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ORIGINAL PAPER

Why do firms down-list or exit from securities markets?

Evidence from the German Stock Exchange

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Abstract
In 2003, the German Stock Exchange instituted the *Prime Standard* as the highest regulated stock market segment in Germany. We analyze the firms' delisting decisions from this market segment between 2003 and 2015, with a focus on different delisting reasons and firm characteristics. We identify 518 firms that listed on the *Prime Standard* at least once during the sample period of which 243 firms left this market segment. Of these firms, 107 down-listed and transferred to lower market segments and 136 firms exited the public equity market for the following reasons: 61 firms merged, 53 were insolvent, and 22 firms went private. Using cross-sectional and firm-fixed effects logit regressions, we provide new evidence for firms' market segment and delisting decisions. Consistent with a cost–benefit analysis, we observe that inferior growth opportunities, low stock liquidity, smaller firm size, poor operating performance, higher audit fees, and more agency conflicts increase the probability that firms opt for a less regulated stock market segment or voluntarily go private. This raises the important issue of securities market reforms that best meet firms and investors preferences.

Keywords Securities market organization · Capital market regulation · Delisting · Down-listing · Going private · Corporate governance

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1 Introduction

Motivated by the increasing number of publicly traded companies since the 1970s, corporate finance research has focused on the decision of firms to go public (IPO) and the consequences of being public.[1] During the last two decades, however, this trend started to reverse with declining numbers of initial public offerings and increasing records of delisting, resulting in a "listing gap", which emerged in the US about 25 years ago and in Germany since the global financial crisis (2008/2009). Jensen (1989) already referred very early to this phenomenon as the "eclipse of the public corporation", arguing that "takeovers, corporate breakups, divisional spin-offs, leveraged buyouts, and going-private transactions are the most visible manifestations of a massive organizational change in the economy". This research gained momentum in recent years with studies investigating this "listing gap" especially in the US, analyzing the determinants and consequences of listing dynamics (Doidge et al. 2017; Lattanzio et al. 2022; Eckbo and Lithell 2022). This includes a wide-ranging discussion of the benefits and costs of private versus public equity markets (Ewens and Farre-Mensa 2020, 2022).

All stock exchanges offer different market segments, allowing firms to choose from various alternatives with respect to listing requirements, regulations and market quality aspects (Jenkinson and Ramadorai 2013; Dang et al. 2018; Bernstein et al. 2020). Therefore, management has to decide when and where to list, when to change market segments (up- or down-listing) (Macey et al. 2008; Marosi and Massoud 2007; Leuz et al. 2008), and when to delist from public equity markets (Bharath and Dittmar 2010; Mehran and Peristiani 2010). As these decisions may depend on a number of factors, the listing or delisting decisions are a noisy indicator of firm behavior, so that a more detailed analysis of a firm's stock market segment decision might contribute to our understanding. Consequently, this study investigates firms' delisting from the German *Prime Standard* over the period 2003–2015 to gain insights into the firms listing and delisting behavior and the effects on stock market segment structures. In our delisting analysis, we distinguish between firms that transfer (down-list) to a lower market segment and firms that leave (exit) public equity markets completely. Exit reasons are mergers, insolvencies and voluntarily going private.

In 2003, Deutsche Börse re-organized its segments subsequent to the new economy period, aiming to implement EU regulatory changes to attract international investors and to deal with the closing of the *Neuer Markt*.[2] The *Prime Standard*

[1] For reviews, see Levis and Vismara (2013), Lowry et al. (2017) and Cumming and Johan (2019). For the German capital market, see Bessler and Book (2021) and Bessler and Schmidt (2022).

[2] For a discussion of the closing of the *Neuer Markt* segment and firms' segment transfer decisions, see Schiereck and Hartmann (2006) and Bessler and Schneck (2016). For a summary of additional research on the *Neuer Markt,* see Bessler and Schmidt (2022) and the references cited therein.

segment is one of the most regulated stock market segment in Germany and has one of the highest requirements and transparency standards in Europe. Moreover, a listing in this segment was a prerequisite for inclusion in the blue-chip selection index DAX.[3] Other segments with less requirements are the *General Standard*, the *Entry Standard* (2005–2017) and *Scale* (since 2017). These segments have fewer transparency obligations, and compared to the *Prime Standard* do not require quarterly financial reports, analyst conferences and an up-to-date corporate calendar, and no simultaneous disclosure and ad-hoc notifications in English and German. The *Online Appendix,* Section A.1 provides more details about the different listing requirements.

We identify 518 distinct German firms, which listed on the *Prime Standard* segment at least once between 2003 and 2015. In January 2003, 329 firms listed in the *Prime Standard* segment but this number declined to 286 at the end of our sample period (see Figure A.1, *Online Appendix*). Despite this relatively small decline in the number of overall listed firms, 243 firms left the segment, while 200 firms entered it during our sample period, suggesting some high listing and delisting activity. One explanation for the down-listing decision is that greater transparency and more disclosure is costly (Leuz and Wysocki 2016; Iliev 2010). This make it less attractive for firms to stay in the highest regulated market segment or even on public markets at all (Berninger et al. 2018; Engelen et al. 2020), especially when no further equity financing is required.

Consistent with such a perspective, we document that 243 of our 518 sample firms have delisted from the *Prime Standard* segment over the sample period. Table 1 documents the yearly statistics and reports the total number of listings, the new listings, down-listings, going privates and other exit reasons, as well as the net effect. The only years with positive net listings in our sample period were 2005–2007 and 2011. The number of listed firms peaked at the end of 2007 at 360, just before the beginning of the global financial crisis and has declined since then. Differentiating between delisting reasons, we find 107 transfers to lower market segments and 136 exits from public equity markets, of which were 61 acquisitions, 53 insolvencies, and 22 firms went private.

In this study, we analyze the phenomenon of firms delisting from the *Prime Standard* in more detail. Since the transfer to a lower segment is the most important reason for the departure from the *Prime Standard*, we focus in our analysis on these firms. Based on cost–benefit arguments, we derive testable hypotheses arguing that firms with low growth opportunities, with weak stock liquidity, smaller firms, and poorly performing firms are more likely to down-list from the highly regulated market segment. From a corporate governance perspective, we expect firms faced with higher regulatory costs and specific types of controlling shareholders to have a higher probability of migrating to a lower segment.[4]

[3] Since March 2021, a listing in the Regulated Market (*Prime* or *General Standard*) is sufficient to become eligible for the DAX selection indices.

[4] For a detailed empirical analysis on the effects of the global financial crisis and family ownership on migrations from the *Prime Standard* to less regulated market segments, see Bessler et al. (2021).

Table 1 Development of listings in Prime Standard segment over time

	Total	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Prime standard firms at beginning of the year		329	324	306	320	338	360	359	326	313	317	306	292	290
Prime standard firms at end of the year		324	306	320	338	360	359	326	313	317	306	292	290	286
Entries during the year	200	6	10	27	37	33	12	6	6	16	10	12	10	15
Delistings during the year	243	11	28	13	19	11	13	39	19	12	21	26	12	19
Down-listings	107	6	12	5	14	2	5	22	7	8	9	10	3	4
…to General Standard	79	6	12	5	13	2	5	16	4	6	4	2	2	2
…to Entry Standard	19							4		2	4	6	1	2
…to m:access	9				1			2	3		1	2		
Exits	136	5	16	8	5	9	8	17	12	4	12	16	9	15
…due to going private	22	0	1	1	0	1	1	3	2	0	2	3	2	6
…due to acquisition	61	2	9	3	4	6	2	9	6	2	4	7	4	3
…due to insolvency	53	3	6	4	1	2	5	5	4	2	6	6	3	6
Net effect	− 43	− 5	− 18	14	18	22	− 1	− 33	− 13	4	− 11	− 14	− 2	− 4

The table reports the number of listed firms, entries and delistings in the *Prime Standard* over the period from 2003 to 2015. The delistings are divided into different reasons: (1) firms down-listing, (2) firms voluntarily delisting their shares from the public market (going private), (3) firms being acquired and (4) firms that filed for insolvency. We also report the net listing effect as difference between entries and exits in a given year

We begin with a descriptive analysis and then use logistic regressions to examine whether delisting firms reveal some specific characteristics. Thereby, we distinguish between different delisting reasons and focus on firms that opt for either changing to a lower market segment (down-list) or going private. We call this decision 'going opaque', because it significantly decreases the transparency standards of firms. Our research contributes to the existing literature along several dimensions. *First*, we highlight tendencies of firms to delist from the *Prime Standard* segment. *Second*, we provide empirical evidence that certain firm characteristics determine the probability of a delisting. Specifically, we identify growth opportunities, liquidity, firm size, and profitability as main determinants for these down-listing firms.

Interestingly, most firms list initially on the *Prime Standard* to signal their quality and commitment to higher transparency standards to investors, although a lower market segment might fit their preferences much better. Therefore, they migrate to a less regulated stock market segments later on as these initial listing rules become too costly. However, often they do not leave the public equity market completely. This appears to be a unique episode subsequent to the closing of the *Neuer Markt* market segment in 2003. Most other exchanges in Europe, such as OMX/Nasdaq and Euronext offer firms the opportunity to list first at a lower market segment and subsequently up-list to higher regulated market segments when they become larger, more profitable and are better able to cope with more demanding regulations. Deutsche Börse adjusted their segment structure by introducing Scale in March 2017, which should function as an entry-level market segment.

We organize the rest of our paper as follows. Section 2 develops our hypotheses. Section 3 describes the sample construction, composition and development. Moreover, this section includes the descriptive analysis of firm characteristics. Section 4 provides the results of our empirical analysis of delistings from the *Prime Standard* and Sect. 5 includes our discussion of these results. Section 6 concludes.

2 Hypothesis development

The firms' decision to list on a specific stock market segment should be the result of different aspects but most importantly of cost–benefit analyses.[5] The potential benefits of opting for a listing in a more regulated market segment are higher stock liquidity, increased visibility and usually higher firm valuation, which is a prerequisite for issuing new equity at attractive terms. Indeed, access to additional equity is

[5] The number of firms in a particular market segment reflects three determinants: *First*, the number of firms entering the segment; *second*, the proportion of firms surviving, and; *third*, the number of firms leaving the segment. While there is an extensive literature on IPO activity (first determinant) and firm survival (second determinant), we are mostly interested in the firms leaving a market segment (third determinant). In the latter case, we can further differentiate between firms that voluntarily opt for a lower market segment (down-list), or may exit the segment to go private. Acquisitions and insolvencies are other exit reasons. We are particularly interested in the firms' voluntary decision to down-list or go private. For excellent literature reviews on the determinants and consequences of delisting, see Fidanza et al. (2018) as well as Martinez and Serve (2017).

often the major argument for a public listing. This is especially true for high-growth companies with substantial investment opportunities but financial constraints (Kim and Weisbach 2008). In contrast, firms with a lack of growth opportunities and lower public equity needs or with access to alternative financing sources such as private equity have a higher probability of staying private or of going private again after some time of being public. Consistent with this notion, Lehn and Poulsen (1989) and Doidge et al. (2017) document a negative relationship between sales and asset growth and delistings of US firms. There also exists a negative relationship between the market-to-book ratio or Tobin's Q and the probability to delist from European public markets (Kashefi Pour and Lasfer 2013; Thomsen and Vinten 2014). Firms might actively reconsider their segment choice if investors have less confidence in the firm's growth opportunities, resulting in lower firm valuations. Consequently, our first hypothesis states:

H1: Firms with *low* market valuation (Tobins Q) have a *higher* probability to transfer to a lower market segment.

Firms also go and stay public to benefit from trading on an organized securities market. Bharath and Dittmar (2010), Mehran and Peristiani (2010) and Martinez and Serve (2011) document that firms with higher liquidity (trading volume) have a lower probability to go private. An additional argument for an upper market segment is 'visibility', i.e. higher attractiveness for institutional investors, analysts, talented employees as well as customers and suppliers (Bancel and Mittoo 2009).[6] When these benefits decrease over the life cycle of a firm or do not materialize as expected, the firm is more likely to delist from the market segment. Therefore, we formulate our second hypothesis as follows:

H2: Firms with *low* stock liquidity (Turnover by Volume) have a *higher* probability to transfer to a lower market segment.

In contrast, the potential drawback of opting for listing in a higher regulated market segment are direct and indirect listing costs due to compliance requirements. For instance, Marosi and Massoud (2007) and Leuz et al. (2008) report that the introduction of the Sarbanes–Oxley Act (SOX) in the US in 2002 significantly increased the probability of firms transferring to the over-the-counter market (OTC market). Moreover, Thomsen and Vinten (2014) find for Europe that the higher investor protection and the adoption of stricter corporate governance codes increased the probability of delisting.[7] Consequently, smaller firms might have a higher propensity to

[6] For Europe, Achleitner et al. (2013) as well as Thomsen and Vinten (2014) argue that a listing increases the visibility of firms. More specifically, Bharath and Dittmar (2010) and Mehran and Peristiani (2010) find that firms with higher financial visibility (i.e. more analyst coverage, higher institutional ownership, and higher trading volume) are less likely to go private in the US.

[7] Moreover, Cumming et al. (2018) find that the probability for going private is higher in countries with better creditor and poorer shareholder rights. The latter is consistent with Espenlaub et al. (2016), who document that in countries with better investor protection, IPOs remain listed for a longer period. Andres et al. (2007) find higher abnormal returns for European LBO-transactions in countries with weak investor protection.

revisit their segment choice, as listing requirements are uniform and listing costs are relatively more burdensome for them. Empirical evidence supporting the size effects is provided by Bharath and Dittmar (2010) and Mehran and Peristiani (2010) for the US, Thomsen and Vinten (2014) for Europe as well as Aslan and Kumar (2011) and Kashefi Pour and Lasfer (2013) for the UK. Thus, we hypothesize:

H3: *Smaller* firms have a *higher* probability to transfer to a lower market segment.

Poorly performing firms as measured by operating performance (profitability) might reconsider their segment choice to lower the explicit and implicit listing costs.[8] Moreover, they often do not attract enough investors to justify their listing and trading in a higher market segment. In addition, low share prices expedite the segment migration, as shares are more easily bought back to gain sufficient voting support for this decision. Consequently, we conjecture in our fourth hypothesis:

H4: *Low* performing firms have a *higher* probability to transfer to a lower market segment.

Firms might also react to increasingly stringent regulation for publicly listed firms. The experience from the reforms in the US suggest that increased compliance costs results in more firms going dark (Marosi and Massoud 2007; Leuz et al. 2008) and going privates (Engel et al. 2007). In contrast, reducing certain requirements such as the introduction of the JOBS Act in the US in 2012 (Dambra et al. 2015), encouraged firms to go public especially in the Biotechnology industry (Lewis and White 2021). In addition, newly publicly listed firms when faced with lower regulatory burdens invested more in innovation after going public (Dambra and Gustafson 2021). Several initiatives to align the German corporate governance system better with international standards have significantly changed the regulatory environment immediately before and during the sample period.[9] One potential response for escaping these additional burdens is to delist from a market segment, such as down-listing to lower market segments or going private (Berninger et al. 2018) or dark.[10] Therefore, we postulate the following fifth hypothesis:

[8] Agency problems due to large free cash flows or misaligned incentive structures between the management and shareholders might also contribute to this decision. Many US studies test the free-cash-flow hypothesis and find a positive relationship between free cash flows and the delisting probability (Lehn and Poulsen 1989; Opler and Titman 1993; Leuz et al. 2008; Bharath and Dittmar 2010). In contrast, some European studies do not find supporting evidence for this hypothesis, suggesting that this issue is less important for delisting (Weir et al. 2005; Renneboog et al. 2007; Achleitner et al. 2013) but is more important for other financial decision. For Germany, Bessler et al. (2014) and Bessler et al. (2016) report that IPOs and established companies use their cash holdings or operating profits, respectively, for increasing dividends and share repurchases to minimize the agency costs of free cash flows.

[9] Rapp and Strenger (2015) and Bessler and Drobetz (2015) provide discussions of the changes in the German corporate governance system and in financing behaviour, respectively, since the 1990s.

[10] In this type of transaction, firms switch to the over-the-counter market (OTC market) and de-register with the regulatory authorities, and therefore terminate public reporting completely ("going dark"). For a detailed analysis of going dark in the US, see Macey et al. (2008), Leuz et al. (2008), and Marosi and Massoud (2007). They also provide evidence that transferring to a lower market segment may not only imply costs but also offer benefits for some firms, such as an increase in liquidity. Therefore, it is important for firms to list in an adequate segment, given their characteristics and investor demands.

H5: *Higher* costs from capital market or corporate governance regulations *increase* the probability that a firm will transfer to a lower market segment.

Finally, the ownership structure and potential agency conflicts arising from the separation of ownership and control are also important for the firm's segment decision. The incentives of larger shareholders to monitor the management and to extract private benefits of control determine the probability of going private (Achleitner et al. 2013). More specifically, the effects of these mechanisms depend on the types of controlling shareholders. For institutional and corporate investors, concentrated ownership in public firms is associated with high monitoring costs and the decline of managerial incentives, both increasing the probability of going private (Cumming et al. 2018). Families decrease potential agency costs due to the unity of ownership and control, while the potential for extracting private benefits of control is higher in family firms, reducing the probability of going private (Achleitner et al. 2013; Cumming et al. 2018). This leads to our sixth hypothesis:

H6: Firms with a *corporation (founding family)* as controlling shareholder have a *higher (lower)* probability to transfer to a lower market segment.

3 Data and sample description

In this section, we explain our sample construction (Sect. 3.1) and provide details about the number of *Prime Standard* listings over time (Sect. 3.2) as well as some descriptive statistics (Sect. 3.3).

3.1 Sample construction

As we are interested in *Prime Standard* listings and delistings, we construct a novel hand-collected data set of all German firms traded at the *Prime Standard* of Deutsche Börse at least once between 2003 and 2015. Our analysis starts in January 2003, when the German Stock Exchange initiated a market re-segmentation subsequent to the new economy period.[11] We provide a detailed description of the listing requirements at Deutsche Börse after 2003 in the *Online Appendix,* Section A.1, Table A.1.

[11] This re-segmentation resulted in four different market segments at Deutsche Börse. The legally defined *Amtlicher Markt* and *Geregelter Markt,* each with the Deutsche Börse-specific segments *Prime Standard* and *General Standard*. During the re-segmentation process, the exchange also closed the *Neuer Markt* segment, which had opened in 1997. Firms that still listed at the *Neuer Markt*, had either to transfer to the higher-ranked *Prime Standard* or to the lower-ranked *General Standard*, either before or at the closing (Schiereck and Hartmann 2006; Bessler and Schneck 2016). This re-segmentation process included adjustments of the DAX indices in March 2003, and the introduction of the TecDAX.

Our data construction starts with the "Prime All Share Index" constituent lists from Deutsche Börse. These files report all (equity) securities issued by companies admitted to the *Prime Standard*. This provides us with 617 individual firms listed at least once in this segment during the sample period. After identifying the corresponding issuers (i.e. excluding "double counts" of firms with two types of listed equity securities[12]) and excluding foreign issuers (identified by Non-German ISINs), we end up with a final sample of 518 firms and 5,527 firm-year observations.

For these firms, we collect three types of data. *First*, we gather accounting and stock market data from Refinitiv's Worldscope database and other sources.[13] *Second*, we collect detailed information on the listing history of our sample firms to track their listing status at each point in time during the sample period. Therefore, we hand-collected information on listing and delisting decisions using several public sources such as ad-hoc announcements, annual reports, press articles and official notifications by Deutsche Börse. For 243 of our 518 sample firms, we are able to identify an event where a company previously listed in the *Prime Standard* delisted from this market segment during our sample period.

We classify all "delisting events" according to their delisting reason and assign them to one of two main categories: *First*, "down-lisiting" or "segment change", when the firm transfers to another (less regulated) listing segment.[14] *Second*, "going private" when the firm leaves the stock exchange because of voluntarily delisting. Other exit reasons are "mergers & acquisitions" when the firm is acquired or merged and "insolvencies" when the firm files for insolvency and disappears from the *Prime Standard*.

3.2 Sample composition and flows

In Table 1, we present the number of firms listed at the *Prime Standard*, entrants and delistings, and the net effect on a yearly basis. In Fig. 1, we report cumulated figures for new listings over time. Starting with 329 firms, 200 firms entered the *Prime Standard,* from which 95 firms has a public offering (IPO), 10 firms listed without offering new shares neither publicly nor privately (introductions or listings), 15 firms up-listed from lower market segments, 3 firms cross-listed from foreign

[12] This applies to 28 issuers, i.e. companies with dual-class shares, for which we kept the most-liquid share class in the sample and deleted the other one. Prominent examples are Volkswagen, BMW, and RWE with their preferred stocks ("Vorzugsaktien") and their common stocks ("Stammaktien"). In June 2002, Deutsche Börse attuned its index policy by making dual-class shares structures less attractive, resulting in a significant increase in voluntary share-class unifications (Betzer et al. 2017). However, Deutsche Börse recently started lobbying for the introduction of dual-class shares in Germany (Bessler and Book 2021). For an empirical study of the changing role of dual-class shares in Europe, see Bessler and Vendrasco (2022).

[13] While we are able to identify 512 of our sample firms in Worldscope, we compile information for the remaining firms from other sources (e.g. annual reports and company reports obtained from the German "*Bundesanzeiger"*).

[14] Typically, firms switching to a less regulated market segment end up in the *General Standard* or *Entry Standard* at Deutsche Börse or at the *m:access* at the Munich Stock Exchange.

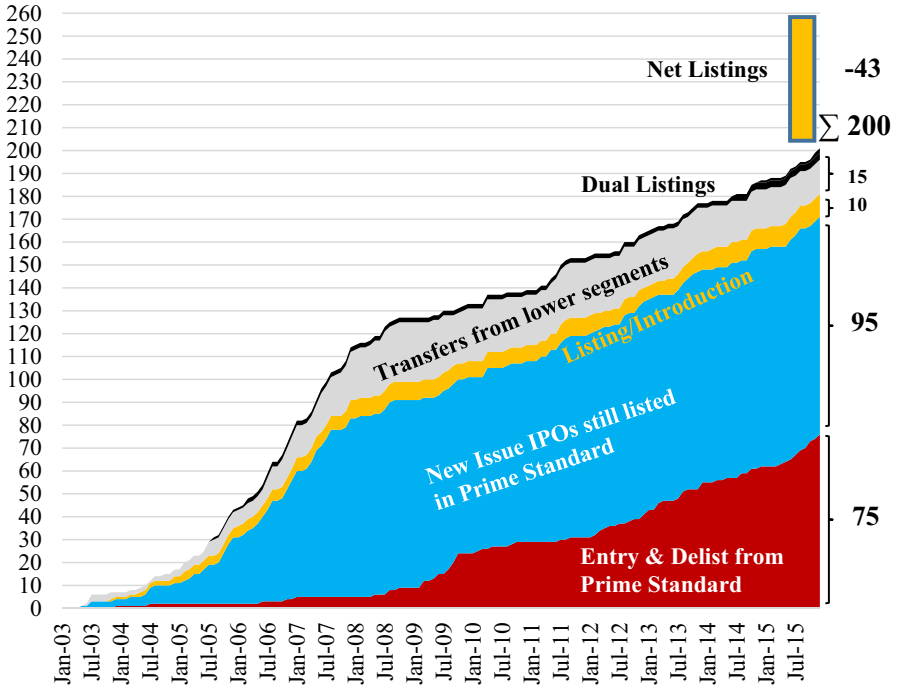

Fig. 1 Entries to Prime Standard by type from 2003 to 2015 (cumulated). The figure illustrates month-by-month the cumulated number of entries in the *Prime Standard* over the period from 2003 to 2015. They are divided into different types: (1) firms that had entered and already left the *Prime Standard*, (2) firms going public and issuing new shares that are still listed in the *Prime Standard*, (3) firms listing their shares without offering new shares neither publicly nor privately (introduction or listing), (4) firms that transferred from a lower market segment into the *Prime Standard* (up-listing), (5) firms that are still listed at another exchange (dual-list) or going public through a private placement (5 firms)

exchanges, and 2 firms used private placements. Interestingly, even within the cohort of firms that went public at the *Prime Standard* during our sample period, 75 have already left this market segment. The *Online Appendix* provides additional details on these firms (Section A.2).

With respect to delisting reasons, we observe 107 firms changing to less regulated market segments, 61 mergers and acquisitions, 53 filings for insolvency, and 22 going private transactions. In Fig. 2, we present the cumulated number of delisting firms differentiated by segment changes and the other exit reasons.

Despite the 200 entrants, 2005–2007 and 2011 are the only years in our sample period where the number of listed firms increases, i.e. we observe a positive net listing effect. As a result, the number of *Prime Standard* listings peaked in 2007 with a maximum of 360 firms. Overall, changing to a lower market segment is the primary reason for firms to down-list from the *Prime Standard*. Therefore, we focus in our analysis on these 107 firms that down-listed and transferred to a less regulated stock market segment and on the 22 firms that went private.

3.3 Descriptive analysis of firm characteristics

We collect market and accounting information for all 518 firms from Refinitiv Datastream. To obtain insights into the characteristics of firms leaving the public equity market, we investigate the firm size (*Size*), firm valuation (*Tobins Q*), profitability (*Return on Assets*), capital structure (*Leverage*), financing behavior (*Equity Issuance*), age of the firm (*Firm Age)*, stock liquidity (*Turnover by Volume*), and listing costs (*Audit Fees)*. *Size* is the log of total assets in 1000 EUR, *Tobins Q* is defined as the book value of total assets plus the market value of equity minus the book value of equity, deflated by the book value of total assets. *Return on Assets* (ROA) is net income scaled by total assets. *Leverage* is defined as total debt divided by total assets and *Equity Issuance* as a firm's net equity issuance scaled by total assets. *Firm Age* is the log of the current year *t* minus the founding year of a company. *Turnover by Volume* is the log of the average number of shares traded and *Audit Fees* are the log of fees paid for auditing services in 1000 EUR. In Table 2, we summarize the data sources and definition of all variables.

In Table 3, we provide comparative descriptive statistics. Panel A presents the comparison of our main variables for firms that delist from the *Prime Standard* and firms that stay listed during our sample period. Firms that leave the *Prime Standard* are, on average, smaller (11.54) than firms that stay in the highest listing segment (12.67). The difference in the average size is significant at the 1% level. The comparison of operating performance, in terms of *Return on Assets*, suggests that segment changing firms (− 9.50%) are on average less profitable than firms that stay listed in the *Prime Standard* (− 2.00%). Furthermore, firms that delist from the *Prime Standard* issue less equity (1.20% vs. 2.50%) and do have a significantly lower stock liquidity (*Turnover by Volume*), on average (5.46 vs. 6.60). A comparison of the median values confirms these results. With respect to the valuation measured by *Tobins Q* and *Leverage*, we do not find any differences between firms that stay or abandon the *Prime Standard*.

Panel B provides the differences for firms that migrate from the *Prime Standard* to a lower regulated segment such as the *General Standard* or *Entry Standard*. Segment changing firms have a lower market valuation (median) in terms of *Tobins Q* (1.10 vs 1.21), with statistical significance at the 5% level. These firms are also smaller (11.15 vs. 12.67), and, on average, less profitable (− 11.90% vs. − 2.00%). Interestingly, these firms do have a lower stock market liquidity in terms of their turnover volume (5.60 vs. 6.60). Firms that delist from the *Prime Standard* due to being acquired do have, on average, a significantly lower market liquidity than firms that stay listed in the *Prime Standard* (4.73 vs. 6.60) (Panel C). For all other variables, we do not find any significant difference.

When comparing insolvent firms with those staying in the *Prime Standard,* we observe that these firms, on average, issue less equity (0.00% vs. 2.50%) (Panel D). However, differences in the remaining variables are insignificant. In Panel E, we compare firms that voluntarily delist from the *Prime Standard* with those that stay listed and find that they are, on average, more profitable (7.50% vs. − 2.00%) but have lower stock market liquidity (median) (6.64 vs. 6.66).

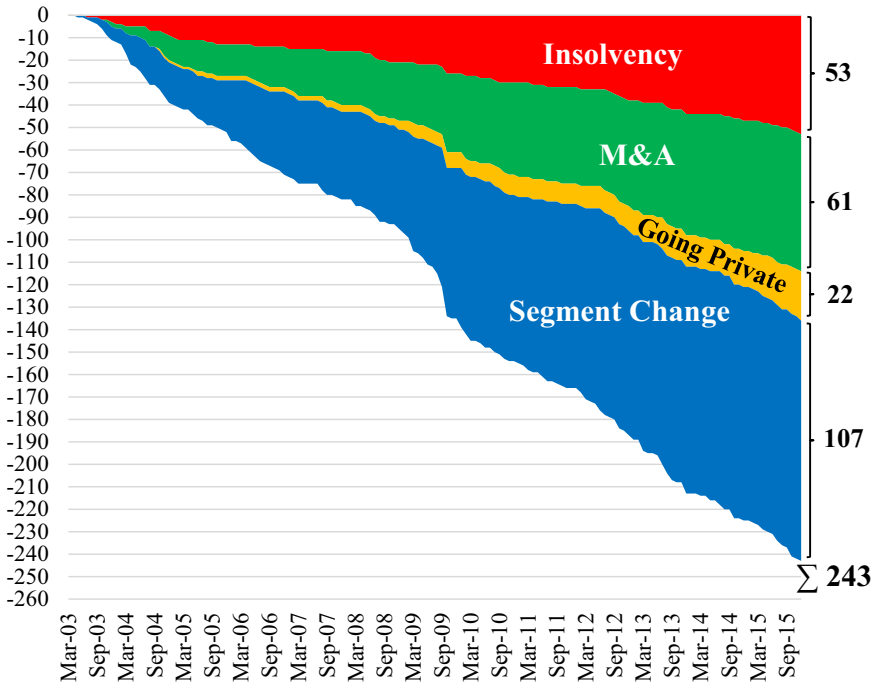

Fig. 2 Delistings from Prime Standard by reason from 2003 to 2015 (cumulated). The figure illustrates month-by-month the cumulated number of delistings from the *Prime Standard* over the period from 2003 to 2015. They are divided into different reasons to exit: (1) firms changing to a lower market segment, (2) firms voluntarily delisting their shares from the public market (going private), (3) firms being acquired and (4) firms that filed for insolvency

4 Empirical analysis

In this section, we present our empirical findings. Section 4.1 begins with a detailed description of the methodology. In Sect. 4.2, we report the results of our logistic regressions to determine the probability of leaving the *Prime Standard*. Section 4.3 distinguishes between various reasons for delisting from the segment. Finally, we provide some robustness tests for our results in Sect. 4.4.

4.1 Methodology

We proceed in three steps to test our hypotheses explaining the probability that a firm leaves the *Prime Standard*. *First*, we apply a 'pooled' cross-sectional logit model (with industry and time fixed effects) to measure how firm characteristics correlate with the delisting decision and estimate the following model:

Table 2 Variable definitions

Variable	Description and construction	Data source
Tobins Q	Total assets plus the market value of equity minus the book value of equity divided by total assets.	Refinitiv Worldscope/Authors' Calculation
Size	Total assets of a firm in EUR 1,000, logarithmized.	Refinitiv Worldscope/Authors' Calculation
Return on assets	Net income relative to total assets.	Refinitiv Worldscope/Authors' Calculation
Leverage	Total debt relative to total assets.	Refinitiv Worldscope/Authors' Calculation
Equity issuance	Net proceeds a company receives from the issue of common and preferred stock relative to total assets.	Refinitiv Worldscope/Authors' Calculation
Firm age	Difference between current year and the founding year of a company, logarithmized.	Refinitiv Worldscope/Authors' Calculation
Turnover by volume	Average number of shares traded over a year, logarithmized.	Refinitiv Worldscope/Authors' Calculation
Free float	The percentage of total shares that is available to ordinary investors, which is the total number of shares less holdings of 5% or more.	Refinitiv Datastream/Authors' Calculation
Audit fees	Amount of fees paid for auditing services in EUR 1,000, logarithmized.	Refinitiv Datastream ASSET 4 ESG/Annual Reports
Founding family	Dummy variable that is one if a founding family holds more than 25% of the voting rights, zero otherwise.	Hoppenstedt Aktienführer/Authors' Calculation
Financial investor	Dummy variable that is one if a financial investor holds more than 25% of the voting rights, zero otherwise.	Hoppenstedt Aktienführer/Authors' Calculation
Bank	Dummy variable that is one if a bank holds more than 25% of the voting rights, zero otherwise.	Hoppenstedt Aktienführer/Authors' Calculation
Corporation	Dummy variable that is one if a corporation holds more than 25% of the voting rights, zero otherwise.	Hoppenstedt Aktienführer/Authors' Calculation
Government	Dummy variable that is one if a government holds more than 25% of the voting rights, zero otherwise.	Hoppenstedt Aktienführer/Authors' Calculation

The table presents the definitions, calculations, and data sources of the used variables in our analysis

Table 3 Descriptive statistics

Panel A: Firm characteristics of firm delistings

Variable	Delisting firms		Staying firms		Difference in	
	Mean	Median	Mean	Median	Mean	Median
Tobins Q	1.518	1.219	1.531	1.213	− 0.013	0.006
Size	11.536	11.190	12.670	12.196	− 1.134***	− 1.006***
Return on assets	− 0.095	− 0.012	− 0.020	0.026	− 0.075**	− 0.038***
Leverage	0.196	0.117	0.210	0.166	− 0.014	− 0.049*
Equity issuance	0.012	0.000	0.025	0.000	− 0.013**	0.000***
Turnover by volume	5.464	5.447	6.604	6.662	− 1.140***	− 1.215***

Panel B: Firm characteristics of down-listings

Variable	Delisting firms		Staying firms		Difference in	
	Mean	Median	Mean	Median	Mean	Median
Tobins Q	1.353	1.101	1.531	1.213	− 0.182*	− 0.113**
Size	11.145	10.705	12.670	12.196	− 1.526***	− 1.491**
Return on assets	− 0.119	− 0.030	− 0.020	0.026	− 0.100***	− 0.056**
Leverage	0.207	0.122	0.210	0.166	− 0.003	− 0.044**
Equityissuance	0.013	0.000	0.025	0.000	− 0.0118*	0.000***
Turnover by volume	5.595	5.504	6.604	6.662	− 1.000***	− 1.15**

Table 3 (continued)

Panel C: Firm characteristics of mergers

Variable	M&A firms		Staying firms		Difference in	
	Mean	Median	Mean	Median	Mean	Median
Tobins Q	2.116	1.211	1.531	1.213	0.587*	0.488
Size	12.657	12.168	12.670	12.196	0.015	0.885*
Return on assets	− 0.045	0.026	− 0.020	0.026	− 0.024	− 0.042
Leverage	0.15	0.165	0.210	0.166	− 0.060	− 0.115*
Equity issuance	0.007	0.000	0.025	0.000	− 0.018*	0.000**
Turnover by volume	4.734	6.647	6.604	6.662	− 1.850***	− 1.750**

Panel D: Firm characteristics of insolvencies

Variable	Insolvent firms		Staying firms		Difference in	
	Mean	Median	Mean	Median	Mean	Median
Tobins Q	2.13	1.738	1.531	1.213	0.600	0.525***
Size	10.572	11.189	12.670	12.196	− 2.073*	− 0.984
Return on assets	− 0.517	− 0.578	− 0.020	0.026	− 0.497	− 0.604*
Leverage	0.436	0.432	0.210	0.166	− 0.227	0.267
Equity issuance	0.000	0.000	0.025	0.000	− 0.025***	0.000***
Turnover by volume	8.111	8.600	6.604	6.662	1.537	1.962***

Table 3 (continued)

Panel E: Firm characteristics of going privates

Variable	Going priv. firms		Staying firms		Difference in	
	Mean	Median	Mean	Median	Mean	Median
Tobins Q	1.856	1.213	1.531	1.213	0.325	0.198
Size	13.199	12.168	12.670	12.196	0.557	0.051
Return on assets	0.075	0.026	− 0.020	0.026	0.096**	0.016*
Leverage	0.186	0.165	0.210	0.166	− 0.023	− 0.096
Equity issuance	0.009	0.000	0.025	0.000	− 0.016*	0.000*
Turnover by volume	5.962	6.639	6.604	6.662	− 0.616	− 0.120**

The table presents the descriptive statistics for the main variables for each type of firm exit. The sample consists of 5527 firm-year observations of German firms over the period from 2003 to 2015

*,**,*** indicate significance at the 0.10, 0.05, and 0.01 level, respectively

$$\begin{aligned} FirmDelisting_{i,t} = {} & \beta_1 TobinsQ_{i,t-1} + \beta_2 Size_{i,t-1} \\ & + \beta_3 RoA_{i,t-1} + \beta_4 Leverage_{i,t-1} + \beta_5 FirmAge_{i,t-1} \\ & + \beta_6 TurnoverbyVolume_{i,t-1} + \beta_7 EquityIssuance_{i,t-1} \\ & + \beta_8 AuditFees_{i,t-1} + \varepsilon_{i,t} \end{aligned} \tag{1}$$

All variables we defined above and in Table 2. This model estimates the average ceteris paribus cross-sectional correlation between explanatory variables and the probability of a delisting decision. In our baseline analysis, the dependent variable $FirmDelisting_{i,t}$ is a dummy variable that is equal to one in the year of the delisting event, and zero otherwise. As audited data is often not available, even in the two years prior to the event, we exclude insolvencies from the regression analysis. We use the firms that stay listed in the *Prime Standard* as control group.

Based on our hypotheses and the literature, we employ several firm-specific balance sheet ratios and capital market indicators as explanatory variables. To control for a firm's ability and need to access the public market for raising additional equity, we derive its market valuation and growth opportunities by including *TobinsQ*. In addition, we employ *EquityIssuance* as direct proxy for the financing behavior. Since listing requirements are uniform for all firms, the listing costs are relatively higher for smaller firms, which we account for by using our *Size* variable. We also include the return on assets (*RoA*) in the model, as a premium listing may become too costly for less profitable firms. To control for the heterogeneity in capital structures, we use *Leverage*. Since the listing benefits are also conditional on the firm's stage in their life cycle, our model incorporates *FirmAge*. We assess the benefits of trading on an organized stock markets using the *TurnoverbyVolume* as proxy for investor's interest and stock liquidity. Our proxy variable for regulatory requirements are *AuditFees*, which captures the direct costs of auditing the financial statements and complying with capital market regulations. Finally, all remaining variables we summarize in Table 2.

We lag explanatory variables by one year to mitigate endogeneity concerns arising from a simultaneity bias. In additional analyses, we build the '*going opaque*' group, which includes segment changes and going privates because in both events the firms significantly reduce transparency, and analyze segment changes and mergers as standalone cause, where the dependent variable is equal to one whenever the firm experienced the respective event in a given year, and zero otherwise.

Second, we add firm-fixed effects to this model to control for unobserved firm heterogeneity and estimate:

$$\begin{aligned} FirmDelisting_{i,t} = {} & \beta_1 TobinsQ_{i,t-1} + \beta_2 Size_{i,t-1} \\ & + \beta_3 RoA_{i,t-1} + \beta_4 Leverage_{i,t-1} + \beta_5 TurnoverbyVolume_{i,t-1} \\ & + \beta_6 EquityIssuance_{i,t-1} + \beta_7 AuditFees_{i,t-1} \\ & + FirmFixedEffects + \varepsilon_{i,t} \end{aligned} \tag{2}$$

This second model controls for unobserved time invariant firm characteristics and aims to estimate the average ceteris paribus within-firm correlation between explanatory

variables and the probability of a delisting decision (Wooldridge 2010). We employ the control variables as described for Eq. (1) but exclude *FirmAge* in this model. Employing the two estimations allows us to compare the average cross-sectional correlation and the within-firm correlation, the latter presumably capturing the cause-effect relationship. Still, we are very cautious about interpreting our results as evidence of causality.

We also investigate the effects of ultimate controlling shareholders on the probability of a firm's delisting from the *Prime Standard*. The ownership information is based on the ultimate owner and hand-collected from Hoppenstedt Aktienführer, Nexis, Who-is-Who database, IR departments and press releases. We extend the models specified in Eqs. (1) and (2) by incorporating dummy variables that are one when a *Founding Family*, *Financial Investor*, *Bank*, *Corporation* or the *Government* holds more than 25% of aggregated voting rights, and is zero otherwise. In this analysis, we disregard the control variables *TurnoverbyVolume*, *EquityIssuance* and *AuditFees*.

Third, as a robustness analysis, we estimate a Cox proportional hazard model. Hazard models are geared to estimate the change in the conditional probability that a firm will experience an event after t years if it has not already experienced it. Thus, hazard models help to investigate the delisting event of a firm over its complete life cycle. Specifically, we estimate the following model:

$$h(t, X(t)) = h(t, 0)\exp(\beta X(t)) \tag{3}$$

where $h(t, X(t))$ is the hazard rate for a firm in time t depending on the covariates $X(t)$. The baseline hazard function is represented by $h(t, 0)$, while $exp(\beta)$ represents the estimated hazard ratios indicating the change in the hazard for a unit increase in the covariates. For reasons of comparability, we display coefficients rather than hazard ratios in our results. As in the main analysis, all variables are included, except for *FirmAge*.[15]

4.2 Determinants of firm delisting

To obtain a general understanding of the explanatory power of our economic and regulatory determinants, we report our logit regression results for *Prime Standard* delistings excluding insolvencies in Table 4. In Panel A, Models 1–5 contain the results from the 'pooled' cross-sectional logit models. We find that delisting firms are smaller, as the coefficient of *Size* is negative and significant at the 1% level. Our results reveal that firms with higher profitability (*Return on Assets*) have a lower probability to leave the *Prime Standard*. In Model 2, we add *Firm Age* to the model, but do not find that older firms are more likely to delist. Hence, there is no support for a firm life cycle effect.[16] As expected, in Model 3 we observe that firms with

[15] As the hazard model measures the time to event and the firm age is naturally continuing to rise until a potential delisting of the firm, we exclude *FirmAge* in the survival model.

[16] A possible explanation is the following conjecture: In 2003, with the re-organization of the market segments, some young firms entered the highest market segment, as they were 'overoptimistic' and or wanted to benefit from signaling a higher quality that, in hindsight, they did not possess. As it turned out, this segment was too ambitious or the market realized the true quality of the firm and these firms subsequently transferred to a lower market segment. In the *Online Appendix,* we provide a discussion of *Neuer Markt* IPOs transferring to the *Prime Standard*.

Table 4 Determinants of firm delisting from the Prime Standard

Panel A: Baseline						
Model	I	II	III	IV	V	VI
Sample	German Prime Standard firms (excl. insolvencies)					
Dependent variable	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Firm delisting	[t-stat.]	[t-stat.]	[t-stat.]	[t-stat.]	[t-stat.]	[t-stat.]
	Pooled logit					FE logit
Tobins Q (t − 1)	− 0.085	− 0.086	− 0.088	− 0.03	− 0.063	0.025
	[− 0.90]	[− 0.91]	[− 0.92]	[− 0.30]	[− 0.51]	[0.11]
Size (t − 1)	− 0.125***	− 0.140***	− 0.053	− 0.126***	− 0.143	0.668
	[− 2.77]	[− 2.75]	[− 1.04]	[− 2.82]	[− 1.25]	[1.55]
Return on assets (t − 1)	− 1.087***	− 1.126***	− 1.215***	− 1.212***	− 1.126*	− 2.636***
	[− 2.71]	[− 2.79]	[− 2.97]	[− 3.13]	[− 1.95]	[− 2.79]
Leverage (t − 1)	− 0.152	− 0.169	− 0.226	− 0.141	− 0.085	− 2.347
	[− 0.36]	[− 0.39]	[− 0.52]	[− 0.33]	[− 0.17]	[− 1.56]
Firm age (ln) (t − 1)		0.1			0.017	
		[0.97]			[0.14]	
Turnover by volume (ln) (t − 1)			− 0.236***		− 0.269***	− 0.554***
			[− 4.36]		[− 4.18]	[− 4.08]
Equity issuance (t− 1)				− 2.051	− 1.019	0.13
				[− 1.63]	[− 0.75]	[0.08]
Audit fees (ln) (t − 1)					0.146	0.494*
					[0.91]	[1.87]
YearFE	Yes	Yes	Yes	Yes	Yes	No
Industry FE	Yes	Yes	Yes	Yes	Yes	No
N	4160	4160	4160	4160	3004	649

Table 4 (continued)

Panel B: Controlling shareholder

Model	I	II	III	IV	V	VI	VII
Sample	German Prime Standard firms (excl. insolvencies)						
Dependent variable:	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Firm delisting	[t-stat.]	[t-stat.]	[t-stat.]	[t-stat.]	[t-stat.]	[t-stat.]	[t-stat.]
	Pooled logit						FE logit
Tobins Q (t − 1)	− 0.094	− 0.084	− 0.085	− 0.154	− 0.07	− 0.128	− 0.127
	[− 0.98]	[− 0.89]	[− 0.89]	[− 1.55]	[− 0.74]	[− 1.28]	[− 0.73]
Size (t − 1)	− 0.160***	− 0.125***	− 0.125***	− 0.137***	− 0.120***	− 0.154***	0.369*
	[− 3.56]	[− 2.77]	[− 2.77]	[− 2.91]	[− 2.60]	[− 3.05]	[1.78]
Return on assets (t − 1)	− 1.006**	− 1.087***	− 1.087***	− 1.172***	− 1.085***	− 1.120***	− 1.689***
	[− 2.41]	[− 2.71]	[− 2.71]	[− 2.76]	[− 2.71]	[− 2.58]	[− 3.08]
Leverage (t − 1)	− 0.128	− 0.149	− 0.151	− 0.199	− 0.082	0.019	− 0.286
	[− 0.30]	[− 0.35]	[− 0.35]	[− 0.47]	[− 0.19]	[0.04]	[− 0.34]
Founding family (t − 1)	− 0.664***					− 0.183	− 1.168***
	[− 3.55]					[− 0.89]	[− 3.23]
Financial investor (t − 1)		− 0.031				0.199	0.528
		[− 0.15]				[0.83]	[1.50]
Bank (t − 1)			− 0.014			0.435	0.408
			[− 0.03]			[0.80]	[0.50]
Corporation (t − 1)				1.403***		1.512***	1.349***
				[7.88]		[7.80]	[3.80]
Government (t − 1)					− 0.949	− 2.247**	− 1.235
					[− 1.26]	[− 2.56]	[− 1.03]

Table 4 (continued)

Panel B: Controlling shareholder

Model	I	II	III	IV	V	VI	VII
Sample	German Prime Standard firms (excl. insolvencies)						
Dependent variable:	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Firm delisting	[t-stat.]	[t-stat.]	[t-stat.]	[t-stat.]	[t-stat.]	[t-stat.]	[t-stat.]
	Pooled logit						FE logit
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	No
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	No
N	4160	4160	4160	4160	4160	4160	1313

The tables present the results from 'pooled' and firm fixed logit regressions on firm delisting, excluding cases of insolvencies as the dependent variable. Each model has a different setting with respect to the firm characteristics. Panel A reports the results for the baseline model and Panel B controls for ultimate ownership. The sample consists of 4160 firm-year observations of German firms over the period from 2003 to 2015. In 'pooled' logit regressions, we control for year and industry fixed effects (FE). Robust t-values are in brackets

*,**,*** indicate significance at the 0.10, 0.05, and 0.01 level, respectively

higher stock liquidity do have a lower probability to down-list or exit from the segment. The coefficient of *Turnover by Volume* is significant at the 1% level. This indicates that firms with higher liquidity seem to benefit from the investor's interests in their shares and the trading environment. *Equity Issuance* and *Audit Fees* correlate only insignificantly with the delisting from the *Prime Standard*. In Model 6, we add firm-fixed effects to account for unobserved firm heterogeneity.[17] We find that profitability measured by *Return on Assets* and stock market liquidity measured by *Turnover by Volume* remain negatively correlated with *Firm Delisting*. In contrast, *Size* becomes uninformative, once we add firm-fixed effects to the model. In the *Online Appendix*, Table A.5, we employ the free float of all outstanding shares as alternative measure for stock liquidity in the pooled and firm-fixed effect logit regressions. We still find a negative coefficient (*Free Float*) that is significant at the 1% level.

In Panel B, we analyze the impact of ultimate controlling shareholders on the probability of a firm's delisting from the *Prime Standard*, excluding insolvencies. We report the results from the 'pooled' logit regressions in Models 1–6. In Model 1, the coefficient for a *Founding Family* is negative and significant at the 1% level, suggesting that a family as controlling shareholder decreases the probability to exit from the *Prime Standard.* Models 2 and 3 reveal that the dummy variables for *Financial Investors* and *Banks,* respectively, are not significantly correlated with a firm's delisting. In Model 4, the coefficient for *Corporation* is positive and significant at the 1% level. This indicates that a strategic investor as ultimate controller increases the probability of a firm to leave the segment. In contrast, the *Government* as controlling shareholder has no significant explanatory power (Model 5). In the full Model 6, we find that firms controlled by another corporation (the government) are more (less) likely to delist from the highest market segment. In Model 7, we control for firm-fixed effects and confirm that founding families (corporations) as controlling shareholders are negatively (positively) associated with a firm's delisting. However, the *Government* dummy becomes uninformative.

Overall, firm size (in the cross-section) and profitability as well as stock liquidity negatively relate to the decision to leave the highly regulated *Prime Standard* during our sample period. Moreover, firms controlled by founding families and the government have less reasons and therefore a lower probability to delist from the segment, while it is higher when a corporation has significant voting power.

4.3 Determinants of delisting reasons

In Table 5, we present the results of a more detailed analysis differentiating between firms leaving the *Prime Standard* due to 'going opaque', down-listing, or merger decisions.

[17] Note that the number of observations decreases here because only delisting firms are informative for the model and therefore remain in the sample for estimation.

4.3.1 Going opaque

In Panel A, Models 1 and 2, we analyze firms that are 'going opaque' and group together firms that changed the segment or opted for going private. Model 1 reveals cross-sectionally that firms that are 'going opaque' are on average smaller (*Size*), do have lower growth opportunities (*Tobins Q*) and have lower profitability (*Return on Assets*). Controlling for firm-fixed effects (Model 2), we find that firms with decreasing growth opportunities (*Tobins Q*) and profitability (*Return on Assets*) are associated with a higher probability for 'going opaque'. However, firm sizes becomes uninformative. Moreover, we find a negative and statistically significant coefficient for *Turnover by Volume,* suggesting that firms with increasing stock liquidity are less likely to down-list or completely abandon public equity markets.[18] In addition, the coefficient of *Audit Fees* is positive and significant at the 5% level. As a proxy for increasing regulatory demands, we interpret this result in such a way that increasing costs might decrease the net benefits of listing, and therefore increases the incentives for migrating (down-list) to a lower market segment or for a going private. Both implies significantly lower costs for compliance with capital market regulation and corporate governance standards.[19] In contrast, we do not find a statistically significant relationship between *Equity Issuance* and the probability for this *Going Opaque* group.

Table 5, Panel B, contains the results for dummy variables that indicate the type of controlling shareholder with more than 25% of the voting rights. Since no firm "going opaque" is state-controlled, this estimation omits the *Government* dummy. In Model 1, the coefficient for *Founding Family* is negative but only significant at the 10% level. In Model 4, we find that *Corporation* positively correlates with *Going Opaque* at the 5% level. However, only *Corporation* remains significant in the full setting (Model 5). Model 6 contains the logistic regressions with firm-fixed effects to control for time-invariant unobserved heterogeneity. Our results suggest that having a *Founding Family* as an ultimate controlling shareholder decreases the probability that the firm will down-list to a lower segment or to go private.

4.3.2 Segment changes

In Panel A, Models 3 and 4, and Panel C, we analyze firms that change the segment and down-list. This test most directly relates to our hypotheses from Sect. 2 and we dedicate the next section to a detailed discussion of our results.

[18] In the *Online Appendix*, Table A.5, our results confirm this finding using the free float of shares as alternative proxy for stock liquidity.

[19] In the US, the 2012 JOBS Act reduced certain disclosure and governance requirements on newly listed firms, leading to more and more efficient investments after going public (Dambra and Gustafson 2021).

4.3.3 Acquisitions

In Models 5 and 6, Panel A, the dependent variable is equal to one if another firm acquired or merged with our sample firm. The cross-sectional design in Model 5 reveals that firms with low growth opportunities (*Tobins Q*) have a smaller acquisition probability. Firms with less liquidity (*Turnover by Volume*) are more likely to become a target.[20] Firm size (*Size*) is statistically insignificant. Taking unobserved firm heterogeneity into account (Model 6), firms with increasing growth opportunities (*Tobins Q*) are more likely to become merger or acquisition targets. Firms with increasing *Size* have a higher probability of being acquired. However, the coefficient is only significant at the 10% level. Moreover, the probability of an acquisition or merger is lower for firms with increasing market liquidity. This event also appears to be more likely when *Equity Issuance* increases over time, but the coefficient here is only weakly statistically significant. These results are opposite compared to our *Going Opaque* group, firms that either down-list or go private, which obviously highlights the fundamental differences of these economic events.

In the *Online Appendix*, Table A.3, we report the results for the effects of ultimate control on the probability that another firm acquired or merged with our sample firm. For the 'pooled' logit regressions, we find that the coefficient for *Founding Family* (*Corporation*) is negative (positive) and significant at the 1% level (Models 1 and 4). In Model 6, we add firm-fixed effects and confirm the previous findings (Model 6). This suggests that acquirers avoid targeting firms with controlling founding families that are most likely only willing to sell at a premium high enough to compensate for their loss in private benefits of control (Achleitner et al. 2013). In contrast, corporations as controlling shareholders are interested in selling their stakes as a lucrative exit strategy if the concentrated position involves costly over-monitoring (Cumming et al. 2018).

4.4 Robustness test: alternative regression model

In this section, we test the robustness of our results in a survival analysis using a Cox proportional hazard model.[21] Table 6 presents the results from the Cox proportional hazard model described in Sect. 4.1. In Model 1, the delisting events are firms that have down-listed to a lower market segment or opted for going private. The coefficients of *Tobins Q, Size, Return on Assets* and *Turnover by Volume* are negative and significant at the 1% level. Moving to Model 2, where the delisting events are restricted to only those firms that changed the segment and down-listed. It becomes evident that *Tobins Q, Size, Return on Assets* and *Turnover by Volume* are negative

[20] To test the robustness of our results, we employ the free float of outstanding shares (in percent) as alternative measure for stock liquidity and find a negative coefficient in the pooled logit model (Table A.5, *Online Appendix*). Due to data availability of the free float variable, we are not able to estimate the firm-fixed effect model.

[21] For other studies on the determinants of IPO survival using the Cox proportional hazard model, see Cattaneo et al. (2015), Bhattacharya et al. (2015), and Wagner and Cockburn (2010).

Table 5 Determinants of different delisting reasons in the Prime Standard

Panel A: Baseline						
Model	I	II	III	IV	V	VI
Sample	German Prime Standard firms (excl. insolvencies)					
	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
	[t-stat.]	[t-stat.]	[t-stat.]	[t-stat.]	[t-stat.]	[t-stat.]
Dependent variable	*'Going Opaque'*		*Down-listing*		*Merger*	
	Pooled logit	FE logit	Pooled logit	FE logit	Pooled logit	FE logit
Tobins Q (t − 1)	− 0.638***	− 0.976**	− 0.791***	− 1.134***	0.403***	3.174***
	[− 2.81]	[− 2.51]	[− 2.97]	[− 2.66]	[2.83]	[3.27]
Size (t − 1)	− 0.326**	0.286	− 0.453***	0.483	0.245	4.720*
	[− 2.45]	[0.55]	[− 2.69]	[0.83]	[1.22]	[1.65]
Return on assets (t− 1)	− 1.825***	− 1.791*	− 1.889**	− 1.756	0.836	3.715
	[− 2.76]	[− 1.71]	[− 2.54]	[− 1.51]	[0.87]	[0.66]
Leverage (t − 1)	0.407	− 2.236	0.265	− 1.311	− 0.897	− 6.078
	[0.69]	[− 1.27]	[0.37]	[− 0.68]	[− 0.96]	[− 0.90]
Firm age (ln) (t − 1)	0.041		0.15		0.005	
	[0.29]		[0.93]		[0.02]	
Turnover by volume (ln) (t − 1)	− 0.191**	− 0.444***	− 0.218**	− 0.421**	− 0.412***	− 1.522***
	[− 2.30]	[− 2.92]	[− 2.45]	[− 2.54]	[− 4.58]	[− 2.99]
Equity issuance (t − 1)	− 2.51	− 3.268	− 1.418	− 1.268	1.163	12.047*
	[− 1.12]	[− 0.91]	[− 0.74]	[− 0.37]	[0.61]	[1.76]
Audit fees (ln) (t − 1)	0.241	0.825***	0.238	0.548*	− 0.068	− 0.718
	[1.36]	[2.59]	[1.13]	[1.65]	[− 0.22]	[− 0.57]
Year FE	Yes	No	Yes	No	Yes	No
Industry FE	Yes	No	Yes	No	Yes	No
N	3004	519	3004	442	2973	130

Panel B: Controlling shareholder —going opaque						
Model	I	II	III	IV	V	VI
Sample	German Prime Standard firms (excl. insolvencies)					
Dependent variable	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
'Going Opaque'	[t-stat.]	[t-stat.]	[t-stat.]	[t-stat.]	[t-stat.]	[t-stat.]
	Pooled logit					FE logit
Tobins Q (t − 1)	− 0.641***	− 0.630***	− 0.627***	− 0.660***	− 0.662***	− 0.569**
	[− 3.89]	[− 3.87]	[− 3.81]	[− 4.05]	[− 3.99]	[− 2.45]
Size (t − 1)	− 0.260***	− 0.242***	− 0.240***	− 0.245***	− 0.259***	0.153
	[− 4.08]	[− 3.73]	[− 3.69]	[− 3.76]	[− 3.94]	[0.68]
Return on assets (t − 1)	− 1.717***	− 1.755***	− 1.745***	− 1.769***	− 1.724***	− 1.430**
	[− 3.68]	[− 3.84]	[− 3.82]	[− 3.82]	[− 3.64]	[− 2.46]
Leverage (t − 1)	0.458	0.453	0.481	0.45	0.489	0.395
	[0.94]	[0.92]	[0.97]	[0.92]	[1.00]	[0.44]

Table 5 (continued)

Panel B: Controlling shareholder —going opaque						
Model	I	II	III	IV	V	VI
Sample	German Prime Standard firms (excl. insolvencies)					
Dependent variable	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
'Going Opaque'	[t-stat.]	[t-stat.]	[t-stat.]	[t-stat.]	[t-stat.]	[t-stat.]
	Pooled logit					FE logit
Founding family (t − 1)	− 0.400*				− 0.231	− 1.114***
	[− 1.85]				[− 0.95]	[− 2.76]
Financial investor (t − 1)		0.093			0.172	0.391
		[0.39]			[0.62]	[0.96]
Bank (t − 1)			− 0.295		− 0.629	0.019
			[− 0.49]		[− 0.82]	[0.02]
Corporation (t − 1)				0.629**	0.637**	0.568
				[2.48]	[2.28]	[1.39]
Year FE	Yes	Yes	Yes	Yes	Yes	No
Industry FE	Yes	Yes	Yes	Yes	Yes	No
N	4160	4160	4160	4160	4160	999
Panel C: Controlling shareholder - down-listing						
Model	I	II	III	IV	V	VI
Sample	German Prime Standard firms (excl. insolvencies)					
Dependent variable:	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Down-listing	[t-stat.]	[t-stat.]	[t-stat.]	[t-stat.]	[t-stat.]	[t-stat.]
	Pooled Logit					FE Logit
Tobins Q (t − 1)	− 0.770***	− 0.758***	− 0.756***	− 0.793***	− 0.798***	− 0.661**
	[− 4.03]	[− 3.96]	[− 3.94]	[− 4.23]	[− 4.08]	[− 2.57]
Size (t − 1)	− 0.384***	− 0.365***	− 0.368***	− 0.373***	− 0.386***	0.001
	[− 4.88]	[− 4.59]	[− 4.58]	[− 4.72]	[− 4.83]	[0.01]
Return on assets (t − 1)	− 1.653***	− 1.687***	− 1.669***	− 1.703***	− 1.638***	− 1.260**
	[− 3.36]	[− 3.50]	[− 3.44]	[− 3.47]	[− 3.24]	[− 2.08]
Leverage (t − 1)	0.501	0.524	0.546	0.494	0.583	0.592
	[0.91]	[0.94]	[0.98]	[0.90]	[1.06]	[0.63]
Founding family (t − 1)	− 0.351				− 0.21	− 0.838*
	[− 1.50]				[− 0.80]	[− 1.93]
Financial investor (t − 1)		− 0.211			− 0.123	0.073
		[− 0.72]			[− 0.36]	[0.15]
Bank (t − 1)			− 0.548		− 0.714	− 0.148
			[− 0.74]		[− 0.76]	[− 0.15]
Corporation (t − 1)				0.699**	0.698**	0.637
				[2.55]	[2.32]	[1.41]
Year FE	Yes	Yes	Yes	Yes	Yes	No

Table 5 (continued)

Panel C: Controlling shareholder - down-listing						
Model	I	II	III	IV	V	VI
Sample	German Prime Standard firms (excl. insolvencies)					
Dependent variable:	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Down-listing	[t-stat.]	[t-stat.]	[t-stat.]	[t-stat.]	[t-stat.]	[t-stat.]
	Pooled Logit					FE Logit
Industry FE	Yes	Yes	Yes	Yes	Yes	No
N	4160	4160	4160	4160	4160	874

The tables present the results from 'pooled' and firm fixed logit regressions on 'Going Opaque' (Down-listing + Going Private), Down-listing and Merger as the dependent variables. Each model has a different setting with respect to the firm characteristics. Panel A reports the results for the baseline model and Panel B (C) controls for ultimate ownership in firms going opaque (changing the segment). The sample consists of 4,160 firm-year observations of German firms over the period from 2003 to 2015. In 'pooled' logit regressions, we control for year and industry fixed effects (FE). Robust t-values are in brackets

*,**,*** indicate significance at the 0.10, 0.05, and 0.01 level, respectively

and significant at the 1 and 5% level, respectively. In Model 3, the exit event contains only cases where the firm merged with another firm. The coefficient of *Tobins Q* is positive indicating that firms with higher growth opportunities are more likely to become a merger target, but with only weak statistical significance. *Turnover by Volume* has a negative coefficient and is significant at the 1% level. Overall, the survival analysis confirms all our previous results from the logistic regressions, suggesting that our findings do not depend on the methodology employed.

5 Discussion

In this section, we discuss the findings for our hypotheses formulated in Sect. 2. We focus on the results in Panel A (Models 3 and 4) and Panel C of Table 5, which directly examine the down-listing decision.

5.1 Hypothesis 1 (market access to capital)

Our first hypothesis relates to the motives of a publicly listed firm to issue new equity. When a firm has hardly any need for raising additional equity to finance growth opportunities, a listing in a highly regulated market segment may become too costly and burdensome (Kashefi Pour and Lasfer 2013). In addition, firms with a lack of growth opportunities experience a comparatively low market valuation and low stock prices, which makes it even less attractive to issue additional equity as a large discount has to be accepted. Thus, we expect to find support for our *Hypothesis 1*, which states that the probability for a firm switching to a lower market

Table 6 Robustness test—survival analysis of firm delistings from the Prime Standard

Model	I	II	III
Sample	German Prime Standard firms (excl. insolvencies)		
	Coeff.	Coeff.	Coeff.
	[t-stat.]	[t-stat.]	[t-stat.]
Dependent variable	*'Going Opaque'*	*Down-listing*	*Merger*
	Cox	Cox	Cox
Tobins Q (t − 1)	− 0.849***	− 1.006***	0.191*
	[− 3.35]	[− 3.29]	[1.78]
Size (t − 1)	− 0.425***	− 0.598***	0.10
	[− 3.27]	**[− 3.48]**	[0.50]
Return on assets (t − 1)	− 1.605***	− 1.350***	− 0.09
	[− 3.81]	**[− 2.79]**	[− 0.22]
Leverage (t − 1)	1.00	1.00	− 1.58
	[1.61]	[1.32]	[− 1.57]
Turnover by volume (ln) (t − 1)	− 0.210***	− 0.210**	− 0.667***
	[− 2.58]	[− 2.30]	[− 6.90]
Equity issuance (t − 1)	− 2.82	− 2.15	2.32
	[− 1.19]	[− 0.97]	[1.09]
Audit fees (ln) (t − 1)	0.20	0.21	0.02
	[1.24]	[1.04]	[0.08]
Year FE	No	No	No
Industry FE	No	No	No
N	2502	2502	2502

The table presents the results from a Cox (1972) proportional hazard model with 'Going Opaque' (Down-listing + Going Private), Down-listing and Merger as the dependent variables. The sample consists of 2502 firm-year observations of German firms over the period from 2003 to 2015. Robust t-values are in brackets

*,**,*** indicate significance at the 0.10, 0.05, and 0.01 level, respectively

segment increases when the firm begins issuing less equity and has limited growth opportunities.

In Models 3 and 4 of Table 5 (Panel A), we include *Tobins Q* to test for the effects of potential growth opportunities on segment transfer decisions. We find a negative and statistically significant coefficient in the 'pooled' and fixed-effects logistic regressions, suggesting that firms with more promising future growth opportunities are less likely to change to a less-regulated segment. These results support our *Hypothesis 1* and the notion that these firms probably benefit from their listing in the highest market segment by obtaining external financing at more favorable terms, signaling their superior quality and trading at higher market valuations. This result is consistent with the empirical findings in Bharath and Dittmar (2010), Mehran and

Peristiani (2010), Kashefi Pour and Lasfer (2013) as well as Thomsen and Vinten (2014), regardless of the proxy employed.

One primary reason for a firms' public market listing is the easier access to new equity, which is especially relevant for high-growth firms in need of financing investment opportunities but which are financially constrained (Kim and Weisbach 2008). Consequently, when the management do not expect future investment opportunities for the firm and do not plan new investment projects for some years to come, it may reconsider its current listing segment (Thomsen and Vinten 2014; Doidge et al. 2017). The management might conclude that transferring (down-list) to a lower market segment will best suits the firm's needs. We also present the results related to the *Equity Issuance* activity of a firm in Models 3 and 4 of Panel A. The estimated coefficient is negative but insignificant in both logistic regression models.

5.2 Hypothesis 2 (stock liquidity)

We include also *Turnover by Volume* as a proxy for the stock liquidity. The 'pooled' logit regression in Model 3 reveals that firms with lower liquidity do have a higher probability to change the segment. However, the corresponding coefficient is only significant at the 10% level. The firm fixed effects model in Model 4 suggests that firms with a decreasing liquidity do have a higher probability to change their stock market segment and therefore supports our *Hypothesis 2*. In the *Online Appendix*, Table A.5, we test the robustness of our results using *Free Float* as an alternative measure for stock liquidity. Our results strongly support all our previous findings.

5.3 Hypothesis 3 (size of the firm)

Our third hypothesis relates to the size of the firm and the propensity to transfer to a lower market segment. Since most of the listing requirements apply to all firms regardless of their size, smaller firms are usually less capable to deal with these fixed costs efficiently (Doidge et al. 2017). They may be more inclined to search for a better-suiting listing segment, which rather caters to the needs and requirements of small and medium-sized firms. In addition, smaller firms may suffer more from financial distress cost and information asymmetries, which both increase the relative listing costs. Therefore, we expect and state in *Hypothesis 3* that smaller firms have a higher probability to down-list to a lower market segment.

We incorporate the log of total assets to test whether the size of the firm affects the probability of transferring to a lower segment. The 'pooled' logistic regression shows a negative and statistically significant coefficient, suggesting that smaller firms are more inclined to down-list to less regulated segments. This finding supports our *Hypothesis 3* and is consistent with the empirical results of a negative relationship between firm size and the probability to delist from the stock markets in the US (Bharath and Dittmar 2010; Mehran and Peristiani 2010), in Europe (Thomsen and Vinten 2014), and in the UK (Aslan and Kumar 2011; Kashefi Pour and Lasfer

2013). With respect to going dark transactions, Leuz et al. (2008) and Marosi and Massoud (2007) also find supporting evidence for this negative size relationship.

It is likely that the securities market reform and the stock market re-segmentation in 2003 affected the outcome. In fact, it seems possible that the firms' decision to list on the *Prime* or *General Standard* after the *Neuer Markt* closed in 2003 did not depend on firm size. Consequently, the 54 *Neuer Markt* IPOs that first transferred to the *Prime Standard* and later on switched to the *General Standard* may affect our results. We discuss and perform robustness tests on that concern in Section A.3 of the *Online Appendix*. Overall, our results remain largely stable when we exclude *Neuer Markt* firms from the analysis.

Usually smaller firms are more constrained in their access to equity capital and generally have higher financial distress costs. Consequently, they suffer more from unexpected economic events and ultimately are more likely to fail (Fidanza 2018). Moreover, bearing the compliance costs of a stock market listing is more difficult for smaller relative to larger firms. For instance, the introduction of SOX undoubtedly increased the costs for many domestic and foreign firms and the probability to leave the US public equity market (Engel et al. 2007; Marosi and Massoud 2007; Leuz et al. 2008; Bessler et al. 2012, 2015). In contrast, when the firm exceeds a certain size threshold, the listing benefits seem to increase, preventing firms from switching (down-list) to lower market segments. We will discuss this regulatory issue in the next section on *Hypothesis 5*.

5.4 Hypothesis 4 (poor performance)

Our fourth hypothesis on economic determinants relates to the firm performance prior to the segment change decision. A poor operating performance increases the probability of a firm to change the market segment, especially when the relative listing costs are too high for this firm and too few investors are attracted to justify the premium listing. Consequently, a listing in a highly regulated market segment may become too burdensome for firms facing economic difficulties. In addition, the consequence of poor firm performance is usually a lower share price, which then accelerates the process of market segment migration. These firms often repurchase the shares at lower costs, frequently resulting in a concentrated ownership structure of a specific shareholder group. Thus, we expect to find support for our *Hypothesis 4*, which states that low performing firms are more likely to transfer to a lower market segment.

We include the variable *Return on Assets*, in Panel A, Models 3 and 4 of Table 5 and present the results with respect to the operating performance of a firm. We find support for our hypothesis in that we document a negative and statistically significant coefficient (at the 5% level) in the 'pooled' logistic regression. This finding indicates that well-performing firms seem to benefit from their listing in the highest market segment at Deutsche Börse. The results are in line with our *Hypothesis 4* and several studies on delisting determinants (Thomsen and Vinten 2014; Doidge et al. 2017).

Another reason why the operating performance influences the segment change decision is that poor performance may also result from the firm's agency issues such as management investing in value-destroying projects (Fidanza 2018). In this context, the down-listing decision itself might reveal information and signal the economic difficulties or higher agency costs that the firm might face in the future. Shareholders could conclude from this signal that the decision is motivated by either being part of a cost saving program or protecting the insiders from public scrutiny and hiding other issues in the firm (Leuz et al. 2008).

5.5 Hypothesis 5 (regulatory costs)

Additionally, we examine the potential effects of regulatory changes on listing behavior in our fifth hypothesis. The objective of these changes was to advance the German corporate governance system more into the direction of the capital-market-oriented Anglo-Saxon model (Rapp and Strenger 2015). However, if the higher costs of new regulation and the increased compliance costs outweigh the listing benefits, a firm is more likely to down-list to a lower regulated listing regime as long as the listing benefits are still sufficiently high. Therefore, we expect and state in *Hypothesis 5* that more demanding capital market or corporate governance regulation increases the probability that a firm transfers to a lower market segment (Thomsen and Vinten 2014; Berninger et al. 2018).

With respect to our regulatory determinants, we introduce the log of *Audit Fees* as a proxy for direct regulatory costs. In contrast to our expectation, we find a positive but statistically insignificant coefficient in both logit regression models. Thus, the annual fees each firm pays for auditing its financial statements and the compliance with the relevant regulation, has no explanatory power for the probability to down-list. However, other costs are more difficult to quantify, possibly explaining our results, such as quarterly financial reports in English instead of semi-annual reports in German and the simultaneous publication of ad-hoc notifications in both German and English. In the US, the findings of Marosi and Massoud (2007) as well as Leuz et al. (2008) suggest that the probability of firms deregistering with the SEC and continuing trading in the Pink Sheets (OTC market) increased significantly after the passage of SOX in 2002. If the costs of complying with the highest listing requirements become too burdensome, firms tend to opt out of this highly regulated environment and down-list.

5.6 Hypothesis 6 (ownership structure)

In our final hypothesis, we analyze the effects of the ownership structure as corporate governance mechanism on the choice of the preferred listing segment. We hypothesize that founding families are less likely to down-list because they have strong control over their firms, are members of the management team and enjoy private benefits of control. For corporate shareholders, we expect that larger stakes in other companies require over-monitoring, which is costly and may reduce

managerial incentives. For going-private transactions, Cumming et al. (2018) provide evidence for these conjectures, while Achleitner et al. (2013) confirm the private benefits of control considerations. Consequently, we estimate the impact of ultimate control on the probability of a firm to down-list to lower market segment and include dummy variables that indicate whether the controlling shareholder holding more than 25% of the voting rights is a founding family, financial investor, bank or other corporation.

In Panel C of Table 5, we find a positive coefficient for *Corporation* that is statistically significant at the 5% level in the 'pooled' logistic regression (Model 4). Model 5 confirms this relationship in the full model setting. In the fixed-effects logistic regressions (Model 6), the *Corporation* dummy becomes uninformative, whereas the coefficient for *Founding Family* is negative but with low significance at the 10% level. Nevertheless, the results support our *Hypothesis 6*.

Overall, we provide supporting evidence for most of our hypotheses. Firms with less promising growth opportunities (*H1*), lower stock liquidity (*H2*), smaller firm size (*H3*) and lower profitability (*H4*) are more likely to down-list to a lower but probably better-suited market segment. In this context, the regulatory costs of the firm do not appear to be a relevant explanatory variable (*H5*), although many firms provide this argument as the main reason for the segment changing decision. However, one probable reason is that the effective direct and indirect regulatory costs are extremely difficult to assess. Finally, firms with a majority shareholder that enjoys private benefits of control (founding families) or has low monitoring incentives (corporations) have a lower (higher) probability to change the segment (*H6*).

5.7 Additional test: differential between down-listing and going private

In this section, we perform tests for the determinants of a firm changing the segment in an alternative subsample. To provide additional insights into the preferred segment decision, we restrict the peer group to firms that have chosen to delist fully from the stock exchange. In Table 7, we report the results from logistic regressions as specified in Eqs. (1) and (2), with *Down-Listing* as dependent variable and *Going Private* as the alternative outcome. Models 1–5 contains the results from the 'pooled' cross-sectional logit models. In all models, the coefficients for *Tobin's Q* and *Return on Assets* are negative and significant at the 1% and 5% levels. When we control for firm-fixed effects (Model 6), we find that firms with lower growth opportunities (*Tobin's Q)* and lower stock liquidity (*Turnover by Volume*) have a higher probability to down-list rather than going private. Moreover, the coefficient for *Audit Fees* is positive but with low statistical significance, while *Return on Assets* become uninformative in this model.

Overall, firms that voluntarily delist and therefore exit from the public equity market have more promising growth opportunities, are more profitable, have higher stock liquidity and pay less audit fees compared to firms that only down-list from the *Prime Standard*.

6 Conclusion

This study investigates the phenomenon of firms delisting from the *Prime Standard*, the highest-regulated stock market segment at the German Stock Exchange. Using a sample of 518 German firms that listed between 2003 and 2015 at least once at the *Prime Standard*, we identify 243 firms that delisted from this segment. We investigate these delisting events and observe that small, less profitable firms with low stock market liquidity do have a higher probability to leave this market segment. By further analyzing these '*going opaque*' firms that opt for lower transparency standards by a segment change (down-listing) or a voluntary delisting (going private), we find that these firms are on average smaller, do have lower growth opportunities and lower profitability. Controlling for unobserved heterogeneity, we find that firms with decreasing growth opportunities, liquidity and profitability as well as increasing regulatory costs do have a higher probability for a '*going opaque*' transaction.

We then focus on 107 firms that down-list to a less regulated market segment and find that firms with more promising future growth opportunities do have a higher probability to stay in the highest regulated stock market segment (H1). In addition, our results suggest that firms with higher stock liquidity (trading volume) tend to remain in the premium segment (H2). Firm size is an important factor in determining the decision to migrate to a less-regulated stock market segment as larger firms do have a higher probability to remain in the *Prime Standard* (H3). Our results also suggest that the more profitable firms are also more likely to stay listed in the *Prime Standard*, supporting our costs of being public hypothesis (H4). Moreover, we do not find that the direct costs of regulation, which we proxy by audit fees, have a significant effect on the decision to change the market segment (H5). Finally, our results indicated that founding families (corporations) as ultimate controlling shareholders decrease (increase) the probability of a firm to change to lower market segments (H6). Using a Cox proportional hazard model as robustness test, we confirm all of our previous findings.

Overall, our results advocate that the firms' cost–benefit considerations are an important explanatory factor for determining the preferred stock market segment and their decision to transfer to a less regulated market segment. Although we observe 243 delisting firms from the *Prime Standard* during the period 2003–2015, the total number of listed firms declined only from 329 to 286 firms, as 200 firms newly listed at this market segment. The number stayed relatively constant since then with 285 listed firms in 2020. Consequently, this highest regulated market segment at the German Stock Exchange still seems attractive as the prime segment for entering the public equity market in Germany. In contrast, the number of listed firms at the *General Standard*, the second and less regulated market segment, declined from 386 to 136 firms over the same period and decreased marginally to 121 firms in 2020. In 2017, the entry-level segment Scale was introduced and attracted 46 listings since

Table 7 Additional test—down-listing versus going privates

Model	I	II	III	IV	V	VI
Sample	Down-listings and going privates from the Prime Standard					
Dependent variable	Coeff	Coeff	Coeff	Coeff	Coeff	Coeff
Down-listing	[t-stat.]	[t-stat.]	[t-stat.]	[t-stat.]	[t-stat.]	[t-stat.]
	Pooled logit					FE logit
Tobins Q (t − 1)	− 0.390**	− 0.382**	− 0.407**	− 0.369**	− 0.512**	− 1.134***
	[− 2.26]	[− 2.24]	[− 2.31]	[− 1.97]	[− 1.97]	[− 2.66]
Size (t − 1)	− 0.048	− 0.056	− 0.038	− 0.049	− 0.193	0.483
	[− 0.68]	[− 0.77]	[− 0.53]	[− 0.70]	[− 1.46]	[0.83]
Return on assets (t − 1)	− 1.612***	− 1.712***	− 1.658***	− 1.626***	− 1.686**	− 1.756
	[− 2.97]	[− 3.07]	[− 3.00]	[− 3.00]	[− 2.22]	[− 1.51]
Leverage (t − 1)	0.27	0.155	0.281	0.277	− 0.26	− 1.311
	[0.44]	[0.24]	[0.45]	[0.45]	[− 0.34]	[− 0.68]
Firm age (ln) (t − 1)		0.167			0.181	
		[1.01]			[0.87]	
Turnover by volume (ln) (t − 1)			− 0.116		− 0.132	− 0.421**
			[− 1.50]		[− 1.39]	[− 2.54]
Equity issuance (t − 1)				− 0.943	− 0.495	− 1.268
				[− 0.48]	[− 0.23]	[− 0.37]
Audit Fees (ln) (t − 1)					0.329	0.548*
					[1.50]	[1.65]
Year FE	Yes	Yes	Yes	Yes	Yes	No
Industry FE	Yes	Yes	Yes	Yes	Yes	No
N	964	964	964	964	627	442

The table presents the results from 'pooled' and firm fixed logit regressions on Down-listing as the dependent variable. The peer group are the firms going private. Each model has a different setting with respect to the firm characteristics. The sample consists of 964 firm-year observations of German firms over the period from 2003 to 2015. In 'pooled' logit regressions, we control for year and industry fixed effects (FE). Robust t-values are in brackets

*,**,*** indicate significance at the 0.10, 0.05, and 0.01 level, respectively

then.[22] These observations open interesting avenues for future research on organizing securities markets and market segments as well as on firms' listing and delisting behavior.

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[22] As our main analysis covers the period from 2003 to 2015, we extended our dataset until 2020 to observe the impact of reforms implemented in 2017. The up-dated figures are included in the *Online Appendix*. We also extended our quantitative analysis until 2020 and the results remain qualitatively the same (unreported).

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