DOI: 10.1111/jbfa.12417

JBFA

The effects of stricter regulation on the going public decision of small and knowledge-intensive firms

Peter-Jan Engelen[1,5] | **Michele Meoli**[2] | **Andrea Signori**[3] | **Silvio Vismara**[2,4]

[1]Utrecht University, the Netherlands

[2]Department of Management, Information and Production Engineering, University of Bergamo, Italy

[3]Catholic University of Milan, Italy

[4]University of Ghent, Belgium

[5]University of Antwerp, Belgium

Correspondence
Silvio Vismara, Department of Management, Information and Production Engineering, University of Bergamo, via Pasubio 7b, 24044 Dalmine (BG), Italy.
Email: silvio.vismara@unibg.it

Abstract

This paper studies the impact of increased securities regulation on the IPOs of small and high-tech, knowledge-intensive firms. We take advantage of the adoption of European SOX-like provisions, staggered at different dates across European countries, to test its influence on the going public decision. Starting from the population of European private firms during 1995–2012, we find that the likelihood of going public has decreased among small and high-tech, knowledge-intensive firms. Consistently, we document a 6% and 8.5% decrease in the industry-adjusted Tobin's Q of small and knowledge-intensive firms that go public after the regulatory change.

KEYWORDS
Europe, IPOs, regulation, SOX, underpricing, valuation

JEL CLASSIFICATION
G30, G38

1 | INTRODUCTION

Several studies address the impact of institutional and regulatory differences on the depth and breadth of IPO markets. For instance, the passage of the US Sarbanes-Oxley (SOX) Act in 2002 has stimulated a still ongoing debate about the unintended consequences of regulation on IPO activity. In particular, the considerable increase in compliance costs has been blamed by many commentators for the recent decline in US IPO volume. Even though it is undeniable that enhanced disclosure requirements are costly for firms (Ahmed, McAnally, Rasmussen, & Weaver, 2010), recent studies question that heavy-handed regulation is the primary cause of such an IPO slowdown (Gao, Ritter, & Zhu, 2013). Nevertheless, the Jumpstart Our Business Startups (JOBS) Act was passed in 2012 with the aim to facilitate funding by easing some of the SOX provisions for firms with less than US$ 1 billion in annual revenues. Dambra, Field, and Gustafson (2015) document a significant post-JOBS increase in IPO activity.

[Correction added on 4 March 2020, after online publication: An additional affiliation has been added for first author, Peter-Jan Engelen.]

This paper analyzes the impact of regulatory changes on the European IPO market.[1] Following SOX, European member states have introduced corporate governance codes aimed at tightening existing regulation and increasing disclosure requirements.[2] Focusing on the European setting is interesting for at least two reasons. The first one is identification. While investigating the economic effects of a single regulatory event, such as US SOX, is challenging due to the presence of potentially confounding factors, these SOX-like provisions have been introduced at staggered dates across European countries, which allows us to better isolate their effect. The second reason is the availability of European private firm data. While US-based studies have assessed the impact of regulatory interventions on the IPO market mainly by looking at changes in IPO volume over time (e.g., Dambra et al., 2015), we investigate how increased regulation has affected a private firm's trade-off between going public and staying private.

The analysis focuses on two characteristics that crucially shape the benefits and costs of the introduction of SOX-like provisions at the firm-level, namely size and proprietary knowledge. We expect a negative impact of the regulatory change on the likelihood of small firms and high-tech and knowledge-intensive services (HTKIS) firms going public. Concerning firm size, increased compliance costs that firms have to bear to comply with tighter regulation are characterized by a fixed component, which becomes proportionally larger for small firms (Coates, 2007; Iliev, 2010). Moreover, increased disclosure requirements worsen the informational gap that small firms have to fill during the IPO process compared to large, established firms, for which a certain amount of information is already available in the public domain (Chemmanur & Fulghieri, 1999). As for the role of proprietary knowledge, firms for which the value of secrecy is higher, such as high-tech and knowledge-intensive firms, are particularly concerned about enhanced disclosure, since it may undermine their competitive position in the long term (Himmelberg & Petersen, 1994). Based on these arguments, tighter regulation is likely to have worsened the economic trade-off associated with the going public decision for small and HTKIS firms. We therefore expect the likelihood of going public, to have decreased after the regulatory change among small firms (relative to large firms), due to increased compliance costs; and among HTKIS firms (relative to other firms), due to increased loss of confidentiality. Furthermore, the negative effects of increased compliance costs and the loss of confidentiality are likely to reflect in the market valuation of these types of companies that, despite the regulatory tightening, still decide to go public. As a result, among firms that go public after the regulatory change, we expect small and HTKIS firms to receive lower valuations at the IPO moment relative to large and non-HTKIS firms.

We test our hypotheses starting from the population of private firms of 25 different European countries (obtained from the Amadeus database) and on the sample of 3,789 firms that went public during 1995–2012. Table 1 shows the timeline of the introduction of the regulatory changes in every single European country. Denmark, Malta and Germany even anticipated the enactment of US SOX in 2002, while the majority of the new codes were adopted within the first two years. The first SOX-like regulatory change in our sample was implemented in Denmark on 6 December 2001, preceding the United States. Most countries implemented a new regulatory setting within two years from the adoption of the US SOX, while others were as late as 2007. The differences in the enactment of these regulatory changes are unlikely to be due to differences in macroeconomic trends across countries, as there is a substantial geographical diversity among both 'early adopters' (e.g., Germany and Greece) and countries that adopted regulatory changes more than three years after SOX (e.g., Belgium, Poland and Sweden).

In order to test our hypotheses on the impact of SOX-like provisions on private firm's likelihood to go public, we follow Pagano, Panetta, and Zingales (1998) and run a probit regression where the dependent variable is a dummy equal to 0 if a firm stays private, and equal to 1 if it goes public in a given year. Our main explanatory variable is EU SOX, a step dummy equal to 1 after the introduction of the new EU SOX-like regulations in the firm's country, which is interacted with our focal variables, namely firm size and a dummy variable identifying HTKIS firms, and a set of controls.

[1] Other studies in the IPO literature find evidence of the impact of regulation on the pricing of securities, see Akyol, Cooper, Meoli, and Vismara (2014), Engelen and Van Essen (2010), and Johnston and Madura (2009). See also Lee, Strong, and Zhu (2014) outside an IPO context.

[2] For a detailed description of the specifics of US SOX see Coates (2007), and for detailed overviews of regulatory changes in Europe see Ferran (2004) and Enriques and Volpin (2007).

TABLE 1 EU SOX-like corporate governance codes

Before SOX	Within 1 year	Within 2 years	Later
Denmark	Austria	Czech Republic	Belgium
Nørby CG Report	*Austrian Code of CG*	*CG Code Based on OECD Principles*	*Belgian Code on CG*
Germany	Cyprus	Finland	Estonia
German CG Code	*Cyprus Code of CG*	*CG Recommendation for Listed Co.*	*Estonian CG Recommendations*
Malta	Greece	France	Hungary
Principles of Good CG	*Hellenic Law 3016/2002*	*Law on Financial Security of 2003*	*Companies Act IV of 2006*
	Slovakia	Ireland	Latvia
	CG Code Based on OECD Principles	*Companies Act of 2003*	*CG Principles and Rec. Implementation*
	Spain	Italy	Luxembourg
	Financial System Reform Measures Act	*Legislative Decree no. 310/2004*	*The Ten Principles*
	UK	Lithuania	Poland
	Combined Code	*CG Code for Listed Companies*	*Code Best Practice for WSE Listed Co.*
		Netherlands	Sweden
		Dutch CG Code (Tabaksblat Code)	*Swedish Code of CG*
		Portugal	
		CMVM Regulation 11/2003	
		Slovenia	
		Slovenian CG Code	

Note: This table shows corporate governance codes adopted by Member States of the EU, by enactment date relative to the US SOX (July 2002).

Then, we test for the effects of SOX-like provisions on IPO valuation by controlling for possible endogeneity in the IPO decision with a Heckman two-step procedure. In this setting, the first step models a private firm's likelihood of going public through the probit model described above, with the number of second-tier markets used as instrument. The inverse Mills' ratio, aimed at correcting for selectivity bias, is then included in the second step, which consists of cross-sectional regressions on IPO valuation, where the industry-adjusted Tobin's Q is the dependent variable. The three explanatory variables of interest are again the EU-SOX dummy and its interaction with the firm size and the HTKIS variables.

The results of our empirical analysis can be summarized as follows. First, we find a lower likelihood that private small and HTKIS firms go public after the regulatory change compared to large and non-HTKIS firms. This is consistent with the idea that the economic incentives to go public have declined following the regulatory change for these two types of firm. In terms of economic impact, the likelihood of going public of a private firm at the 25th percentile of the sales distribution has decreased after regulatory change by 13%, on average, compared with that of a firm at the 75th percentile. Similarly, HTKIS firms' likelihood of going public has decreased by 7% compared with a non-HTKIS firm. Second, consistent with our hypothesis on the negative effects of the regulatory change, we find that the IPO-date valuations of small and HTKIS firms that do go public after the introduction of SOX-like regulation have decreased. The economic impact is relevant, since small firms experience a 6% average valuation decrease in the industry-adjusted Tobin's Q following the regulatory intervention, while HTKIS firms experience an 8.5% decrease. These results are confirmed by our regression discontinuity design analysis, which rules out an alternative explanation that these changes are due to an overlapping general time trend, and by several additional robustness tests.

Further, we challenge our results against the economies of scope hypothesis introduced by Gao et al. (2013) for the US market, and documented by Ritter, Signori, and Vismara (2013) in the European context. According to this view, there has been a decline in the frequency of IPOs in the US and Europe, especially by small firms, due to the increasing advantages of selling out to a larger organization. To assess the role played by EU SOX-like provisions on IPO activity over time, we estimate time-series regressions where the dependent variable is the scaled IPO volume, and amongst the explanatory variables, we include: a time trend variable and a measure of M&A growth as proxies for the effect of economies of scope; Euromid Index, as a proxy for market conditions; and the EU SOX dummy, to test any effect of the change in legislation. Overall, our results support the role played by the economies of scope explanation, as confirmed by the negative effects of our proxies on IPO activity. At the same time, our evidence shows that the introduction of EU SOX-like legislation does not harm aggregate IPO activity, as the negative effect of EU SOX is weakly present only among regulated market IPOs, and not significant among second-tier market IPOs.

The contribution of this paper is threefold. First, we add to the debate concerning the impact of regulation on IPO activity. Ritter (2014) suggests that both tightening and de-burdening regulatory changes do not primarily affect IPO activity. Dambra et al. (2015) document that the de-risking provisions of the JOBS Act of 2012 increased the number of IPOs conducted by firms with high proprietary disclosure costs. From a historical perspective, Cattaneo, Meoli, and Vismara (2015) show that easing of regulations does not lead to a significant increase in the number of IPOs in Italy. Takahashi and Yamada (2015) find, in contrast, that relaxing listing requirements enabled high-growth firms to go public in Japan. While these studies mainly focus on the variation of IPO activity over time, we assess the influence that increased securities regulation exerts on the economic trade-off associated with the going public decision of small and HTKIS firms. Our study first finds that small and HTKIS firms are more reluctant to go public after the introduction of SOX-like provisions in Europe. Second, we shed light on the effects that regulation exerts on firms that do go public. If regulation induces firms to disclose more information, one may expect an increase in firm valuation caused by a reduction in cost of capital thanks to lower information asymmetry. We document however that this is not the case. Finally, our results also have policy implications for European and US markets. As more stringent regulation comes at a prohibitive cost for certain types of firm, tailor-made provisions should avoid such firms being pushed out of public equity markets. For instance, the SEC is gradually expanding the exemptions to Sarbanes-Oxley to a larger subset of firms. SEC (2018) tries to reduce compliance costs for smaller companies while maintaining appropriate investor protection by expanding the scope of smaller reporting companies (SRCs) to companies with less than US$ 250 million of public float (compared to the previous threshold of US$ 75 million). Furthermore, SEC (2019) proposes to allow SRCs with less than US$ 100 million in revenues not to 'obtain an attestation of their internal control over financial reporting from an independent outside auditor'.

2 | THE IMPACT OF EU SOX-LIKE RULES ON ACCESS TO STOCK MARKET FINANCING

Increased regulation brings both benefits and costs. Investors face a lower risk of losses from fraud, thanks to more reliable financial reporting, greater transparency, and accountability of listed firms. Public companies, on the one hand, should experience a lower cost of capital, since a larger and more accurate amount of information becomes subject to the market's assessment. On the other hand, those firms are forced to spend more money on internal controls. If the effort put forth by firms in adopting practices aimed at preventing misconduct and fraud was suboptimal before the reforms, then increasing such investments would be beneficial for financial market participants. In practice, however, the costs and benefits accruing to firms associated with this type of regulatory intervention are hard to quantify (Coates, 2007).

Under Section 404 of the US Sarbanes-Oxley (SOX) Act, management is responsible for (i) establishing and maintaining an adequate internal control structure and procedures for financial reporting; and (ii) assessing the effectiveness of the internal control structures (SOX 404 a). Management is thus supposed to disclose any material weakness in their firm's control system (Ashbaugh-Skaife, Collins, Kinney, & LaFond, 2008). Moreover, outside auditors must attest those disclosures (SOX 404 b). Section 302 also requires the chief executive officer and the chief financial officer to certify that they are responsible for establishing and maintaining internal controls and for the quality of financial reporting.

Inspired by US SOX, EU Member States introduced similar rules tightening existing regulations (see Table 1). The EU SOX-like regulations provide detailed rules about internal controls over financial reporting that are inspired by US SOX Section 404. For instance, Section V of the Tabaksblat Code for the Netherlands requires that 'the management board is responsible for the quality and completeness of publicly disclosed financial reports'. In particular, Section V.1.3 requires that 'the management board is responsible for establishing and maintaining internal procedures which ensure that all major financial information is known to the management board, so that the timeliness, completeness and correctness of the external financial reporting are assured'. In a similar vein, the UK Combined Code requires that 'directors should explain in the annual report their responsibility for preparing the accounts and there should be a statement by the auditors about their reporting responsibilities' (Art. C.1.1). The Code furthermore requires that 'the board should, at least annually, conduct a review of the effectiveness of the group's system of internal controls and should report to shareholders that they have done so. The review should cover all material controls, including financial, operational and compliance controls and risk management systems' (Art. C.2.1.). Similar provisions can be found in Art.154-bis of the Italian Consolidated Law on Finance (TUF) for Italy or in Article L. 225–37 of the French Commercial Code for France. In general, the new European rules require issuing firms to report in their official prospectus how they comply with the EU SOX-like regulations.

We now turn to our Hypotheses on the impact of the more stringent EU SOX-like regulations on the access to equity financing through the stock exchange for small and HTKIS firms.

2.1 | Going public decision

Stricter regulation can deter small and HTKIS firms from going public in two ways. First, stricter disclosure requirements imply higher costs of compliance. Second, they might also imply higher proprietary costs.

2.1.1 | Compliance cost effect

The implementation of SOX clearly imposed additional compliance costs on firms. Estimates vary: Alexander, Bauguess, Bernile, Lee, and Marietta-Westberg (2013) report in their survey a cost of US$ 1.21 million, FEI (2007) US$ 1.7 million during fiscal year 2006 and US$ 3.8 million during fiscal year 2005, CFOC (2005) estimated an incremental cost of US$ 2.4 million per reporting unit, while CRA (2005) reported a cost of US$ 4.2 million for 2005. However, SOX compliance was not uniformly costly for all firms.

Compliance costs are known to have a fixed component associated with the implementation or improvement of internal control systems, their monitoring, and more stringent reporting (Enriques & Volpin, 2007). Such a fixed cost component is inevitably heavier for small firms. Several studies document that the increased disclosure imposed by the US SOX Act, which inspired EU SOX-like regulations, has been particularly onerous for small firms. Ahmed et al. (2010) find that the median small firm in their sample incurs an annual cost of US$ 6 million. Small firms' operating cash flows to assets decline by 3.0% compared to 0.7% for medium-sized firms and 0.5% for large firms, consistent with fixed costs of compliance. In a similar vein, Alexander et al. (2013) find a strong inverse relationship between compliance costs and firm size. Total compliance costs for the smallest tercile are eight times as high as the smallest tercile, although the difference becomes a bit smaller over time. Ahmed et al. (2010) show that the difference between small and large firms is not a one-year phenomenon, but the compliance costs are significantly higher for small firms up to four years after implementation. Zhang (2007) finds that small firms that obtain a deferment to comply with SOX disclosure requirements experience significantly higher negative abnormal returns, indicating that compliance costs are significant for them. Ahmed et al. (2010) document a more severe decline in operating cash flows for smaller firms following the regulatory change.

Extant literature provides concrete support on how the increased disclosure requirements are associated with a loss of competitive advantage. For instance, Thomsen and Vinten (2007) examine delistings from European stock exchanges in the period 1996 to 2004 and find indications that the adoption of stricter corporate governance codes has led to more going-private transactions. The effect is stronger and significant for small firms, while weaker and insignificant for large firms. They conclude that the costs outweigh the benefits for small firms because of increased governance regulation. In a similar way, Martinez and Serve (2011) examine the introduction of stricter corporate governance provisions in France over the period 1997–2006 and they find that small firms delist more after the introduction of stricter rules. These factors suggest that European small firms are likely to incur a larger increase in compliance costs to meet the stricter disclosure requirements imposed by the new SOX-like regulations.[3] Everything else equal, this should discourage them from going public after the regulatory change. Therefore, we hypothesize:[4]

Hypothesis 1: Small firms are less likely to go public after the introduction of EU SOX-like regulations.

2.1.2 | Proprietary disclosure cost effect

In the disclosure literature, there is a long-standing debate about whether financial markets would benefit from mandatory disclosure requirements (Grundfest, 1998; Healy & Palepu, 2001) or whether a voluntary disclosure system would be more beneficial from a regulatory cost-benefit perspective (Benston, 1973; Easterbrook & Fischel, 1984; Stigler, 1964). Under the latter viewpoint and assuming perfectly efficient markets, firms may find it convenient to voluntarily disclose an efficient amount of information (Diamond, 1985). Our study does not take a stance in this debate as our results do not directly contradict either viewpoint. However, irrespective of this stance, a well-established problem in the disclosure literature is the adverse impact of proprietary information (Dye, 1986). While financial reporting can often give rise to externality effects (Foster, 1980), e.g., investors can extract information about a firm's expected earnings from the earnings releases of other firms in an industry, proprietary costs refer to the specific case in which the information disclosure reduces the present value of the future cash flows of the firm itself (Dye, 1990). If the information might be useful to competitors, disclosure implies a key loss in the information advantage over its competitors and will affect the disclosing firm negatively (Vismara, Signori, & Paleari, 2015; Verrecchia, 1983; Wagenhofer, 1990). In such a case disclosure can put the firm in a competitive disadvantage (Campbell, 1979; Yosha, 1995). This harmful effect is particularly strong in industries characterized by a high value of secrecy, where the economic importance of proprietary knowledge is substantial, and the loss of confidentiality may undermine a firm's ability to preserve its competitive advantage (Hayes & Lundholm, 1996). We identify these firms as high-technology and knowledge-intensive services (HTKIS) firms. A key information factor for HTKIS firms is data about research and development (R&D) expenditures (Aslan & Kumar, 2011; Pagano et al., 1998).

As R&D programs of HTKIS firms are hugely idiosyncratic to a firm, competitors cannot derive much value from observing R&D expenditures or from public knowledge of the R&D plans of another firm than the focal HTKIS firm (Aboody & Lev, 2000). For instance, the European biotech firm Genmab (Denmark) cannot learn much about the drug development pipeline of Galapagos (Belgium) by observing its own pipeline or by learning details about the R&D

[3] This is also confirmed by anecdotal evidence. For instance, in the Netherlands one could observe extensive media coverage discussing the impact of the increased compliance costs for small firms surrounding the introduction of the Dutch corporate governance code Tabaksblat (*Het Financieele Dagblad*, 2003; *De Volkskrant*, 2003; *De Telegraaf*, 2004). Several small caps delisted from Euronext Amsterdam due to those increased compliance costs: Free Record Shop (2002), others. For instance, the CEO of Free Record Shop stated 'more and more rules were added. Especially in the Tabaksblat code there were a number of proposals that small companies like ours cannot easily meet. It impedes entrepreneurship', as quoted in *FEM Business* 2005a. Other entrepreneurs such as the CEO of VDP Group abstain from going public for the same reason (*FEM Business*, 2005b). A study of Ernst & Young (2003) indeed estimated the heavy impact of the introduction of the Code Tabaksblat for small caps (cost of 13% of net profit) compared to mid caps (only 2% of net profit).

[4] Note that we state our hypotheses as alternative hypotheses instead of null hypotheses.

program of ArgenX (the Netherlands). Only when Galapagos discloses confidential information about its pipeline, would this have value for other biotech firms. If a biotech firm has to disclose too many details in the prospectus about development costs, development times and so on, this would allow competitors to put a value on the R&D programme (Cassimon, Engelen, Thomassen, & Van Wouwe, 2004). In a similar way confidential information about an alpha test in a software firm would provide useful information for its competitors (Cassimon, Engelen, & Yordanov, 2011). Aboody and Lev (2000) argue that as long as R&D expenditures can be immediately expensed in financial statements, little or no information can be derived by investors or competitors. However, when R&D development costs are capitalized, this would provide competitors with a lot of valuable information (Aboody & Lev, 1998). Accounting norms indeed require the capitalization of certain R&D expenditures which meet specific criteria (International Accounting Standard Board, 2005). Firms have some discretion in determining whether those criteria are met and whether R&D expenditures need to be capitalized (Shah, Liang, & Akbar, 2013). However, stricter accounting control would make this choice less flexible and would force a firm going public to disclose more information than it would otherwise prefer to share as the competitive dynamics of high-tech and knowledge-intensive industries may induce firms to voluntarily maintain a certain level of confidentiality (Himmelberg & Petersen, 1994). For instance, White, Lee, and Tower (2007) find that Australian biotech firms generally disclose less about intangible assets in their annual reports than could be expected. Bassemir and Novotny-Farkas (2018) find that financial reporting quality of young, fast growing firms that seek access to public equity markets improves around stricter accounting norms. As such, Bukh, Nielsen, Gormsen, and Mouritsen (2005) find that Danish IT and pharmaceutical firms disclose more information on intellectual capital in Danish IPO prospectuses.

Indeed, stricter disclosure requirements result in a larger and more accurate amount of firm-specific information being publicly revealed. The accounting literature shows that stronger internal control systems lead to more accurate financial statements and higher quality information for investors (Doyle, Ge, & McVay, 2007a; Hammersley, Myers, & Shakespeare, 2008). The more effective a firm's internal control is, the less noisy and more reliable the financial information becomes (Ashbaugh-Skaife et al., 2008). This is especially true for firms that are growing more rapidly, are more complex and have more intangible assets (Ashbaugh-Skaife et al., 2008; Bronson, Carcello, & Raghunandan, 2006; Doyle, Ge, & McVay, 2007b; Francis, LaFond, Olsson, & Schipper, 2005). Overall, this strand of literature suggests that more precise and harder information will show up in the prospectus due to stricter rules on internal control systems, on the quality of financial statements, and the certification by management.

These factors suggest that firms operating in high-tech and knowledge-intensive industries may suffer more from the loss of confidentiality arising from the stricter disclosure requirements (Aslan & Kumar, 2011; Yosha, 1995). Everything else equal, this should discourage them from going public after the regulatory change. Based on the above arguments, we formulate the following hypothesis:

Hypothesis 2: High-tech and knowledge-intensive (HTKIS) firms are less likely to go public after the introduction of EU SOX-like regulations.

2.2 | Valuation

The fact that the attractiveness of remaining private might have increased for small and HTKIS firms does not imply, of course, that these categories of firms have ceased to go public once disclosure requirements have been tightened. Rather, small and HTKIS firms that decide to go public provide a suitable empirical setting to assess the impact of the regulatory change on the observable outcomes of the IPO process. An important indicator in which the positive and negative effects should reflect is the valuation these firms obtain at the IPO moment. If the negative effects of increased compliance costs and the loss of confidentiality are particularly detrimental for small and HTKIS firms, respectively, the market should assign them a lower valuation after the regulatory change. Iliev (2010) documents that the increase in compliance costs caused by US SOX Section 404 has reduced the market value of small firms. As for HTKIS firms, Dambra et al. (2015) show that the number of IPOs by firms with high proprietary disclosure costs has increased once confidential communication with institutional investors before publicly filing for an IPO was permitted by the JOBS Act (the so-called testing-the-waters process). This provision has been particularly appreciated by issuers because it allows them to shield confidential information from competitors. This affirms that the enhanced disclosure requirements introduced by US SOX were perceived as potentially detrimental to this category of firms. Based on the above arguments, we formulate the following hypothesis:

Hypothesis 3: Small firms and high-tech and knowledge-intensive firms obtain a lower valuation at the IPO moment after the introduction of EU SOX-like regulations.

3 | DATA, SAMPLE AND VARIABLES

3.1 | Data and sample

Our empirical analysis is based on a sample of private and public firms, comprising the population of European private firms obtained from Amadeus during our sample period (611,143 firm-year observations). In order to avoid the inclusion of firms that do not actually face the option to go public, we build our private firm sample by imposing the following two criteria: (1) at least three consecutive years of complete financial data; (2) at least 1 € million in total assets. The threshold on size is set after considering listing requirements: for instance, the London Stock Exchange, which hosts the largest number of our sample IPOs, requires a minimum market capitalization of £700,000 to be admitted to the main market, but there are no requirements in terms of size to be admitted to the second-tier market AIM. We end up with 611,413 firm-year observations by 128,062 unique firms. Lack of independence for observations related to the same firm is controlled for by clustering standard errors at the firm level. Following Pagano et al. (1998) and Chemmanur, Signori, and Vismara (2018), after a firm goes public, it is dropped from the sample. We lag independent variables by one year in the first step regression, so that the observations for firms going public stop at the last fiscal year before the IPO.

As far as the valuation of IPO firms is concerned, our sample consists of 3,789 IPOs occurring during the period 1995–2012 on Euronext (a consortium of the Belgian, Dutch, French and Portuguese stock exchanges), Deutsche Borse (Germany), the London Stock Exchange (the United Kingdom), Nasdaq OMX (a consortium of the stock exchanges of Denmark, Estonia, Finland, Iceland, Latvia, Lithuania and Sweden), and the national stock exchanges of Austria, Cyprus, Czech Republic, Greece, Hungary, Ireland, Italy, Luxembourg, Malta, Poland, Slovakia, Slovenia and Spain. Our primary source of information is the EurIPO database, which contains IPO prospectuses and extensive information on companies that have gone public in Europe since 1995.[5] In line with previous studies, we exclude from our sample admissions to stock markets that are not accompanied by initial equity offerings, re-admissions, listings of companies that are already listed on other stock markets, and IPOs by investment entities. The composition of the sample is presented in Table 2. We define small firms as those having pre-IPO annual sales (inflation-adjusted) below the sample median. HTKIS firms are defined based on the Eurostat (2009) classification, that categorizes manufacturing industries as high-tech, medium-tech, or low-tech, according to their technological intensity (R&D expenditure/value added), while services are aggregated into knowledge-intensive services and less knowledge-intensive services, based on their share of tertiary-educated persons. These firms account for 57.1% of our sample. There is a partial overlap between the two categories, since 1,199 firms (31.6% of the sample) are both small and HTKIS. We take this aspect into account by controlling for firm size and the HTKIS status simultaneously in all our multivariate analyses.

[5] See Vismara, Paleari, and Ritter (2012, Appendix A.1) for a description of the EurIPO database.

TABLE 2 Sample composition

	All IPOs	Firm size (sales, €m)		Small firms (below median sales)		High-tech & knowledge-intensive	
	no.	mean	median	no.	%	no.	%
Euronext	783	347.1	14.0	460	58.7	476	60.8
Deutsche Borse	606	306.2	22.1	287	47.4	408	67.3
London Stock Exchange	1,956	348.5	15.8	1,023	52.3	1,063	54.3
Others	444	379.7	58.0	124	27.9	215	48.4
Total	3,789	345.1	19.5	1,894	50.0	2,162	57.1

Note: This table shows sample composition of 3,789 IPOs taking place in Europe (Euronext, Deutsche Borse, London Stock Exchange, and Others – i.e. Athens, Budapest, Cyprus, Dublin, Ljubljana, Luxembourg, Madrid, Malta, Milan, Nasdaq OMX, Prague, Warsaw and Wien stock exchanges) during 1995–2012. Firm size is pre-IPO annual sales in euro millions. Small firms have pre-IPO annual sales below the sample median. High-tech & knowledge-intensive services (HTKIS) firms are IPOs conducted by firms belonging to HTKIS industries, as defined by the Eurostat (2009) sectorial classification.

3.2 | Methodology and variables

In our analysis, we first test Hypotheses 1 and 2, on the impact of SOX-like provisions on a private firm's likelihood of going public. Following Pagano et al. (1998), we run a probit regression where the dependent variable is a dummy equal to 0 if a firm stays private, and equal to 1 if it goes public in a given year. After a company goes public, it is dropped from the sample. The explanatory variable is EU SOX, a step dummy equal to 1 after the introduction of the new EU SOX-like regulations. This variable is then interacted with our focal variable firm size (the natural logarithm of pre-IPO annual sales adjusted for inflation)[6] and a dummy variable identifying HTKIS firms (equal to 1 for firms belonging to a high-technology or knowledge-intensive industry, as defined by Eurostat's sectorial classification in Eurostat, 2009). The coefficient of the interaction between EU-SOX and firm size will allow us to test Hypothesis 1, while the coefficient of the interaction between EU-SOX and HTKIS firms will allow us to test Hypothesis 2.

Additionally to the two moderating variables, namely firm size and HTKIS, the specification of our model includes the following control variables: firm age (the natural logarithm of 1 plus age in years, calculated from the year of foundation), the firm's profitability (the profit or loss before taxation, divided by total assets), firm leverage (the book value of debt divided by the book value of equity), and industry Q (Tobin's Q implied by the offer price of firms going public in the same industry (3-digit SIC) and year as those of the private firm).

Finally, Gao et al. (2013) and Ritter et al. (2013) point at increasing economies of scope over time, namely the advantage for small firms to sell out to a larger organization rather than to grow independently via IPO, as the primary motivation for the decline in IPO activity, which is concentrated among small firms. Part of the decline in the annual numbers of IPOs may be due to a structural shift that has lessened the profitability of small independent companies relative to their value as part of a more established organization (Ritter, 2011). To capture this effect in a private firm's going public decision, we include the following three measures: stock return, defined as the one-year return of the main equity index of the country's stock exchange; M&A activity, defined as the percentage variation in the annual number of completed M&A transactions involving a target incorporated in the same country and operating in the same industry (3-digit SIC) as those of the private firm; and time trend, which equals one for the first year of the sample and increases by one unit

[6] Given the time span and the countries covered by our sample, as well as the crucial role played by firm size as explanatory variable, we adjust sales to account for the effect of consumer price inflation over time and across countries. As inflation measure, we use the Harmonised Indices of Consumer Prices (HICP) available in the Eurostat database, and set the final year of our sample (2012) as reference year.

for each year onwards. Industry (3-digit SIC), year, and country fixed effects are also included. Details on all variable definitions are reported in Appendix A.

Next, we test Hypothesis 3 about the effect on IPO valuation by controlling for possible endogeneity in the IPO decision. Since the introduction of SOX-like provisions may affect a private firm's likelihood of going public, possible changes in valuation may be due to a change in the nature of firms that are admitted to the stock market afterward, rather than to the direct effect of the regulatory intervention on the two indicators. For instance, one could argue that, due to stricter corporate governance practices and enhanced disclosure requirements, the average quality of the firms going public after the regulatory change has increased, with potential effects on the observed valuation of IPOs. In line with previous studies addressing selection issues in the IPO setting (e.g., Bayar & Chemmanur, 2012), we employ a Heckman two-step procedure. This methodology allows us to correct for the selectivity bias that may arise due to the effect that the SOX-like regulatory change (and other unobservable factors, such as the quality of the firm) may exert both on the treatment selection, i.e., the IPO decision, and on the treatment outcome, i.e., the valuation of firms that go public.

The first step models a private firm's likelihood of going public through the probit model described above. The inverse Mills' ratios, aimed at correcting for selectivity bias, are then included in the second step, which consists of cross-sectional regressions on IPO valuation. In this first stage, the second-tier markets variable is now used as an identification variable. It is defined as the number of second-tier markets open in each country-year based on Bernstein, Dev, and Lerner (2018) and Vismara, Paleari, and Ritter (2012). This variable allows identification because the opening of a new second-tier market, typically characterized by looser admission criteria than those of an official market, exogenously increases a private firm's likelihood of going public. In other words, the pool of IPO candidates is enlarged in the presence of more second-tier markets in which to go public. Thus, it should predict a private firm's IPO decision.

The dependent variables of the Heckman's second step aimed at testing Hypotheses 3 is the industry-adjusted Tobin's Q. Tobin's Q is defined as the ratio of the market value of assets to the book value of assets, where market value is the sum of the book value of assets and the market value of common stock (calculated using the offer price) minus the book value of common equity. The industry-adjusted value is obtained by subtracting the average Tobin's Q of all listed firms in the same industry (3-digit SIC) and year from the Tobin's Q of the focal firm. The three explanatory variables of interest are the EU-SOX dummy; firm size (the natural logarithm of pre-IPO annual sales adjusted for inflation); and the HTKIS dummy (equal to 1 for firms belonging to a high-technology or knowledge-intensive industry, as defined by Eurostat's sectorial classification in Eurostat, 2009), as previously defined. Our model will be estimated on the full sample of 3,789 IPOs occurring during the period 1995–2012, where the EU-SOX dummy variable will be interacted with firm size and the HTKIS dummy. The coefficient of both interaction terms will allow us to test Hypothesis 3.

We then employ a set of control variables that previous studies found to be significant determinants of our dependent variables. Firm age (the log of one plus the age in years of the firm at the IPO moment) is included as a proxy for the risk of the IPO firm (Ritter, 1984). Since reputable underwriters can influence the IPO valuation and post-IPO performance of the companies they take public, we include underwriter reputation (defined as the lead underwriter's market share in terms of IPO proceeds raised in the four main European stock exchanges – Euronext, Frankfurt, London, Milan – during our sample period, as in Migliorati & Vismara, 2014). A similar role is found to be played by venture capitalists (Megginson & Weiss, 1991), for which we control by including a venture capital (VC) backing dummy that equals 1 in case a VC is among the firm's pre-IPO shareholders, and 0 otherwise. The fraction of primary shares is an important proxy of the shareholders' attitude towards the going public decision, that may affect IPO outcomes (Leland & Pyle, 1977) as well as other types of equity offerings (Vismara, 2016). Thus, we include dilution, defined as the number of primary shares included in the offer at the IPO moment divided by the number of outstanding shares prior to the IPO. We also control for a firm's capital structure by including leverage (James & Wier, 1990), computed as the ratio between pre-IPO book values of total debt and equity, and for market conditions by including pre-IPO market return, defined as the average daily return of the stock exchange index where the company goes public over the 30 days prior to IPO (Lowry & Murphy, 2007).

Formally, we first implement stage one by estimating the following equation (probit):

$$P_{it} = \beta_0 + \beta_1 EU\ SOX_{it} + \beta_2 EU\ SOX_{it} \cdot Size_{it} + \beta_3 EU\ SOX_{it} \cdot HTKIS_{it} + \bar{\beta} Z_{it} + \gamma\ Second\_tier\ markets_{it} + \alpha_t + \theta_j + \vartheta_k + \varepsilon_{it} \quad (1)$$

where P_{it} is the dichotomous dependent variable in the first stage (selection equation), equal to 1 for firms that go public in year t, and 0 otherwise; Z_{it} is the set of control variables (firm size, HTKIS, firm age, profitability, leverage, industry Q, stock return, M&A activity, time trend); second-tier markets is the first stage instrument; α_t, θ_j and ϑ_k are year, industry and country fixed effects, respectively; ε_{it} is the error term. We then implement stage two by estimating the following equation (OLS):

$$Q_i = \delta_0 + \delta_1 EU\ SOX_i + \delta_2 EU\ SOX_i \cdot Size_i + \delta_3 EU\ SOX_i \cdot HTKIS_i + \delta_4 IMR_i + \bar{\delta} W_i + \alpha_t + \theta_j + \vartheta_k + \varepsilon_i \quad (2)$$

where Q_i is the dependent variable in the second stage (outcome equation), namely industry-adjusted Tobin's Q, observable only for firms that went public, i.e., with $P_i = 1$ in the first equation; IMR_i is the inverse Mills' ratio, estimated from the first step regression; W_i is the set of control variables in the second stage (firm size, HTKIS, firm age, underwriter reputation, VC backing, IPO dilution, leverage, pre-IPO market return, M&A activity); α_t, θ_j and ϑ_k are year, industry and country fixed effects, respectively; ε_i is the error term.

3.3 | Descriptive statistics

Table 3 shows descriptive statistics of these variables in our sample of IPOs, by distinguishing between pre- and post-EU SOX periods, between small and large firms, and between HTKIS and other firms, while the correlation matrix and the variance inflation factors (VIFs) are reported in Appendix B. Panel A suggests that the introduction of EU SOX-like provisions had a significant effect on IPO valuation, as the industry-adjusted Tobin's Q of companies going public before and after the regulatory changes shifted from 0.9 to 0.7, on average. Although such a sizeable difference is consistent with a mitigating role of the new regulations, the technology bubble of the late 1990s (for which we perform robustness tests in Section 5) certainly contributed to inflated pre-EU-SOX values. While the size of the companies going public does not change significantly after the introduction of the new regulation, the fraction of IPOs conducted by HTKIS firms slightly decreases (from 59.1% to 55.0%). Panel B shows that the industry-adjusted Tobin's Q is significantly higher among small firms (1.1 vs. 0.5), and the fraction of HTKIS firms is more substantial (63.3% vs. 50.9%). Panel C reports that HTKIS firms receive significantly higher valuations at the IPO moment (0.9 vs. 0.6 industry-adjusted Tobin's Q). These firms tend to access the public equity market earlier (11.6 vs. 15.4 years old), are more VC-backed (49.0% vs. 41.8%), and are less indebted (20.1% vs. 32.8% leverage) than the rest of the sample.

The sample of 3,789 IPO-firms is compared with a sample of 128,062 private firms selected as described in the previous section. Table 4 reports the comparative statistics. This univariate analysis reveals that, on average, firms that decide to go public are significantly larger in size, younger in age, less profitable, and more leveraged than those remaining private. This corroborates the recent findings of Drobetz, Janzen, and Meier (2019) who report differences in investment and financing decisions of private and public firms. For instance, private firms have less capital, use more short-term debt financing, smooth dividend payments less, and are less cash flow sensitive than public firms.

TABLE 3 Descriptive statistics

	Pre-EU SOX (1,858 IPOs)		Post-EU SOX (1,931 IPOs)		Difference Pre-post SOX	
Panel A. EU SOX	*mean*	*median*	*mean*	*median*	*mean*	*median*
Industry-adjusted Q	0.9	0.3	0.7	0.1	0.2**	0.2***
Firm size (sales, €m)	426.6	18.3	266.7	21.7	159.9	−3.4
HTKIS (%)	59.1	100.0	55.0	100.0	4.1**	0.0**
Firm age (years)	15.1	9.0	11.4	5.0	3.7***	4.0***
Underwriter reputation	1.5	0.6	1.1	0.4	0.4***	0.2**
VC backing (%)	42.8	0.0	48.9	0.0	−6.1***	0.0***
IPO dilution (%)	30.4	25.8	38.8	30.2	−8.4***	−4.4***
Leverage	23.8	13.9	27.1	13.3	−3.3***	0.6**
Pre-IPO market return (%)	0.03	0.04	0.03	0.06	0.00	−0.02
	Small firms		Large firms		Difference	
Panel B. Firm size	(1,894 IPOs)		(1,895 IPOs)		Small - Large firms	
Industry-adjusted Q	1.1	0.5	0.5	0.1	0.6***	0.4***
Firm size (sales, €m)	5.3	3.3	684.7	68.2	−679.4***	−64.9***
HTKIS (%)	63.3	100.0	50.9	100.0	12.4***	0.0***
Firm age (years)	9.2	5.0	17.2	9.0	−8.0***	−4.0***
Underwriter reputation	0.8	0.3	1.8	1.0	−1.0***	−0.7***
VC backing (%)	46.8	0.0	45.0	0.0	1.8	0.0
IPO dilution (%)	36.4	30.0	32.9	25.0	3.5***	5.0***
Leverage	21.1	8.0	29.9	17.3	−8.8***	−9.3***
Pre-IPO market return (%)	0.02	0.05	0.04	0.05	−0.02**	0.00*
	HTKIS firms		Other firms		Difference	
Panel C. HTKIS status	(2,162 IPOs)		(1,627 IPOs)		HTKIS - Other firms	
Industry-adjusted Q	0.9	0.4	0.6	0.1	0.3***	0.3***
Firm size (sales, €m)	258.3	14.7	460.4	30.7	−202.1	−16.0**
Firm age (years)	11.6	6.0	15.4	7.0	−3.8***	−1.0***
Underwriter reputation	1.3	0.4	1.3	0.4	0.0	0.0
VC backing (%)	49.0	0.0	41.8	0.0	7.2***	0.0***
IPO dilution (%)	34.5	28.0	34.9	27.2	−0.4	0.8
Leverage	20.1	9.0	32.8	18.7	−12.7***	−9.7***
Pre-IPO market return (%)	0.03	0.05	0.03	0.05	0.0	0.0

Note: This table shows descriptive statistics of the sample of 3,789 IPOs occurring in Europe (Euronext, Deutsche Borse, London Stock Exchange, and Others – i.e. Athens, Budapest, Cyprus, Dublin, Ljubljana, Luxembourg, Madrid, Malta, Milan, Nasdaq OMX, Prague, Warsaw and Wien stock exchanges) during 1995–2012. The sample is divided by: IPOs occurring before and after the introduction of the SOX-like regulatory changes in the country where the company goes public (Panel A); small and large firms, i.e. with pre-IPO annual sales below or above the sample median (Panel B); High-tech & knowledge-intensive services (HTKIS) status, i.e. IPOs conducted by firms belonging to HTKIS industries, as defined by the Eurostat (2009) sectorial classification (Panel C). All variables are defined in Appendix A. ***, ** and * indicate significance at the 1, 5 and 10 percent levels of the difference in means (*t*-test) and medians (Wilcoxon-Mann-Whitney) between the two groups.

TABLE 4 Private and IPO firms

	Go public 3,789 obs.		Stay private 128,062 obs.		Difference Public - private	
	mean	*median*	*mean*	*median*	*mean*	*median*
Firm size (sales, €m)	337.0	23.2	23.4	6.1	313.6***	(17.1***)
HTKIS (%)	57.1	100	61.0	100	−3.9***	(0.0***)
Firm age (years)	13.6	7.0	26.1	20.0	−12.5***	(−13.0***)
Profitability (%)	2.1	0.2	4.9	3.1	−2.8***	(−2.9***)
Leverage (%)	26.1	14.5	11.7	2.4	14.4***	(12.1***)
Industry Q	2.0	1.6	1.7	1.4	0.3***	(0.2***)
Stock return (%)	8.7	5.9	7.9	5.6	0.8***	(0.3***)
M&A activity (%)	11.9	12.3	2.2	1.5	9.7***	(10.8***)
Time trend	10.6	11.0	13.7	14.0	−3.1***	(−3.0***)
Second-tier markets	3.3	3.0	2.1	1.0	1.2***	(2.0***)

Note: Descriptive statistics of the samples of European private firms and IPO firms, during 1995–2012. The table shows the mean and median (in parentheses) values, with ***, ** and * indicating significance at the 1, 5 and 10 percent levels of the difference in means (*t*-test) and medians (Wilcoxon-Mann-Whitney, in parentheses) between the two groups. Variables are defined in Appendix A.

4 | RESULTS

4.1 | Going public decision

In Table 5, we report the estimates of the probit regression on the probability to conduct an IPO within the population of European private firms. Results are reported in the form of marginal effects, since no conclusions can be drawn about the sign and the significance of the interaction terms in nonlinear models (such as probit models) by examining the coefficients of the interaction terms (Ai & Norton, 2003). To draw valid inferences from the interaction variable effect, we therefore estimate the marginal effect of the interaction variable and its significance using the delta method described by Ai and Norton (2003). Model 1 is our baseline probit regression model of a firm's likelihood of conducting an IPO after the introduction of EU SOX-like regulations. To avoid the identification being driven by the non-linearity of the first step, we use the second-tier markets variable as an instrument. This variable is defined as the number of second-tier markets open in each country-year of the focal firm (Bernstein et al., 2018; Vismara et al., 2012).

A first, important finding is that there is no significant impact of the EU SOX-like regulations on the *average* private firm's likelihood of going public, as documented by the coefficient of the EU SOX dummy in Model 1. In other words, the introduction of SOX-like regulations has not affected European IPO activity at an aggregate level. This is consistent with the conclusions proposed by Gao et al. (2013) and Ritter et al. (2013) who show that the introduction of the SOX Act in the US and the corresponding SOX-like regulatory changes in Europe have not affected the IPO volume of the two regions. Next, Models 2 to 4 zoom in on the focal firms of our hypotheses, namely the impact of firm size and the HTKIS nature of firms. In Model 2, the coefficient of the interaction term between the EU SOX dummy and firm size reveals that, after the regulatory change, small firms' likelihood of going public has decreased relative to that of large firms. This confirms our Hypothesis 1 and seems to be consistent with the theory that the increased compliance costs, characterized by a fixed component that is proportionally larger for small firms, have contributed to discourage them from going public. To gauge the economic impact of the size effect, we conduct the following calculation: for a private firm at the 25th percentile of the sales distribution (equal to €4.6 million), the regulatory change has decreased

TABLE 5 Going public decision

	(1)	(2)	(3)	(4)	(5)
EU SOX	0.03	−0.06***	−0.02***	−0.00	−0.00
	(0.43)	(−5.01)	(−2.84)	(−0.90)	(−0.34)
EU SOX x Size		0.06***		0.07***	0.06**
		(10.23)		(4.97)	(2.32)
EU SOX x HTKIS			−0.07***	−0.07***	−0.05***
			(18.48)	(18.42)	(17.67)
Firm size (sales, €m)	0.09***	0.04***	0.08***	0.03***	0.03***
	(26.69)	(8.61)	(25.76)	(8.68)	(8.82)
HTKIS (%)	−0.09***	−0.10***	−0.02*	−0.02*	−0.02***
	(−7.91)	(−8.03)	(−1.91)	(−1.92)	(−3.45)
Firm age (years)	−0.09***	−0.09***	−0.09***	−0.09***	−0.09***
	(−46.09)	(−45.11)	(−44.72)	(−43.93)	(−47.26)
Profitability (%)	−0.00***	−0.00***	−0.00***	−0.00***	−0.00***
	(−5.79)	(−5.74)	(−5.84)	(−5.80)	(−5.86)
Leverage (%)	0.00***	0.00***	0.00***	0.00***	0.00***
	(3.54)	(3.55)	(3.04)	(3.06)	(3.32)
Industry Q	0.02***	0.02***	0.02***	0.02***	0.02***
	(4.13)	(4.14)	(4.92)	(4.79)	(5.23)
Stock return (%)	0.05***	0.05***	0.04***	0.05***	0.06***
	(3.75)	(3.71)	(3.66)	(3.70)	(3.95)
M&A activity (%)	0.03***	0.02***	0.02***	0.02***	0.01***
	(8.02)	(8.00)	(7.97)	(7.95)	(8.75)
Time trend					−0.02***
					(25.15)
Second-tier markets	0.02***	0.02***	0.02***	0.02***	0.01***
	(8.81)	(8.83)	(8.84)	(8.84)	(6.94)
Year fixed effects	Yes	Yes	Yes	Yes	No
Industry fixed effects	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes
Pseudo R-squared	0.745	0.746	0.748	0.760	0.672
Unique firms (obs.)	(611,143)	(611,143)	(611,143)	(611,143)	(611,143)

Note: Table 5 shows probit regressions on the likelihood of going public of the sample of 611,143 firm-year observations during 1995–2012. The dependent variable is equal to 1 in case a firm goes public in a given year (after going public, the firm is dropped from the sample). Marginal effects and Z-statistics (in parentheses) are reported. Interaction terms are computed using the delta method (Ai & Norton, 2003). All independent variables (except EU SOX) are lagged by one year. Independent variables are defined in Appendix A. Industry (3-digit SIC), year, and country fixed effects are included when reported. Standard errors are clustered at the firm level. ***, ** and * indicate significance at the 1, 5 and 10 percent levels, respectively.

the likelihood of going public by 13% compared with a firm at the 75th percentile of the sales distribution (equal to €51.8 million).[7]

[7] Since the size variable is in logarithm, we need to consider the difference between the log of sales of the firm at the 25th percentile and the log of sales of the firm at the 75th percentile, which equals 2.23. By multiplying this difference with the marginal effect of the interaction term, we obtain the economic impact: 2.23*0.06 = 0.13.

In Model 3, the coefficient of the interaction term between the EU SOX and HTKIS dummies is negative and significant. This reveals that, after the regulatory change, HTKIS firms have become on average less likely to go public. Again, this seems to be consistent with our hypothesis that enhanced disclosure requirements are perceived as potentially detrimental for firms with higher proprietary disclosure costs. In terms of economic magnitude, the marginal effects indicate that the introduction of EU SOX decreases HTKIS firms' likelihood of going public by 7%, on average, compared with a non-HTKIS firm. The two above results are completely new to the literature, and persist also when tested together in Models 4 and 5.

In line with the univariate results, the coefficients of the control variables show that firm size and leverage are positively associated with a firm's likelihood of conducting an IPO. While the positive effect of size on a private firm's likelihood of going public is largely predictable, the evidence on leverage is similar to that of Aslan and Kumar (2011) for UK firms and is consistent with private firms' need to rebalance their capital structure, possibly after exhausting their debt capacity. On the other hand, age and profitability are negatively associated with the IPO likelihood. The evidence on firm age is consistent with Chemmanur et al. (2018) who find that younger firms, typically facing greater growth options than older firms, are more likely to go public, while that on profitability is in contrast with Pagano et al. (1998) who find a positive relationship between a private firm's ROA and its likelihood of going public. Since IPOs in our setting tend to be conducted by relatively young firms, they could still be struggling with generating positive earnings due to their focus on growth, which could explain the difference. At the same time, more profitable companies may need less external equity. As expected, the probability to go public increases also with the valuation received by IPO firms operating in the same industry, which indicates the presence of favorable windows of opportunity, and with the number of second-tier markets open in the current year, which confirms the validity of our instrument. Finally, the significant coefficients of the M&A activity and time trend variables document that the economies of scope effect matters to firms facing the IPO decision. In particular, the negative coefficient of the time trend variable, estimated in Model 5 without year fixed effects due to collinearity issues, confirms that, after controlling for other important determinants of the IPO decision, private firms' likelihood of going public has decreased over time.

4.2 | Valuation

Table 6 reports the results of the second step estimation on IPO valuation, measured by the industry-adjusted Tobin's Q implied by the IPO price. The unreported first step estimation is the same model as in Table 5, and generates the Mills' ratio that is included among the second step regressors in order to correct for the selectivity bias associated with the IPO decision. In the second step, we first run a baseline model aimed at estimating the influence of the determinants of our dependent variables (Model 1), and assess whether their impact varies after the introduction of EU SOX-like regulatory changes by splitting the sample accordingly (Models 2 and 3). Second, we test the hypothesis of the effects of the regulatory changes on small firm IPOs by adding an interaction term between the EU SOX and firm size variables (Model 4), and split the sample between small and large firms (Models 5 and 6). Third, we test the effects on HTKIS firm IPOs by adding an interaction term between the EU SOX and HTKIS variables (Model 7), and split the sample between HTKIS and other firms (Models 8 and 9). Finally, we jointly test these effects on the whole sample (Model 10). All regressions control for industry, year, country and market fixed effects.

The evidence shows that, at an aggregate level, the regulatory changes have not exerted any influence on the valuation of the *average* company going public, as documented by the insignificant coefficient of the EU SOX dummy (Model 1). Firm size is an important determinant of IPO valuation, which is relatively higher for small firms. Our hypothesis predicts that small firms receive a lower valuation at the IPO after the regulatory change, relative to large firms, while HTKIS firms experience a lower valuation.

We find that the interaction term between EU SOX and firm size is positive and significant, although at the 10% level (Model 4), suggesting that small firms receive lower valuations at the IPO moment after the regulatory change. Evidence from the sample split is also consistent, as the coefficient of the EU SOX dummy is negative and significant among small firms (Model 5), while it turns positive and significant among large firms (Model 6). The coefficient in

TABLE 6 Heckman's second step on IPO valuation

	Pre- vs. Post-SOX			Small vs. Large firms			HTKIS vs. Others			All
	All	Pre	Post	All	Small	Large	All	HTKIS	Other	sample
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
EU SOX	0.10			−1.31*	−0.07**	0.24***	0.16	−0.08**	0.13	−1.19
	(1.13)			(−1.71)	(−2.31)	(2.74)	(1.44)	(−2.24)	(1.03)	(−1.52)
Firm size	−0.47***	−0.56***	−0.43***	−0.56***	−0.21***	−0.28***	−0.57***	−0.60***	−0.53***	−0.61***
	(−18.32)	(−13.77)	(−12.22)	(−14.81)	(−2.88)	(−8.43)	(−18.32)	(−14.38)	(−11.49)	(−14.42)
HTKIS	0.13	0.10	0.17	0.13	0.12	0.03	0.17*			0.14
	(1.62)	(0.89)	(1.41)	(1.62)	(0.89)	(0.44)	(1.79)			(1.36)
EU SOX × Size				0.09*						0.09*
				(1.84)						(1.74)
EU SOX × HTKIS							−0.13***			−0.09**
							(−2.90)			(−2.08)
Firm age	−0.08**	−0.09*	−0.05	−0.08**	−0.16**	−0.01	−0.08**	−0.07	−0.09*	−0.08**
	(−2.25)	(−1.95)	(−0.94)	(−2.27)	(−2.45)	(−0.27)	(−2.25)	(−1.61)	(−1.80)	(−2.27)
Underwriter reputation	0.14***	0.15***	0.11***	0.14***	0.08**	0.13***	0.14***	0.14***	0.14***	0.14***
	(6.04)	(5.08)	(2.86)	(6.04)	(2.21)	(6.35)	(6.04)	(4.80)	(3.80)	(6.04)
VC backing	−0.04	−0.04	−0.08	−0.04	−0.00	−0.01	−0.04	0.04	−0.19	−0.04
	(−0.52)	(−0.42)	(−0.68)	(−0.53)	(−0.00)	(−0.19)	(−0.52)	(0.44)	(−1.57)	(−0.53)
IPO dilution	−0.03***	−0.05***	−0.02***	−0.03***	−0.05***	−0.01**	−0.03***	−0.03***	−0.03**	−0.03***
	(−4.59)	(−3.05)	(−3.67)	(−4.60)	(−4.35)	(−2.26)	(−4.59)	(−3.83)	(−2.04)	(−4.59)
Leverage	−0.06	−0.08	0.01	−0.06	0.17	−0.34**	−0.06	0.16	−0.31*	−0.06
	(−0.46)	(−0.41)	(0.08)	(−0.47)	(0.75)	(−2.14)	(−0.46)	(0.83)	(−1.68)	(−0.47)

(Continues)

TABLE 6 (Continued)

	Pre- vs. Post-SOX			Small vs. Large firms			HTKIS vs. Others			All
	All	Pre	Post	All	Small	Large	All	HTKIS	Other	sample
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Pre-IPO market return	0.37	0.63	0.50	0.37^{*}	0.84^{*}	0.49	0.37	0.62	0.20	0.37
	(0.73)	(0.96)	(0.59)	(1.73)	(1.83)	(1.04)	(0.73)	(0.93)	(0.26)	(0.73)
M&A activity	−0.01	−0.00	−0.05	−0.01	−0.00	−0.01	−0.01	−0.02	0.01	−0.01
	(−0.59)	(−0.24)	(−1.07)	(−0.59)	(−0.16)	(−0.68)	(−0.58)	(−0.81)	(0.38)	(−0.59)
Mills' ratio	-0.02^{**}	-0.04^{**}	-0.03^{*}	-0.02^{**}	-0.06^{**}	-0.05^{***}	-0.02^{**}	-0.04^{**}	−0.01	-0.03^{**}
	(−2.10)	(−2.29)	(−1.86)	(−2.11)	(−2.37)	(−2.64)	(−2.15)	(−2.34)	(−1.47)	(−2.22)
Constant	2.30^{***}	2.79^{***}	2.67^{***}	2.73^{***}	1.21^{***}	1.06^{***}	2.25^{***}	2.42^{***}	1.64^{***}	2.37^{***}
	(19.18)	(15.11)	(9.16)	(15.93)	(6.48)	(8.83)	(19.13)	(15.42)	(12.05)	(15.78)
Observations	3,789	1,858	1,931	3,789	1,894	1,895	3,789	2,162	1,627	3,789
Wald Chi-squared	525.34	341.82	225.94	529.39	68.33	256.03	526.24	338.74	190.38	530.01

Note: Heckman's second step regression on industry-adjusted Tobin's Q (winsorized at 1%). Mills' ratios are obtained from the first step estimation reported in Table 5. Independent variables are defined in Appendix A. Pre-(post-) SOX IPOs occur before (after) the introduction of the SOX-like regulatory change in the country where the company went public. Small (large) firms have pre-IPO annual sales below (above) the sample median. HTKIS are IPOs conducted by high-tech and knowledge-intensive firms, as defined by the Eurostat (2009) sectorial classification. Industry (3-digit SIC), year, and country fixed effects are included. ***, ** and * indicate significance at the 1, 5 and 10 percent levels, respectively.

Model 5 reveals that small firms suffer from a 0.07 decrease in industry-adjusted Tobin's Q at the IPO moment (holding all other variables constant), which corresponds to a 6% decrease from the pre-EU SOX average valuation (equal to 1.17).[8]

As for HTKIS firms, the coefficient of the interaction term between the EU SOX and the HTKIS dummy is negative and significant, documenting that HTKIS firms also experience a lower IPO valuation (Model 7). Coherently, by splitting the sample between HTKIS and other firms, we find that the coefficient of the EU SOX dummy is negative and significant only among HTKIS firms (Model 8), while it is not statistically different from zero in the rest of the sample (Model 9). The magnitude of the coefficient on Model 8 reveals that HTKIS firms suffer from a 0.08 decrease in the industry-adjusted Tobin's Q at the IPO, which corresponds to an 8.5% decrease from the pre-EU SOX average (equal to 0.94).

All these effects persist in the full model specification (Model 10), where the coefficients of the interaction terms between the EU SOX dummy and the firm size and HTKIS variables are positive and negative, respectively. Overall, the evidence is consistent with our hypothesis that the stricter disclosure requirements imposed by the new EU SOX-like rules have worsened the IPO valuation of small firms and HTKIS firms, relatively to other types of firm.

5 | ADDITIONAL ANALYSES AND ROBUSTNESS TESTS

This section provides additional ad-hoc analyses and presents an alternative method and specification to test for the robustness of our empirical results. First, we challenge our results against an alternative hypothesis. Second, we corroborate our findings by analyzing the trend in foreign companies' IPOs. Then, we present our robustness tests. We start with a regression discontinuity design, then we check for the impact of non-overlapping periods and the shift of entry of the enactment of the new rules. We furthermore test for different proxies for proprietary disclosure and information asymmetry. Finally, we check whether our results are driven by second market IPOs and bubble years.

5.1 | Economies-of-scope hypothesis

First, we challenge our results by testing the economies of scope hypothesis introduced by Gao et al. (2013), which acknowledges that there has been a decline in the frequency of IPOs in the US, especially by small firms. According to this hypothesis, there are advantages in selling out to a larger organization, and these benefits have increased over time. Ritter et al. (2013) document a similar trend in the decline in European IPOs and attribute the decline in IPO volume and market valuations to both the economies of scope hypothesis and negative market conditions in Europe.

To challenge our results against this view, we present the results in Table 7, reporting estimates of time-series regressions with residuals following an AR(1) process, where the dependent variable is the scaled IPO volume, defined as the number of IPOs scaled by real GDP, measured in € trillions of 2012 purchasing power. We use the same set of control variables as Gao et al. (2013), including the time trend variable (which is used by the authors to test the economies of scope explanation), plus the following three indicators: (i) M&A growth, as a further proxy for the effect of economies of scope; (ii) Euromid Index, as a proxy for market conditions; and (iii) the EU SOX dummy, to test any effect of the change in legislation. M&A growth [t−1, t] is the percentage variation in the number of completed M&A transactions from the previous quarter, involving a target incorporated in one of our sample countries. We choose this variable because the economies of scope hypothesis predicts that the benefits to small firms to become part of a large organization (namely, being acquired) have increased over time relative to the scenario in which small firms try to grow and survive as stand-alone firms. This implies that M&As may serve as a substitute growth channel to IPOs. In

[8]Given that the average IPO valuation of a small firm in our sample, pre-SOX, was equal to €37.2 million euro, this coefficient implies a €2.2 million loss. Our estimate lies in the range of estimates in former literature, which we report in Section 2.1.1, ranging from €1.2 to 4.2 million.

TABLE 7 Robustness tests: IPO volume

	All IPOs			IPOs by foreign firms		
	All markets	Regulated markets	Second-tier markets	All markets	Regulated markets	Second-tier markets
	(1)	(2)	(3)	(4)	(5)	(6)
EU SOX	−11.41*	−2.58*	−8.83	0.67*	−0.39**	1.06***
	(6.36)	(−1.76)	(5.56)	(1.91)	(−2.56)	(3.00)
Time trend	−0.66***	−0.18***	−0.48***	−0.03***	0.01**	−0.04***
	(0.16)	(−5.17)	(0.14)	(−3.43)	(2.15)	(−4.14)
M&A growth [*t*−1, *t*]	−0.30**	−0.07*	−0.23**	−0.01	0.00	−0.01
	(0.13)	(−1.76)	(0.11)	(−1.02)	(0.81)	(−1.49)
Real GDP growth [*t*, *t*+3]	1.97***	0.24**	1.73***	0.08**	0.03*	0.05
	(0.53)	(2.18)	(0.53)	(2.03)	(1.92)	(1.03)
Initial IPO return (*t*−1)	0.28***	0.03	0.25***	0.01	0.00*	0.00
	(0.10)	(1.47)	(0.09)	(1.15)	(1.94)	(0.63)
M/B small firms (*t*−2)	−11.59	−5.44**	−6.15	−0.50	0.00	−0.50
	(8.93)	(−2.39)	(7.95)	(−1.13)	(−0.01)	(−1.00)
EuroMid return [*t*−2, *t*−1]	−0.20	−0.03	−0.17	−0.01	0.00	−0.01
	(0.13)	(−0.92)	(0.10)	(−1.40)	(−0.04)	(−1.30)
EuroMid future return [*t*+1, *t*+4]	0.18***	0.03**	0.15***	0.01	0.00	0.00
	(0.06)	(2.26)	(0.05)	(1.21)	(1.27)	(0.79)
% of small firms with EPS ≥ 0 (*t*−1)	0.07	−0.20*	0.27	0.01	−0.01	0.01
	(0.49)	(−1.70)	(0.43)	(0.25)	(−0.59)	(0.48)
Quarter 1 dummy	−6.96*	−1.96**	−5.00	0.02	−0.01	0.03
	(3.84)	(−2.25)	(3.42)	(0.09)	(−0.13)	(0.16)
EuroMid Index	37.30***	7.86***	29.43***	1.06***	0.06	1.01***
	(5.03)	(5.87)	(4.41)	(3.65)	(0.65)	(3.43)
AR(1) coefficient	0.72***	−0.30	0.81***	0.40**	0.34**	0.44***
	(5.55)	(−1.33)	(8.78)	(2.56)	(2.08)	(2.89)
Observations	72	72	72	72	72	72
R-squared	0.78	0.71	0.81	0.48	0.35	0.51
Durbin-Watson statistics	2.07	1.94	2.03	2.37	2.46	2.27

Note: Time-series regressions using maximum likelihood estimation with residuals following an AR(1) process. The dependent variable is scaled IPO volume, defined as the number of IPOs scaled by real GDP, measured in € trillions of 2012 purchasing power. Data are on a quarterly basis. Models 1–3 consider all our sample IPOs, while Models 4–6 considers only IPOs by non-EU and non-US firms. Models 2 and 5 consider IPOs on regulated markets only, and Models 3 and 6 consider IPOs on second-tier markets only. EU SOX equals 1 starting from the second quarter of 2002, when the implementation of SOX-like regulatory changes began in Europe with the introduction of The German Corporate Governance Code by German authorities. Time Trend equals 1 for Q1 1995 and increases by 1 for each quarter onwards until Q4 2012. M&A growth [*t*−1, *t*] is the percentage variation in the number of completed M&A transactions from the previous quarter, involving a target incorporated in one of the sample countries. Real GDP growth [*t*, *t*+3] is the percentage growth in real GDP from quarter *t* to quarter *t*+3, downloaded from Eurostat. Initial IPO return (*t*−1) is the average first-day percentage return of sample IPOs in quarter *t*−1, defined as the difference between the first-day closing price and the offer price divided by the offer price. M/B for small firms (*t*−2) is the market-to-book ratio of small firms (defined as less than €250 million in annual sales using €2012), calculated as the sum of market value of small firms divided by the sum of book value of small firms, measured at quarter *t*−2. EuroMid return [*t*−2, *t*−1] is the FTSE EuroMid Index percentage return from quarter *t*−2 to *t*−1. EuroMid future return [*t*+1, *t*+4] is the FTSE EuroMid Index percentage return in quarter *t*+1 to *t*+4. Percentage of small firms with EPS≥0 (*t*−1) is the percentage of firms with at least three years of trading history that have non-negative EPS in quarter *t*−1 (small firms are with less than €250 million in annual sales using €2012). Quarter 1 dummy is a first-quarter dummy that equals one in the first quarter of each year, and zero otherwise. EuroMid Index is the value of the FTSE EuroMid equity index scaled at 1 in Q1 1995. AR(1) is the lagged error term. T-statistics are in parentheses below the coefficients. ***, ** and * indicate significance at the 1%, 5% and 10% level respectively.

Model (1) we regress the scaled number of IPOs on all markets, in Model (2) only on regulated markets, and in Model (3) only on second-tier markets.

Our results show that the M&A growth variable, measuring for potential economies of scope, has a negative coefficient, consistent with the economies of scope hypothesis, as firms tend to consider going public and being acquired as substitute growth options. By contrast, the negative effect of EU SOX is weakly present only among regulated market IPOs, where regulation is stricter, and not significant among second-tier market IPOs. Overall, the evidence documents that the economies of scope explanation does play a role, as confirmed by the negative coefficients of the time trend and M&A growth variables, but the introduction of EU SOX-like legislation does not harm aggregate IPO activity. This is consistent with our evidence in Table 5 that, on average, the regulatory change has not significantly affected a private firm's likelihood of going public. What we find is instead that such likelihood has decreased among small and HTKIS firms following the change in legislation. In other words, we are not arguing that EU-SOX regulations are to blame for the decline in IPO activity, but that the regulations have made the IPO less likely among certain categories of firms (namely, small and HTKIS firms).

5.2 | Impact on foreign companies' IPO

Although we document that SOX-like legislation has only marginally affected aggregate IPO activity, we shed further light on its effects by replicating the time-series regressions implemented in the previous section to assess the impact on IPOs by foreign companies. The idea is that these regulatory changes might have decreased the attractiveness of European markets as a possible IPO destination of foreign firms that are exempt from SOX provisions in their home country. To this extent, we employ the scaled number of IPOs by firms incorporated in countries that are exempt from SOX-like provisions (i.e., firms neither Europe nor the US) as dependent variable. Again, in Model (4) we regress the scaled number of IPOs on all markets, in Model (5) only on regulated markets, and in Model (6) only on second-tier markets. Our evidence is that post-SOX IPO volume in Europe, originated by foreign firms, decreased in regulated markets but increases in second-tier markets, consistent with a lower attractiveness of markets subjected to the regulatory tightening.

5.3 | Regression discontinuity design

To rule out the hypothesis that the changes in the likelihood to go public, as well as in IPO valuation, after the introduction of the EU SOX are driven by overlapping general trends, rather than caused by the regulatory change itself, we adopt a Regression Discontinuity Design (RDD).[9] The RDD approach consists in a quasi-experimental technique that uses ex-post data to evaluate a programme's impact in a context where units are considered treated or not according to a certain threshold in a reference variable, called the forcing variable. This methodology is particularly suitable to study the effects of regulatory changes because it allows us to isolate the effects of EU SOX from those of a changing business climate and other confoundings, contemporaneous events that would have affected all firms. Our forcing variable is the listing date: when it follows the enactment of the EU SOX, we expect the effects of the regulatory change on IPO valuation to come into play. Following Imbens and Lemieux (2008), the goal is to estimate the following equations:

$$P_{it} = \beta_0 + \beta_1 EU\ SOX_{it} + \beta_2 EU\ SOX_{it} \cdot Size_{it} + \beta_3 EU\ SOX_{it} \cdot HTKIS_{it} + f\left(x_{i,T}\right) + \bar{\beta} Z_{it} + \gamma\ Second\_tier\ markets_{it} + \alpha_t + \theta_j + \vartheta_k + \varepsilon_{it} \quad (3)$$

$$Q_i = \delta_0 + \delta_1 EU\ SOX_i + \delta_2 EU\ SOX_i \cdot Size_i + \delta_3 EU\ SOX_i \cdot HTKIS_i + f\left(x_{i,T}\right) + \delta_4 IMR_i + \bar{\delta} W_i + \alpha_t + \theta_j + \vartheta_k + \varepsilon_i \quad (4)$$

[9] The RDD approach has been used in other papers in entrepreneurial finance (e.g., Kerr, Lerner, & Schoar, 2014).

where P_{it} and Q_i are the dependent variables of the first and second step equations, namely a private firm's likelihood of going public in year *t* and the industry-adjusted Tobin's Q at the IPO; $x_{i,T}$ is the forcing variable properly normalized, i.e., a time trend centred at the date of the introduction of the EU SOX; $f(x_{i,T})$ is a p-th order parametric polynomial to account for non-linearity of the relationship between the time trend and the dependent variable, and thus to control that the eventual break in $x_{i,T} = 0$ is not due to unaccounted non-linearity. The vectors of control variables in equations (3) and (4) are the same as those presented in equations (1) and (2), respectively.

In Table 8, we report the estimates of our RDD analysis, with the likelihood of going public (left-hand side) and the IPO valuation (right-hand side) as dependent variables, by including a polynomial of the time trend variable up to the third order, as in Almeida, Fos, and Kronlund (2016). Each row corresponds to a separate regression. For brevity, we only show the coefficients of our explanatory variables. Results show that the coefficients of the EU SOX variable and of its interactions with firm size and the HTKIS nature remain all significant with the expected sign. This evidence persists after accounting for both the linear and non-linear effects of time trend. Therefore, we can conclude that the changes in the likelihood of going public and the IPO valuation after the introduction of the EU SOX are significant, also when accounting for the potential changing business climate over time, or other overlapping time trends.

5.4 | Non-overlapping periods and alternative enactment dates

We test whether the probability of going public (left-hand side) and the average level of IPO valuation (right-hand side) may have been affected before or after EU SOX. Following Akyol, Cooper, Meoli, and Vismara (2014) and Christensen, Hail, and Leuz (2011), we examine the valuation patterns around the enactment dates. First, in Panel B of Table 8, we report the estimates of our regressions by changing the definition of the EU SOX variable as follows: ($t-1$) indicates that EU SOX equals one if an IPO occurs during the one-year period that ends 182 days before the enactment date of the EU SOX rules in the issuer's state of incorporation; (t) indicates that it equals one if an IPO occurs during the 1-year period surrounding the enactment date of the EU SOX; ($t-1$) indicates that it equals one if an IPO occurs more than 182 days after the enactment date of the EU SOX. Second, in Panel C of Table 8, EU SOX equals one if an IPO occurs after $t + N$, where t is the enactment date of the EU SOX rules in the issuer's state of incorporation, and N is the number of years relative to day t (integer from –3 to +3). Again, each row corresponds to a separate regression, where we only show the coefficients of our explanatory variables.

Results in Panel B show that the coefficients are significant with the expected sign only after the introduction of the EU SOX rules (post-EU SOX). This documents that changes in IPO valuation have occurred only after the regulatory intervention (and not before), consistent with the idea that this is their main cause. Results in Panel C show that, with the probability to go public (left-hand side) and the IPO valuation (right-hand side), the coefficients of the EU SOX and its interaction terms with firm size and the HTKIS nature are significant not only at the true enactment date (t), but also up to two and, in some cases, three years later, which may suggest that the extent to which the increased compliance costs brought by the regulatory change have penalized small firms has been fully assessed by the market not exactly in correspondence of the enactment date, but with a small delay. Coefficients are almost never significant before the actual regulatory change, supporting our hypothesis.

5.5 | Alternative proxies

We test whether our results are robust to alternative proxies for proprietary disclosure. Model 1 in Table 9 uses R&D-to-sales as an alternative proxy for our HTKIS dummy variable. Following Dambra et al. (2015), we define the R&D-to-sales variable as the ratio between a firm's R&D expenses and sales, and set it to zero for firms with no R&D and to one for firms with R&D greater than sales.[10] Our results show that the coefficient of the interaction term between the

[10] The correlation with the HTKIS dummy amounts to 0.138 (significant at the 1% level). Note that our sample is restricted due to different accounting treatment between UK and other European countries (Stolowy & Jeny-Cazavan, 2001).

TABLE 8 Robustness tests: regression discontinuity design, non-overlapping periods, alternative enactment dates

	IPO likelihood			Industry-adjusted Q		
	EU SOX	EU SOX × Size	EU SOX × HTKIS	EU SOX	EU SOX × Size	EU SOX × HTKIS
Panel A: Regression discontinuity design						
1-order polynomial	−0.01	0.06**	−0.05***	−1.19	0.09*	−0.10**
	(−0.35)	(2.30)	(−17.60)	(−1.49)	(1.73)	(−2.10)
2-order polynomial	−0.01	0.06**	−0.05***	−1.17	0.08*	−0.09**
	(−0.30)	(2.26)	(−16.81)	(−1.45)	(1.70)	(−2.09)
3-order polynomial	−0.00	0.06**	−0.05***	−1.16	0.07	−0.09**
	(−0.29)	(2.24)	(−16.88)	(−1.40)	(1.58)	(−2.09)
Panel B: Non-overlapping time periods around the enactment dates						
Pre-EU SOX (*t*−1)	−0.00	−0.00	−0.01	1.30	−0.04	0.15
	(−0.22)	(−0.07)	(−0.47)	(0.59)	(−0.64)	(0.61)
EU SOX (*t*)	−0.01	0.03*	−0.02*	−0.94	0.08	−0.18*
	(−1.03)	(1.86)	(−1.72)	(−1.13)	(1.09)	(−1.74)
Post-EU SOX (>*t*)	−0.01	0.05**	−0.04**	−1.84*	0.17**	−0.22**
	(−1.15)	(2.06)	(−2.27)	(−1.93)	(2.10)	(−2.45)
Panel C: Alternative enactment dates						
$t-3$	0.01	0.02	−0.01	−0.80	0.02	−0.03
	(0.95)	(0.57)	(−0.68)	(−0.22)	(0.28)	(−1.16)
$t-2$	0.00	0.03	−0.01	−0.46	0.01	−0.03
	(0.16)	(1.50)	(−0.47)	(−0.80)	(0.36)	(−1.13)
$t-1$	−0.01	0.05**	−0.05***	−0.90	0.06	−0.07*
	(−0.57)	(2.25)	(−3.34)	(−1.34)	(1.08)	(−1.76)
$t+1$	−0.01	0.06**	−0.06***	−0.99	0.07*	−0.11**
	(−1.51)	(2.29)	(−6.21)	(−1.59)	(1.77)	(−2.29)
$t+2$	−0.01	0.04*	−0.04**	−1.23	0.08**	−0.13***
	(−1.43)	(1.77)	(−2.86)	(−1.59)	(2.13)	(−2.75)
$t+3$	−0.01	0.01	−0.03*	−1.42	0.06	−0.12**
	(−1.05)	(0.60)	(−1.89)	(−1.01)	(1.40)	(−2.17)

Note: Panel A shows the results of a regression discontinuity analysis by introducing an n-order polynomial of a time trend variable centered at the enactment date of the EU SOX. Panel B uses varying definitions of the EU SOX variable as follows: (t − 1) indicates that EU SOX equals one if an IPO occurs during the one-year period that ends 182 days before the enactment date of the EU SOX in the issuer's state of incorporation; in (t), it equals one if an IPO occurs during the 1-year period surrounding the enactment date of the EU SOX; in (t − 1), it equals one if an IPO occurs more than 182 days after the enactment date of the EU SOX. Panel C uses varying definitions of the EU SOX variable as follows: $t + N$ indicates that EU SOX equals one if an IPO occurs after $t + N$, where t is the enactment date of the EU SOX in the issuer's state of incorporation, and N is number of years relative to day t; the variable equals zero otherwise. N is an integer whose value ranges from −3 to +3. Each row represents a separate Heckman two-step regression, with a probit regression on IPO likelihood as first step, and an OLS regression on industry-adjusted Tobin's Q (winsorized at 1%) as second step. For brevity, only the coefficients of the EU SOX dummy and its interactions with firm size and HTKIS variables are reported. Industry (3-digit SIC), year, and country fixed effects are included. ***, ** and * indicate significance at the 1, 5 and 10 percent levels, respectively.

EU SOX and the R&D-to-sales variable is negative and significant. This confirms our earlier findings that HTKIS firms experience a lower firm value at the moment of going public.

To provide more evidence on whether the loss of confidentiality associated with stricter disclosure requirements contribute to decrease in valuations, we introduce the Herfindahl index (HHI) in Model 2 in Table 9. The existing literature uses industry concentration as a proxy for proprietary costs (e.g., Ali, Klasa, & Yeung, 2014; Dambra, Wasley, & Wu, 2013; Harris, 1998) and finds that firms with higher industry concentration disclose less public information. Dambra

TABLE 9 Robustness tests: alternative proxies for proprietary disclosure costs

	X = R&D to sales	X = HHI index
	(1)	(2)
EU SOX × X	–0.62**	–0.34
	(–2.50)	(–1.52)
X	1.57***	–0.02
	(2.99)	(–0.24)
EU SOX	0.20	0.09
	(1.51)	(1.00)
Controls	Yes	Yes
Observations	1,956	3,789
Wald Chi-squared	219.02	324.25

Notes: Heckman's second step regression on industry-adjusted Tobin's Q (winsorized at 1%), with the firm's R&D-to-sales ratio (Model 1) and the industry (3-digit SIC)-year Herfindahl Index (Model 2) as an alternative proxy for proprietary disclosure costs. Unreported control variables are the same as those used in Table 6. Industry (3-digit SIC), year, and country fixed effects (except in Model 1) are included. ***, ** and * indicate significance at the 1, 5 and 10 percent levels, respectively.

et al. (2015) use this index to document that firms in highly concentrated industries are more likely to go public in less stringent regulatory regimes. As in Chemmanur, He, and Nandy (2010), we construct the industry HHI by summing up the square of each firm's market share (in terms of sales) at the three-digit SIC level, using the population of European firms covered by Amadeus during the sample period. However, the coefficient of the interaction term between EU SOX and HHI is negative but not significant.

5.6 | Regulated vs. second-tier markets

Another potential concern that may cast doubts on the reliability of our evidence is that our sample includes second-tier market IPOs. These markets, the most notable example of which is London's Alternative Investment Market, are designed to facilitate firms in the access to the public equity market by means of looser regulatory requirements (Vismara et al., 2012).[11] Corporate governance codes are not mandatory on second markets, but financial advisors have stronger incentives to require that the firm they are taking public meets stricter corporate governance requirements after the adoption of such codes (Akyol et al., 2014). Although we control for their presence in our multivariate analysis by including a dummy for second market IPOs, one could argue that estimating the effects of the new corporate governance codes by pooling markets with different rules may be inaccurate. We therefore repeat our hypothesis testing by restricting the sample to the 1,736 IPOs occurring on the regulated markets of the stock exchanges of our sample. Results of the second step regressions are reported in Table 10.

The evidence on IPO valuation (Model 1) is robust to the sample restriction. In particular, small and HTKIS firms suffer from a decrease in valuation after the regulatory change, as documented by the positive and negative coefficients of the two interaction terms. Further, the negative direct effect of the EU SOX dummy becomes stronger compared to the evidence obtained from the full sample, which may suggest a more detrimental effect on the valuation of companies going public in these markets. Overall, the results are consistent with our hypotheses on the effects of the introduction of EU SOX-like provisions on valuation. This documents that our evidence is robust to the exclusion of second market IPOs from the sample.

[11] Approximately half of the firms in our sample go public in London, as reported in Table 2. To ensure that our evidence is not entirely UK-driven, we repeat our Heckman two-step procedure by excluding London IPOs, and find that our results hold.

TABLE 10 Robustness tests: regulated markets and tech bubble IPOs

	Regulated markets	Bubble years excluded	
		1999–2000	1998–Feb 2000
	(1)	(2)	(3)
EU SOX	−2.84***	−0.91	−0.76
	(−3.33)	(−0.66)	(−0.55)
Firm size	−0.44***	−0.46***	−0.42***
	(−10.58)	(−9.74)	(−8.54)
HTKIS	0.26**	0.22	0.28
	(2.10)	(0.65)	(0.70)
EU SOX × Size	0.19***	0.07*	0.08*
	(3.35)	(1.77)	(1.93)
EU SOX × HTKIS	−0.18**	−0.11**	−0.11**
	(−2.48)	(−2.24)	(−2.24)
Controls	Yes	Yes	Yes
Observations	1,736	2,918	2,625
Wald Chi-squared	240.57	302.03	152.39

Notes: Model 1 reports the second step of the Heckman procedure on industry-adjusted Tobin's Q (winsorized at 1%) estimated on the subsample of regulated market IPOs. Models 2–3 exclude IPOs occurring during the tech bubble. Model 2 excludes IPOs in years 1999 and 2000. Model 3 excludes IPOs occurring in 1998, 1999, and January and February 2000. Unreported control variables are the same as those used in Table 6. Industry (3-digit SIC), year, and country fixed effects are included. ***, ** and * indicate significance at the 1, 5 and 10 percent levels, respectively.

5.7 | Bubble years

A high number of dot-com companies went public in the late 1990s. These are treated as pre-EU SOX IPOs in our study, thereby raising the concern that the decrease in valuation after the regulatory change may be driven by the 'bubble' values. To rule out this alternative explanation, we check the robustness of our results by excluding all IPOs occurring over the bubble period, identified in two ways: over years 1999 and 2000 (as in Ljungqvist & Wilhelm, 2003); and over 1998, 1999 and January–February 2000 (as in Demers & Lev, 2001). The results of the second step regressions on the restricted sample are reported in Table 10 (Models 2 and 3, respectively). Evidence on IPO valuation is consistent with previous full sample estimates, since the direct effect of the regulatory change is negative, while the interaction terms with firm size and the HTKIS status are positive and negative, respectively (Model 3).

6 | CONCLUSIONS

Going public through an IPO is an important step in the sequential financing cycle of firms. Raising capital through a stock exchange listing attracts new equity capital to finance growth and future projects, either at the moment of the IPO or seasoned equity offerings. Easy access to the stock market thus plays an important role in financing firm growth. In this article, we address the impact of the introduction of EU SOX-like provisions on the going public process of small and high-tech and knowledge-intensive services (HTKIS) firms in Europe. We test whether tightened disclosure requirements and increased compliance costs due to EU SOX-like regulations impacted small and HTKIS firms going public in Europe.

On the one hand, complying with stricter disclosure requirements is costly for small and HTKIS firms, and may potentially endanger their competitive position if rivals are able to exploit such an increased amount of publicly available information. Our evidence shows that small and HTKIS firms have become more reluctant to go public after the introduction of EU SOX-like regulations.

On the other hand, the main upside associated with this regulatory intervention is the decrease in information asymmetry faced by firm outsiders, which should ameliorate market efficiency and lower the cost at which firms are able to raise capital in the public equity market. We find that small and HTKIS firms did not experience an increase in IPO valuation. In particular, small and HTKIS firms going public after the regulatory change receive a lower valuation at the moment of the IPO. This finding is consistent with the idea that the increased compliance costs and the loss of confidentiality associated with stricter disclosure requirements have offset the benefits of lower asymmetric information for small firms and HTKIS firms. Policy-makers should assess whether more accurate pricing or access to stock market financing is more important in nurturing the economy.

ACKNOWLEDGMENTS

We would like to thank Yan Alperovych, Wolfgang Bessler, Douglas Cumming, Jongsub Lee, Michelle Lowry, Volkan Muslu, Jay Ritter, Jeroen van Raak, Bart Zhou Yueshen, Wei Wang, seminar participants at Aarhus University, and participants in the 2016 FMA meetings and 2017 ENTFIN conference for helpful comments. Research data not shared. (Paper received July 2018, revised version accepted October 2019)

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from Universoft (www.universoft.it). Restrictions apply to the availability of these data, which were used under license for this study. Data are available from the authors with the permission of Universoft.

ORCID

Andrea Signori https://orcid.org/0000-0002-7502-5451

REFERENCES

Aboody, D., & Lev, B. (1998). The value relevance of intangibles: The case of software capitalization. *Journal of Accounting Research*, *36*, 161–191.

Aboody, D., & Lev, B. (2000). Information asymmetry, R&D, and insider gains. *Journal of Finance*, *55*(6), 2747–2766.

Ahmed, A. S., McAnally, M. L., Rasmussen, S., & Weaver, C. D. (2010). How costly is the Sarbanes Oxley Act? Evidence on the effects of the Act on corporate profitability. *Journal of Corporate Finance*, *16*(3), 352–369.

Ai, C., & Norton, E. C. (2003). Interaction terms in logit and probit models. *Economics Letters*, *80*(1), 123–129.

Akyol, A. C., Cooper, T., Meoli, M., & Vismara, S. (2014). Do regulatory changes affect the underpricing of European IPOs? *Journal of Banking & Finance*, *45*, 43–58.

Alexander, C. R., Bauguess, S. W., Bernile, G., Lee, Y. H. A., & Marietta-Westberg, J. (2013). Economic effects of SOX Section 404 compliance: A corporate insider perspective. *Journal of Accounting and Economics*, *56*(2-3), 267–290.

Ali, A., Klasa, S., & Yeung, E. (2014). Industry concentration and corporate disclosure policy. *Journal of Accounting and Economics*, *58*(2), 240–264.

Almeida, H., Fos, V., & Kronlund, M. (2016). The real effects of share repurchases. *Journal of Financial Economics*, *119*(1), 168–185.

Ashbaugh-Skaife, H., Collins, D. W., Kinney, Jr, W. R., & LaFond, R. (2008). The effect of SOX internal control deficiencies and their remediation on accrual quality. *The Accounting Review*, *83*(1), 217–250.

Aslan, H., & Kumar, P. (2011). Lemons or cherries? Growth opportunities and market temptations in going public and private. *Journal of Financial and Quantitative Analysis*, *46*(2), 489–526.

Bassemir, M., & Novotny-Farkas, Z. (2018). IFRS adoption, reporting incentives and financial reporting quality in private firms. *Journal of Business Finance & Accounting*, *45*(7-8), 759–796.

Bayar, O., & Chemmanur, T. J. (2012). What drives the valuation premium in IPOs versus acquisitions? An empirical analysis. *Journal of Corporate Finance*, *18*(3), 451–475.

Benston, G. J. (1973). Required disclosure and the stock market: An evaluation of the Securities Exchange Act of 1934. *American Economic Review*, *63*(1), 132–155.

Bernstein, S., Dev, A., & Lerner, J. (2018). The Creation and Evolution of Entrepreneurial Public Markets, working paper No. w25414. Cambridge, MA: National Bureau of Economic Research.

Bronson, S. N., Carcello, J. V., & Raghunandan, K. (2006). Firm characteristics and voluntary management reports on internal control. *Auditing: A Journal of Practice & Theory*, *25*(2), 25–39.

Bukh, N. P., Nielsen, C., Gormsen, P., & Mouritsen, J. (2005). Disclosure of information on intellectual capital in Danish IPO prospectuses. *Accounting, Auditing & Accountability Journal*, *18*(6), 713–732.

Business, F. E. M. (2005a). Financieel: Beursleed bij kleine fondsen, 12 March.

Business, F. E. M. (2005b). Kapitaalmarkt: Naar de beurs, of niet? 19 February.

Campbell, T. S. (1979). Optimal investment financing decisions and the value of confidentiality. *Journal of Financial and Quantitative Analysis*, *14*(5), 913–924.

Cassimon, D., Engelen, P. J., Thomassen, L., & Van Wouwe, M. (2004). The valuation of an NDA using a 6-fold compound option. *Research Policy*, *33*(1), 41–51.

Cassimon, D., Engelen, P. J., & Yordanov, V. (2011). Compound real option valuation with phase-specific volatility: A multi-phase mobile payments case study. *Technovation*, *31*(5-6), 240–255.

Cattaneo, M., Meoli, M., & Vismara, S. (2015). Financial regulation and IPOs: Evidence from the history of the Italian stock market. *Journal of Corporate Finance*, *31*, 116–131.

CFOC (2005). *Estimating the Costs and Benefits of Rendering an Opinion on Internal Control over Financial Reporting*. A Joint Study by the Chief Financial Officers' Council and the President's Council on Integrity and Efficiency. Washington DC, USA: Chief Financial Officer Council. Available at https://ignet.gov/sites/default/files/files/kgdoc.pdf

Chemmanur, T. J., & Fulghieri, P. (1999). A theory of the going-public decision. *Review of Financial Studies*, *12*(2), 249–279.

Chemmanur, T. J., He, S., & Nandy, D. K. (2010). The going-public decision and the product market. *Review of Financial Studies*, *23*, 1855–1908.

Chemmanur, T. J., Signori, A., & Vismara, S. (2018). The exit choices of European private firms: A dynamic empirical analysis. Working paper. New York, USA: Social Sciences Research Network (SSRN).

Christensen, H. B., Hail, L., & Leuz, C. (2011). Capital-market effects of securities regulation: The role of implementation and enforcement. Working paper. Boston, USA: National Bureau of Economic Research.

Coates, J. C. (2007). The goals and promise of the Sarbanes-Oxley Act. *Journal of Economic Perspectives*, *21*(1), 91–116.

CRA (2005). Sarbanes-Oxley Section 404 Costs and Remediation of Deficiencies: Estimates from a Sample of Fortune 1000 Companies. Charles River Associates, D06155-00. New York, USA: Securities and Exchange Commission. Available at https://www.sec.gov/spotlight/soxcomp/soxcomp-all-attach.pdf

Dambra, M., Field, L. C., & Gustafson, M. T. (2015). The JOBS Act and IPO volume: Evidence that disclosure costs affect the IPO decision. *Journal of Financial Economics*, *116*(1), 121–143.

Dambra, M., Wasley, C. E., & Wu, J. S. (2013). SoftTalk management cash flow forecasts: Bias, quality, and stock price effects. *Contemporary Accounting Research*, *30*(2), 607–644.

Demers, E., & Lev, B. (2001). A rude awakening: Internet shakeout in 2000. *Review of Accounting Studies*, *6*(2-3), 331–359.

De Volkskrant (2003). De stille uittocht van de beursdwergen, 30 October.

De Telegraaf (2004). Meer en meer bedrijven zoeken uitgang Damrak, 26 May.

Diamond, D. W. (1985). Optimal release of information by firms. *Journal of Finance*, *40*(4), 1071–1094.

Doyle, J. T., Ge, W., & McVay, S. (2007a). Accruals quality and internal control over financial reporting. *The Accounting Review*, *82*(5), 1141–1170.

Doyle, J., Ge, W., & McVay, S. (2007b). Determinants of weaknesses in internal control over financial reporting. *Journal of Accounting and Economics*, *44*(1), 193–223.

Drobetz, W., Janzen, M., & Meier, I. (2019). Investment and financing decisions of private and public firms. *Journal of Business Finance & Accounting*, *46*(1-2), 225–262.

Dye, R. A. (1986). Proprietary and nonproprietary disclosures. *Journal of Business*, *59*(2), 331–366.

Dye, R. A. (1990). Mandatory versus voluntary disclosures: The cases of financial and real externalities. *Accounting Review*, *65*(1), 1–24.

Easterbrook, F. H., & Fischel, D. R. (1984). Mandatory disclosure and the protection of investors. *Virginia Law Review*, *70*(4), 669–715.

Engelen, P. J., & van Essen, M. (2010). Underpricing of IPOs: Firm-, issue- and country-specific characteristics. *Journal of Banking and Finance*, *34*(8), 1958–1969.

Enriques, L., & Volpin, P. (2007). Corporate governance reforms in continental Europe. *Journal of Economic Perspectives*, *21*(1), 117–140.

Ernst & Young (2003). Geprijsd & Geprezen: Verslag van een indicatief onderzoek naar de kostenimplicaties van de invoering van de conceptcode van de Commissie Corporate Governance, August.

Eurostat (2009). 'High-technology' and 'knowledge based services' aggregations based on NACE Rev. 2, Bruxelles, Belgium: Eurostat.

FEI (2007). FEI Survey on Sarbanes-Oxley Section 404 Implementation. Toronto, Canada: Financial Executives Research Foundation.

Foster, G. (1980). Externalities and financial reporting. *The Journal of Finance*, *35*(2), 521–533.

Francis, J., LaFond, R., Olsson, P., & Schipper, K. (2005). The market pricing of accruals quality. *Journal of Accounting and Economics*, *39*(2), 295–327.

Ferran, E. (2004). *Building an EU securities market*. Cambridge: Cambridge University Press.

Gao, X., Ritter, J. R., & Zhu, Z. (2013). Where have all the IPOs gone? *Journal of Financial and Quantitative Analysis*, *48*(6), 1663–1692.

Grundfest, J. (1998). Securities regulation, In P. Newman (Ed.), *The new palgrave dictionary of economics and the law* (pp. 410–419). London: MacMillan.

Hammersley, J. S., Myers, L. A., & Shakespeare, C. (2008). Market reactions to the disclosure of internal control weaknesses and to the characteristics of those weaknesses under section 302 of the Sarbanes Oxley Act of 2002. *Review of Accounting Studies*, *13*(1), 141–165.

Harris, M. S. (1998). The association between competition and managers' business segment reporting decisions. *Journal of Accounting Research*, *36*(1), 111–128.

Hayes, R. M., & Lundholm, R. (1996). Segment reporting to the capital market in the presence of a competitor. *Journal of Accounting Research*, *34*(2), 261–279.

Healy, P. M., & Palepu, K. G. (2001). Information asymmetry, corporate disclosure, and the capital markets: A review of the empirical disclosure literature. *Journal of Accounting and Economics*, *31*(1-3), 405–440.

Het Financieele Dagblad (2003). Code-Tabaksblat jaagt bedrijven op hoge kosten, 24 September.

Himmelberg, C. P., & Petersen, B. C. (1994). R&D and internal finance: A panel study of small firms in high-tech industries. *Review of Economics and Statistics*, *76*(1), 38–51.

Iliev, P. (2010). The effect of SOX Section 404: Costs, earnings quality, and stock prices. *Journal of Finance*, *65*(3), 1163–1196.

Imbens, G. W., & Lemieux, T. (2008). Regression discontinuity designs: A guide to practice. *Journal of Econometrics*, *142*(2), 615–635.

International Accounting Standard Board (2005). Intangible assets. International Accounting Standard, 38 (London), Available at http://www.assb.gov.sg/docs/attachments/fr-assb_frs_1Jan2018/SB-FRS_38_(2018).pdf

James, C., & Wier, P. (1990). Borrowing relationships, intermediation, and the cost of issuing public securities. *Journal of Financial Economics*, *28*(1), 149–171.

Johnston, J., & Madura, J. (2009). The pricing of IPOs post-Sarbanes-Oxley. *Financial Review*, *44*(2), 291–310.

Kerr, W. R., Lerner, J., & Schoar, A. (2014). The consequences of entrepreneurial finance: Evidence from angel financings. *Review of Financial Studies*, *27*(1), 20–55.

Lee, E., Strong, N., & Zhu, Z. (2014). Did regulation fair disclosure, SOX, and other analyst regulations reduce security mispricing? *Journal of Accounting Research*, *52*(3), 733–774.

Leland, H. E., & Pyle, D. H. (1977). Informational asymmetries, financial structure, and financial intermediation. *Journal of Finance*, *32*(2), 371–387.

Ljungqvist, A., & Wilhelm, Jr, W. J. (2003). IPO pricing in the dot-com bubble. *The Journal of Finance*, *58*(2), 723–752.

Lowry, M., & Murphy, K. J. (2007). Executive stock options and IPO underpricing. *Journal of Financial Economics*, *85*(1), 39–65.

Martinez, I., & Serve, S. (2011). The delisting decision: The case of buyout offer with squeeze-out (BOSO). *International Review of Law and Economics*, *31*(4), 229–239.

Megginson, W. L., & Weiss, K. A. (1991). Venture capitalist certification in initial public offerings. *Journal of Finance*, *46*(3), 879–903.

Migliorati, K., & Vismara, S. (2014). Ranking underwriters of European IPOs. *European Financial Management*, *20*(5), 891–925.

Pagano, M., Panetta, F., & Zingales, L. (1998). Why do companies go public? An empirical analysis. *Journal of Finance*, *53*(1), 27–64.

Ritter, J. R. (1984). The 'hot issue' market of 1980. *Journal of Business*, *57*(2), 215–240.

Ritter, J. R. (2011). Equilibrium in the initial public offerings market. *Annual Review of Financial Economics*, *3*(1), 347–374.

Ritter, J. R. (2014). Re-energizing the IPO Market. *Journal of Applied Finance*, *24*, 37–48.

Ritter, J. R., Signori, A., & Vismara, S. (2013). Economies of scope and IPO activity in Europe. In M. Levis & S. Vismara (Eds.), *Handbook of research on IPOs*, Cheltenham: Edward Elgar.

SEC (2018). SEC expands the scope of smaller public companies that qualify for scaled disclosures, *Press release*. New York, USA: Securities and Exchange Commission, 2018–2116.

SEC (2019). SEC Proposes Amendments to More Appropriately Tailor the Accelerated and Large Accelerated Filer Definitions. *Press release*. New York, USA: Securities and Exchange Commission, 2019–2068.

Shah, S. Z. A., Liang, S., & Akbar, S. (2013). International Financial Reporting Standards and the value relevance of R&D expenditures: Pre and post IFRS analysis. *International Review of Financial Analysis*, *30*, 158–169.
Stigler, G. J. (1964). Public regulation of the securities markets. *Journal of Business*, *37*, 117–142.
Stolowy, H., & Jeny-Cazavan, A. (2001). International accounting disharmony: The case of intangibles. *Accounting, Auditing & Accountability Journal*, *14*, 477–497.
Takahashi, H., & Yamada, K. (2015). IPOs, growth, and the impact of relaxing listing requirements. *Journal of Banking & Finance*, *59*, 505–519.
Thomsen, S., & Vinten, F. (2007). Delistings and the costs of governance: A study of European stock exchanges 1996-2004 April 2007. *Journal of Management and Governance*, *18*(3). https://doi.org/10.1007/s10997-013-9256-7
Verrecchia, R. E. (1983). Discretionary disclosure. *Journal of Accounting and Economics*, *5*, 179–194.
Vismara, S. (2016). Equity retention and social network theory in equity crowdfunding. *Small Business Economics*, *46*(4), 579–590.
Vismara, S., Paleari, S., & Ritter, J. R. (2012). Europe's second markets for small companies. *European Financial Management*, *18*(3), 352–388.
Vismara, S., Signori, A., & Paleari, S. (2015). Changes in underwriters' selection of comparable firms pre- and post-IPO: Same bank, same company, different peers. *Journal of Corporate Finance*, *34*, 235–250. https://doi.org/10.1016/j.jcorpfin.2015.07.010
Wagenhofer, A. (1990). Voluntary disclosure with a strategic opponent. *Journal of Accounting and Economics*, *12*(4), 341–363.
White, G., Lee, A., & Tower, G. (2007). Drivers of voluntary intellectual capital disclosure in listed biotechnology companies. *Journal of Intellectual Capital*, *8*(3), 517–537.
Yosha, O. (1995). Information disclosure costs and the choice of financing source. *Journal of Financial Intermediation*, *4*(1), 3–20.
Zhang, I. X. (2007). Economic consequences of the Sarbanes–Oxley Act of 2002. *Journal of Accounting and Economics*, *44*(1–2), 74–115.

How to cite this article: Engelen P-J, Meoli M, Signori A, Vismara S. The effects of stricter regulation on the going public decision of small and knowledge-intensive firms. *J Bus Fin Acc*. 2020;47:188–217. https://doi.org/10.1111/jbfa.12417

APPENDIX A: VARIABLE DEFINITIONS

Variable name	Definition
Cross-sectional regressions	
EU SOX	Dummy equal to 1 if the IPO occurs after the country in which the issuer is going public adopted the SOX-like regulatory change (governance code)
Firm age	Log of 1 + age in years, where age is the difference between the current year and year of foundation
Firm size	Log of inflation-adjusted annual sales (in 2012 € millions), using the Harmonised Indices of Consumer Prices (HICP) from Eurostat
HTKIS	Dummy equal to 1 if the firm belongs to a high-technology or knowledge-intensive industry, as defined by Eurostat (2009) sectorial classification. Manufacturing industries are classified as high-tech, medium-tech, or low-tech, according to their technological intensity (R&D expenditure/value added). Services are aggregated into knowledge-intensive services and less knowledge-intensive services, based on their share of tertiary educated persons
Industry Q	Industry-year valuation of IPO firms, defined as the Tobin's Q implied by the offer price of firms going public in the same industry (3-digit SIC) and year as those of the private firm
Industry-adjusted Q	Tobin's Q minus the average Q of all listed firms in the same industry (3-digit SIC) and year as those of the IPO firm. Tobin's Q is defined as (book value of assets + market value of common stock at offer price – book value of common stock) / book value of assets

Variable name	Definition
IPO dilution	Primary shares sold at IPO / pre-IPO shares outstanding
Leverage	Book value of debt / book value of equity, pre-IPO
M&A activity	Country-industry-year growth in M&A activity, defined as the percentage variation in the annual number of completed M&A transactions involving a target incorporated in the same country and operating in the same industry (3-digit SIC) as those of the private firm
Pre-IPO market return	Average daily return of the stock exchange index where the company goes public in the 30 days prior to the IPO
Profitability	Profit (loss) before taxation / total assets
Second-tier markets	Number of second-tier markets open in a given country and year
Stock return	Country-year stock return, defined as the one-year return of the main equity index of the country's stock exchange
Time trend	Equals one for the first year of the sample and increases by one unit for each year onwards
Underwriter reputation	Market share of the lead underwriter measured by proceeds raised in Europe (London, Euronext, Frankfurt, and Milan) during 1995–2012
VC backing	Dummy equal to 1 for venture capital-backed IPOs
Time-series regressions	
EuroMid future return [t+1, t+4]	FTSE EuroMid Index percentage return in quarter t+1 to t+4
EuroMid Index	Value of the FTSE EuroMid equity index scaled at 1 in Q1 1995
EuroMid return [t–2, t–1]	FTSE EuroMid Index percentage return from quarter t–2 to t–1
Initial IPO return (t–1)	Average first-day percentage return of sample IPOs in quarter t–1, defined as the difference between the first-day closing price and the offer price divided by the offer price
M&A growth [t–1, t]	Percentage variation in the number of completed M&A transactions from the previous quarter, involving a target incorporated in one of the sample countries
M/B small firms (t–2)	Market-to-book ratio of small firms (defined as less than €250 million in annual sales using €2012), calculated as the sum of market value of small firms divided by the sum of book value of small firms, measured at quarter t–2
Quarter 1 dummy	Equals one in the first quarter of each year, and zero otherwise
Real GDP growth [t, t+3]	Percentage growth in real GDP from quarter t to quarter t+3, downloaded from Eurostat
Scaled IPO volume	Number of IPOs scaled by real GDP, measured in € trillions of 2012 purchasing power
Time trend	Equals 1 for Q1 1995 and increases by 1 for each quarter onwards until Q4 2012
% of small firms with EPS≥0 (t–1)	Percentage of firms with at least three years of trading history that have non-negative EPS in quarter t–1 (small firms are with less than €250 million in annual sales using €2012)

APPENDIX B: CORRELATION MATRIX AND VARIANCE INFLATION FACTORS (VIFS)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1)	EU SOX	1								
(2)	Firm size	0.02	1							
(3)	HTKIS	0.04***	−0.14***	1						
(4)	Firm age	−0.15***	0.23***	−0.06***	1					
(5)	Underwriter reputation	−0.12***	0.34***	0.02	0.12***	1				
(6)	VC backing	−0.00	−0.10***	0.10***	−0.09***	0.02	1			
(7)	IPO Dilution	0.07***	−0.02	−0.03***	−0.18***	−0.04***	−0.06***	1		
(8)	Leverage	0.01***	0.19***	0.02***	0.13***	0.10***	−0.07***	−0.01***	1	
(9)	Pre-IPO market return	−0.02	0.02	0.05***	0.05***	0.02	0.01	−0.04***	0.01	1
(10)	M&A activity	0.12***	−0.03	0.09***	0.04**	0.11***	−0.02	−0.01	0.01	0.06**

Variable	VIF
EU SOX	6.26
EU SOX × HTKIS	5.17
EU SOX × Size	3.53
Firm size	2.29
HTKIS	2.10
Firm age	1.30
Underwriter reputation	1.31
VC backing	1.08
IPO dilution	1.16
Leverage	1.14
Pre-IPO market return	1.04
M&A activity	1.24
Mean VIF	3.68

Notes: Panel A reports the correlation coefficients and statistical significance among the independent variables used in our model. ***, ** and * indicate significance at the 1, 5, and 10 percent levels, respectively. Panel B reports the Variance Inflation Factors. The mean VIF is computed by taking into account also industry (3-digit SIC), country and year fixed effects, but their VIFs are not shown for brevity.