature that is specific to the setting is the tendency of many firms to have a banker on the board. As the results show that such financial expertise seems to reduces underreporting, this could be something other firms or countries may want to emulate. Nonetheless, more research is certainly needed on the effects of performance vesting in ESO.

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