Regulation comes at a cost: underpricing and valuation of European IPOs

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Abstract

Literature has shown that stringent regulatory changes typically reduce IPO underpricing. The traditional explanation is that the uncertainty surrounding firms going public decreases thanks to improved transparency. By reducing cost of capital, this should in turn increase their valuations. Using a sample of 3,789 IPOs during 1995-2012, we show that the adoption of SOX-like provisions, staggered at different dates across European countries, has instead reduced the valuations of small and high-tech firms. We argue that this is due to increased direct costs of compliance, proportionally larger for smaller firms, and indirect costs due to loss of confidentiality, higher for high-tech and knowledge-intensive services firms.

Keywords: Regulation; IPOs; underpricing; valuation; SOX; Europe.

JEL Classification: G30, G38

1. Introduction

In financial markets, whenever the social and private values of information differ, firms trading off the private costs and benefits of transparency may not provide socially optimal levels of disclosure (Bushee and Leuz, 2005). To balance firms' incentives to reveal a suboptimal amount of information (Verrecchia, 1983) and to make it more evenly distributed, increasing disclosure requirements is likely to be an effective mechanism for regulatory authorities to alleviate market inefficiencies (Diamond and Verrecchia, 1991). For instance, the main objective of U.S. Sarbanes-Oxley Act (SOX), as reported in its first line, is "to protect investors by improving the accuracy and reliability of corporate disclosures". Regulatory interventions, however, bring costs that can offset their benefits.

In the IPO literature, consensus has been reached over the evidence that the amount of "money left on the table" by companies going public has lowered after the introduction of SOX and similar SOX-like provisions in various institutional settings (Akyol et al., 2014; Ekkayokkaya and Pengniti, 2012; Johnston and Madura, 2009; Shi et al., 2013). Since underpricing is traditionally seen as an indirect cost for the issuing firm, its reduction has been categorized as one of the benefits brought by increased securities regulation. In line with information asymmetry-based theories (e.g., Allen and Faulhaber, 1989; Beatty and Ritter, 1986; Benveniste and Spindt, 1989), by reducing the extent of information asymmetry between firm insiders and outsiders, the level of compensation required by investors in the form of underpricing to participate in IPOs has decreased. Everything else equal, this should increase the valuations of listing firms, by reducing the cost of capital (Rajan and Zingales, 2003). This paper documents that, unfortunately, this is not the case.

There are, indeed, costs associated with the increased production of information that can destroy value. First, as reporting activity implies consumption of time and resources, information production is costly *per se*. These direct costs of compliance are expected to increase after stringent regulatory changes, due to the firms' greater effort to comply with stricter disclosure requirements. Second, disclosed information is a public good because firm insiders implicitly pay for its production but cannot charge potential investors for its use, which raises the concern that rivals may use such information to erode the firm's competitive position in the product market (Darrough and Stoughton, 1990). Stricter regulatory requirements increase the indirect costs of loss of confidentiality, as firms are enforced to publicly reveal a larger and more accurate set

of information that they would otherwise refrain from disclosing in order to protect their competitive advantage.

Benefits and costs of the regulatory intervention affect firms in different ways, depending on their characteristics (Mulherin, 2005). We first discuss the beneficial effects on IPO underpricing. While the above-mentioned studies document that companies going public after stricter disclosure regulation benefit from lower underpricing, we hypothesize that this reduction is not homogeneous across firms, since some may benefit from the decrease in information asymmetry more than others. In particular, firms affected by higher information asymmetry should enjoy larger benefits from increased disclosure, thereby experiencing a larger reduction in underpricing. We identify these firms as (1) small firms, and (2) high-tech and knowledge-intensive services (HTKIS) firms. Small size as well as the high-tech and knowledge-intensive status are typically associated with higher information asymmetry faced by investors, as these have to incur greater costs of becoming informed about these types of firms (Dambra et al., 2015; Ritter, 1991). We hypothesize that companies going public after stringent regulatory changes exhibit lower underpricing, in line with previous literature (e.g., Johnston and Madura, 2009), and that the decrease in underpricing is more pronounced among small and HTKIS firms, because of the larger amount of information asymmetry to be reduced by increased regulation.

We then turn to the effects of increased disclosure on IPO valuation. Firms that incur a larger increase in compliance and loss of confidentiality costs are more likely to receive a lower valuation at the IPO because the benefits of increased transparency may be offset by such costs. On the one hand, the costs firms have to bear to comply with new regulations are characterized by a fixed component which is proportionally larger for small firms, that are therefore penalized to a greater extent (Coates, 2007; Iliev, 2010). On the other hand, industries where competition is highly focused on innovation, such as high-tech and knowledge-intensive sectors, are characterized by a higher value of secrecy as a firm's proprietary knowledge is often crucial in guaranteeing the long-term sustainability of its business (Himmelberg and Petersen, 1994). These firms face a higher risk of releasing valuable information to rivals, which may result in their competitive advantage being damaged. One of the primary deterrents to disclosure is indeed the proprietary nature of the information to be disclosed (Bhattacharya and Ritter, 1983). We therefore expect small and HTKIS firms

going public after the regulatory change to receive lower valuations at the IPO, because they might be required to disclose more information than what they would do otherwise.

We test our hypotheses on a sample of 3,789 companies going public in 16 different European countries during 1995-2012. Following the example of the United States, EU Member States adopted SOX-like provisions geared towards tightening existing regulation.[1] Table 1 shows the timeline of the introduction of the regulatory changes in each single European country. Denmark, Malta, and Germany even anticipated the entry into force of U.S. SOX in 2002, while the majority of the new codes were adopted within the first two years. While numerous U.S.-based studies investigating the economic effects of a single regulatory event like SOX have to deal with the presence of other confounding factors, we take advantage from the staggered implementation of the same regulatory change across European countries to analyze its effect at different points in time. This empirical setting offers better identification of the regulatory effects than a single regulatory event such as SOX.

[TABLE 1]

The results of our empirical analysis can be summarized as follows. After controlling for potential selection effects of the regulatory change on the characteristics of the companies going public through a two-step Heckman procedure, we find that the introduction of more stringent regulations has decreased IPO underpricing. As hypothesized, small and HTKIS firms have experienced a larger decrease. We then assess the impact on firm value, and find that small and HTKIS companies going public after the regulatory changes have received lower valuations at the IPO. These results are robust to a number of tests where we use alternative information asymmetry proxies, exclude IPOs occurring on second-tier exchange-regulated markets, and document that the evidence is not driven by the high levels of IPO underpricing and valuation reached during the tech bubble years. We argue that the increase in compliance costs, proportionally larger

[1] Numerous papers provide a detailed description of the specifics of SOX (e.g., Coates, 2007). For corporate governance reforms in Europe, see Ferran (2004).

for small firms, and loss of confidentiality costs, more relevant for HTKIS firms, has been detrimental for their valuations. Overall, our evidence confirms the beneficial effect of SOX-like regulatory changes on IPO underpricing, but also sheds light on the unintended consequences on the valuation of small and HTKIS firms.

The remainder of the paper is organized as follows. Section 2 discusses the theoretical arguments that lead to the formulation of the testable hypotheses of the paper. Section 3 describes sample, data, and variables used in the empirical analysis, and presents some descriptive statistics of the sample of IPOs. Section 4 presents the results of the multivariate analysis, and Section 5 provides additional robustness tests. Section 6 concludes.

2. Hypotheses

2.1 Underpricing

Corporate governance codes require issuing firms to report in their official prospectus how they comply with the code recommendations, or otherwise to explain the reasons why their corporate governance policies deviate from the guidelines provided by the local code. As a result, firms are deterred from deviating from recommended policies, and tend to do so only in case of legitimate reasons for non-compliance. Such an increased disclosure contributes to reduce uncertainty around the valuation of IPO firms thanks to the decreased information asymmetry. The crucial role played by disclosure in shaping a firm's level of information asymmetry is proven by the considerable number of IPO studies that have tried to quantify information asymmetry by means of disclosure-based proxies, such as the uses of IPO proceeds stated in the official prospectus (Beatty and Ritter, 1986), the number of risk factors (Beatty and Welch, 1996), and the information content and disclosure tone of the prospectus (Hanley and Hoberg, 2010; Ferris et al., 2013). If increased disclosure is an effective tool to reduce information asymmetry, then the need to underprice shares in order to compensate IPO investors for their risk-taking behavior is alleviated. Several studies find empirical support to this prediction by examining how regulatory changes affect IPO underpricing in different institutional settings, most notably the U.S. (Johnston and Madura, 2009), Europe (Akyol et al.,

2014), Thailand (Ekkayokkaya and Pengniti, 2012), and at a cross-country level (Shi et al., 2013). In the same vein, we expect companies going public to experience a lower level of underpricing after the introduction of SOX-like corporate governance codes.

However, the costs that outsiders have to bear to collect information about a firm are expected to vary according to a number of factors, such as the characteristics of the firm or the industry in which it operates. One of these factors is firm size. Small firms are typically associated with a higher level of information asymmetry for a number of reasons. First, they tend to be affected by higher uncertainty than large, established firms due to resource constraints that prevent them from developing trustworthy relationships with stakeholders (Stinchcombe, 1965). Second, small firms are more likely to lack reliability and accountability in their internal functions, which may lead them to produce comparatively little codified information about their historical performance and prospects (Baum, 1996). Third, smaller firms attract less analyst and media coverage (Das et al., 2006; Fang and Peress, 2009). These factors suggest that smaller firms are affected by a higher level of uncertainty that contributes to widen the informational gap between firm insiders and outsiders.

Another crucial characteristic in shaping a firm's extent of information asymmetry is the degree of innovativeness and intangibility of its business model. Theoretical models of information asymmetry predict that firms whose value depends more on growth opportunities than on tangible assets are associated with a higher valuation uncertainty that exacerbates the informational disadvantage suffered by firm outsiders (Bhattacharya and Ritter, 1983). Growth opportunities play a fundamental role among high-technology and knowledge-intensive firms, where research-driven investments, tacit knowledge, and technological know-how represent key factors of a firm's viability in the product market. These factors are by their nature more difficult to evaluate, as R&D and innovation-based physical investments preclude an accurate assessment of firm value (Himmelberg and Petersen, 1994). Furthermore, the outputs of these investments cannot be perfectly predicted from the inputs, which puts firm insiders at a substantial information advantage regarding the long-term viability of business models and knowledge products (Arrow, 1962). Consistently, these firms often suffer from limited access to capital markets because of the lack of reliable information about their operating history, uncertainty about their current real status and performance, and absence of collateralizable

assets for debt financing (e.g., Bernanke and Gertler, 1989). These factors suggest that firms operating in high-tech and knowledge-intensive industries are affected by a higher level of uncertainty that contributes to widen the informational gap between firm insiders and outsiders. Such proprietary considerations are found to be a deterrent to prospectus disclosure and, in turn, to drive underpricing (Leone et al., 2007).

We hypothesize that firms suffering from higher information asymmetry benefit from the increased disclosure to a larger extent, since they are allowed to remove a larger fraction of uncertainty surrounding their value. Since, for the above arguments, a decrease in information asymmetry results in a decrease in IPO underpricing, we formulate the following hypothesis:

Hypothesis 1: The introduction of corporate governance codes reduces IPO underpricing to a larger extent among small firms and high-tech and knowledge-intensive firms, for which increased disclosure removes a larger fraction of information asymmetry.

2.2 Valuation

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 also bear 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, they are forced to spend more money on internal control systems. If the effort put by firms in adopting practices aimed at preventing misconduct and fraud was suboptimal before the reforms, then raising such an incentive would be beneficial for financial market participants. In practice, however, the costs and benefits accruing to firms associated with this type of regulatory interventions are hard to quantify (Coates, 2007). Based on these arguments, we do not formulate any explicit hypothesis on the influence of new corporate governance codes on the average valuation of companies going public after their introduction.

In the previous section, we hypothesized that the extent of the benefits brought by increased disclosure varies across firms, based on their characteristics. By the same reasoning, we now discuss how the costs of increased disclosure may vary across firms. First, stricter disclosure requirements imply higher costs of compliance. These 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 and Volpin, 2007). Such a fixed cost component is inevitably heavier for small firms. A number of studies document that the increased disclosure imposed by the U.S. SOX Act, which inspired European corporate governance codes, has been particularly onerous for small firms. Zhang (2007) finds that small firms that obtain a deferment to comply with SOX disclosure requirements experience significantly higher 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. Iliev (2010) quantifies the increase in compliance costs for small firms, and documents detrimental effects on their value. These factors suggest that also European small firms are likely to incur a larger increase in compliance costs to meet the stricter disclosure requirements imposed by the new corporate governance codes.

Stricter disclosure requirements result in a larger and more accurate amount of firm-specific information that is publicly revealed. Under the assumption of perfectly efficient markets, rational firms may find it convenient to voluntarily disclose an efficient amount of information (Diamond, 1985). In practice, however, firms have the incentive not to disclose information if such a release may hurt their competitive position (Verrecchia, 1983). This incentive 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 and Lundholm, 1996). Again, we identify these industries as high-technology and knowledge-intensive sectors. Bhattacharya and Ritter (1983) develop a model in which a firm's competitive advantage may be compromised by the disclosure of information about its innovative investments. Even when firms can produce information and release them to outsiders at negligible costs, the competitive dynamics of high-tech and knowledge-intensive industries imply strategic considerations that may induce firms to voluntarily maintain a certain level of secrecy (Himmelberg and Petersen, 1994). For instance, these firms tend to view patents as an ineffective method of appropriating the returns to R&D because patenting requires full disclosure of the achieved innovation, thereby releasing potentially valuable information to competitors (Levin et al., 1987). These factors suggest that firms operating in high-tech and knowledge-intensive industries may incur higher costs of loss of confidentiality arising from the stricter disclosure requirements imposed by the new corporate governance codes.

Based on the above arguments, we expect that the increase in the costs of compliance and loss of confidentiality will be heavier for small firms and high-tech and knowledge-intensive firms. These larger costs may balance the larger benefits arising from the reduction in information asymmetry previously hypothesized. Since, however, these costs are characterized by a direct component that is immediately borne by firms, we expect them to offset the (indirect) benefits from increased transparency, causing a relative decrease in IPO valuations. Therefore, we formulate the following hypothesis:

Hypothesis 2: For small firms and high-tech and knowledge-intensive firms, that suffer from a larger increase in compliance costs and loss of confidentiality costs, respectively, the introduction of corporate governance codes reduces the IPO valuation more than for other types of firms.

3. Data, sample and variables

3.1 Data and sample

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), Nasdaq OMX (a consortium of the stock exchanges of Armenia, Denmark, Estonia, Finland, Iceland, Latvia, Lithuania, and Sweden), and the stock exchanges of Austria, Cyprus, Czech Republic, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, Malta, Poland, Slovakia, Slovenia, Spain, and the United Kingdom. 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[2]. 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 (Gao et al., 2013). The composition of the sample is presented in Table 2. Small firms are defined as those having pre-IPO annual sales (inflation-adjusted) below the sample median, and 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-

[2] See Vismara et al. (2012, Appendix A.1) for a description of the EurIPO database.

intensive services and less knowledge-intensive services, based on their share of tertiary educated persons. These firms account for 57.1% of our sample of IPOs.

[TABLE 2]

3.2 Variables and descriptive statistics

We test our two hypotheses by using two different dependent variables. First, we use IPO underpricing, calculated as the difference between the closing price of the first day of trading and the offer price, divided by the offer price; second, we use Tobin's Q as a measure of valuation, 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 on the offer price) minus the book value of common stock. The three explanatory variables of interest to our study are EU SOX dummy, equal to 1 in case the IPO occurs after the introduction of the new corporate governance code in the country where the company goes public; firm size, defined as the log of pre-IPO annual sales adjusted for inflation; and the HTKIS dummy, equal to 1 in case the firm belongs to a high-tech or knowledge-intensive service industry, based on Eurostat (2009) classification as defined above.

We employ a set of controls that previous studies found to be significant determinants of our dependent variables. Firm age, defined as the log of one plus the age in years of the firm at the IPO, is included as a proxy for the risk of the IPO firm (Ritter, 1984). Since reputable underwriters can influence the level of underpricing (Carter and Manaster, 1990) and the IPO valuation (Chemmanur and Krishnan, 2012) 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 and Vismara (2014). A similar role is found to be played by venture capitalists (Megginson and 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. The fraction of primary shares is an important proxy of the shareholders' attitude towards the going public

decision, that may affect IPO outcomes (Leland and Pyle, 1977). Thus, we include dilution, defined as the number of primary shared offered in the IPO divided by the number of pre-IPO shares outstanding. We also control for a firm's capital structure by including leverage, 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, as in Lowry and Murphy (2007). In the underpricing analysis, we also include prior 30-day underpricing, computed as the average underpricing of IPOs occurring in the same stock exchange over the 30 days prior to the IPO date, as in Bradley and Jordan (2002).

Table 3 shows descriptive statistics of these variables in our sample, by distinguishing IPOs according to the pre- and post-SOX period, small and large firms, and the HTKIS status. Panel A shows that the average level of IPO underpricing decreases from 28.6%, among firms going public before SOX-like regulatory changes are introduced, to 12.2% afterwards. 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 contributes to inflate pre-EU-SOX values. On the other hand, our univariate analysis suggests that the introduction of SOX-like provisions has not exerted any effect on IPO valuation, as the Tobin's Q of companies going public before and after the regulatory changes is not statistically different (3.7 vs. 3.8, on average). 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 underpricing is significantly higher among small firms (23.6% vs. 16.8%, on average), consistent with the notion that smaller firms tend to be more affected by information asymmetry. Tobin's Q is also higher among small firms (5.3 vs. 2.2), where the fraction of HTKIS firms is more substantial (63.3% vs. 50.9%). Panel C reports that HTKIS firms are on average more underpriced at the IPO (22.5% vs. 17.2%), but do not receive significantly different valuations at the IPO from those of other firms. 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.

[TABLE 3]

3.3 Methodology

When testing our hypotheses, we first have to address a fundamental selection issue. Since the introduction of SOX-like provisions may affect a private firm's likelihood of going public, possible changes in underpricing and valuation may be due to a change in the nature of firms that are admitted to the stock market afterwards, rather than to the direct effect of the regulatory intervention on the two variables. 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 underpricing and valuation of IPOs. In line with previous studies addressing selection issues in the IPO setting (e.g., Bayar and 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. underpricing and valuation of firms that do go public.

In the first step, we model a private firm's likelihood of going public on the population of European private firms, obtained from Amadeus, during our sample period (611,143 firm-year observations). A number of studies have indeed shown how regulatory changes affect firms' propensity to go or to remain public (Cattaneo et al., 2015; Doidge et al., 2013; Engel et al., 2007; Gao et al., 2013). 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 1 if it goes public in a given year. After a company goes public, it is dropped from the sample. As independent variables, we include the EU SOX dummy to test whether its introduction has affected a private firm's likelihood to conduct an IPO. As control variables, we use firm size (sales), age (years), profitability (return on assets), leverage (total debt over total assets), industry Q (median Tobin's Q of firms gone public in the 12 months before and operating in the same industry, at the SIC 1-digit level), as well as industry, year, and country fixed effects.

The inverse Mills' ratios obtained for each IPO firm from the first step estimation, aimed at correcting for selectivity bias, are then included in the second step, which consists of cross-sectional regressions on IPO underpricing and valuation. In our analyses, 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 SOX-like regulatory changes by splitting the sample accordingly (Models 2 and 3); second, we test the hypothesis on 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.

4. Results

4.1 Probability to go public

Table 4 reports descriptive statistics and estimates of the probit regression on the probability to conduct an IPO on the population of European firms. Descriptive statistics reveal 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. As for the potential effects of the introduction of SOX-like regulatory changes on a firm's likelihood of conducting an IPO, evidence from the probit regression reports that the coefficient of the EU SOX dummy is not significant. This documents that, after controlling for other determinants of a firm's decision to conduct an IPO, SOX-like provisions have not significantly affected such probability. Our finding is in line with previous studies assessing the impact of these regulatory interventions on IPO activity. For instance, Gao et al. (2013) show that the introduction of the SOX Act is not the primary cause of the decline in U.S. IPO activity, while Ritter et al. (2013) provide analogous evidence from the European setting, where the introduction of SOX-like provisions is not found to have decreased IPO volume. Consistent with the univariate results, the coefficients of the control variables show that sales and leverage are positively associated with a firm's likelihood of conducting an IPO, while age and profitability are negatively

associated. Predictably, the probability to go public increases also with the valuation received by IPO firms operating in the same industry.

[TABLE 4]

4.2 Underpricing

Table 5 reports the results of the Heckman's second step on IPO underpricing. Consistent with prior studies, we find a negative and significant coefficient of the EU SOX dummy on IPO underpricing at an aggregate level (Model 1). This confirms that the introduction of SOX-like corporate governance codes in Europe has reduced the average level of underpricing. The results also reveal that underpricing is higher for small firms, consistent with the idea that they are more severely affected by information asymmetry. Our hypothesis predicts that the reduction in underpricing is larger among small and HTKIS firm IPOs. Concerning small firms, we find that the interaction term between EU SOX and firm size is positive and significant (Model 4), suggesting that small firms benefit from a larger reduction in underpricing. This evidence is confirmed by the sample split, where the coefficient of the EU SOX is negative both for small and large firms, but significant only for small firms (Model 5).

As for HTKIS firms, the coefficient of the interaction term between the EU SOX and HTKIS variables is negative and significant, documenting that the decrease in underpricing is more pronounced for this type of firms (Model 7). Coherently, by splitting the sample between HTKIS and other firms, we find that the coefficient of the EU SOX dummy is negative in both subsamples, but its magnitude and statistical significance are sensibly larger among HTKIS firms (Model 8). All these effects persist in the full model specification (Model 10), where the coefficient of the EU SOX dummy is negative and significant, and the coefficients of its interactions with firm size and HTKIS variables remain positive and negative, respectively. Overall, the evidence is consistent with our hypothesis that the stricter disclosure requirements imposed by SOX-like provisions have reduced IPO underpricing, with this reduction being more pronounced among small and HTKIS firms that, in these respects, have benefited from the regulatory change to a larger extent.

[TABLE 5]

4.3 Valuation

Table 6 reports the results of the second step estimation on IPO valuation, measured by the Tobin's Q implied by the IPO price. The evidence shows that, at an aggregate level, the regulatory changes have not exerted any influence on the valuation of the companies going public, as documented by the insignificant coefficient of the EU SOX dummy (Model 1). Firm size is again an important determinant of IPO valuation, which is relatively higher for small firms. Our hypothesis predicts that small and HTKIS firms receive a lower valuation at the IPO after the regulatory change, relatively to large firms, due to the increased compliance and loss of confidentiality costs associated with stricter disclosure requirements. Concerning small firms, we find that the interaction term between EU SOX and firm size is positive and significant (Model 4), suggesting that small firms receive lower valuations at the IPO 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). This documents that SOX-like provisions have played an opposite role on IPO valuations, depending on the size of the firm.

As for HTKIS firms, the coefficient of the interaction term between the EU SOX and the HTKIS dummy is negative and significant, documenting that also HTKIS firms 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). All these effects persist in the full model specification (Model 10), where the direct effect of the EU SOX dummy becomes negative and significant, and the coefficients of its interaction terms with 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 corporate governance codes have worsened the IPO valuation of small firms, due to

increased compliance costs, and HTKIS firms, due to increased loss of confidentiality costs, relatively to other types of firms.

[TABLE 6]

5. Robustness tests

5.1 Long run performance

The widely documented evidence that IPOs underperform in the long run (Ritter, 1991) suggests that investors tend to recognize overoptimistic firm valuations at the time of the IPO. As a consequence, the higher is the initial return experienced by a firm in an IPO, the more pronounced will be the subsequent downward adjustment of the firm's stock price as more information becomes available over time. Our previous evidence indicates that the stricter disclosure mandated by corporate governance codes has reduced IPO underpricing. This would imply that the downward adjustment of the firm's valuation in the long run should become less pronounced. In particular, since IPOs by small firms and high-tech and knowledge-intensive firms are found to experience a larger decrease in underpricing, we should expect a more favorable (or less unfavorable) long-run performance of these firms, given that pricing accuracy at the IPO has been increased by the stricter disclosure. We test this implication by repeating our regressions using 5-year BHAR as dependent variable, which allows us to reduce the right-skewness associated with the distribution of buy-and-hold raw returns. Following Loughran and Ritter (1995), we compute it as the buy-and-hold abnormal return of each IPO firm as follows:

$$BHAR_i = [\prod_{t=1}^{T}(1 + R_{i.t})] - \left[\prod_{t=1}^{T}\left(1 + R_{M,t}\right)\right], \text{ with T>12} \quad [1]$$

where $R_{i,t}$ is the monthly return on stock i at time t, T is the minimum between three years and the time from IPO to the adoption of SOX-like provisions or to delisting, and $R_{M,t}$ is the raw monthly

return of the FTSE Euromid index, excluding dividends.[3] The holding period starts from the 22nd day of trading, as underwriters may be stabilizing prices during the first 21 days.

Table 7 shows mean and median values of the 5-year BHAR of our sample of IPOs, and reports the results of the second step regressions. Consistent with the IPO long-run underperformance phenomenon, we find an average 5-year BHAR of -30.1% associated with the whole sample. This underperformance is more pronounced, on average, among IPOs occurring before the introduction of SOX-like provisions (-39.8% vs. -20.1%), and among small (-41.7% vs. -18.2%) and HTKIS (-38.9% vs. -17.8%) firms. The regression results suggest the absence of a direct effect of the regulatory change on the log-run performance of IPOs, as documented by the insignificant coefficient of the EU SOX dummy (Model 1). Concerning firm size, the coefficient of the interaction term between EU SOX and size is negative and significant (Model 4), suggesting that small firm IPOs have performed better in the long run after the regulatory change. This evidence, however, does not find support in the small and large firm subsamples. As for HTKIS firms, the coefficient of the interaction term between EU SOX and HTKIS variables is positive, documenting that also HTKIS firm IPOs have exhibited a better long run performance (Model 7), although statistical significance is weak. These effects are partly confirmed by the full model estimation (Model 10), where the coefficient of the EU SOX dummy remains insignificant, the coefficient of its interaction with firm size is negative and significant, and that of the interaction with the HTKIS dummy is positive but not significant. Overall, the evidence is partly consistent with our expectation that the long run performance of IPOs conducted by small and HTKIS firms improves after the regulatory change, since the stricter disclosure requirements have reduced underpricing to a larger extent for these firms.

[TABLE 7]

[3] Since for some firms the introduction of SOX-like provisions falls within the BHAR holding period, we truncate this period at the date of the regulatory change for firms going public between one and five years before. We then set a minimum holding period of 12 months for all firms, which leads to the exclusion of firms going public less than one year before the regulatory change or delisted within one year of the IPO. Furthermore, since stock returns include dividends and index returns don't, the expected BHAR may be positive rather than zero in an efficient market.

5.2 Firm age as alternative proxy for information asymmetry

A number of studies suggest that, besides firm size, the age of the firm is also an important proxy for the level of information asymmetry faced by outsiders (e.g., Ritter, 1984). Information about younger firms is more costly to obtain since information production, due to press coverage and analyst following, increases with the age of the firm. Younger firms are therefore more difficult to valuate and are associated with a higher level of information asymmetry. In line with the hypothesis on the role played by firm size, we expect also younger firms to benefit to a larger extent from the increased disclosure imposed by the new corporate governance codes. If increased disclosure allows them to remove a greater fraction of information asymmetry, then we should observe a larger decrease in underpricing after the regulatory changes. We therefore repeat our analysis on IPO underpricing by using age as alternative for size to proxy a firm's level of information asymmetry. Table 8 shows the results of the second step regressions after including the interaction term between EU SOX dummy and firm age, and splitting the sample according to young and old firms (young firms are defined as having age at the IPO below the sample median).

The evidence documents that the reduction in underpricing following the regulatory changes is larger among younger firms, as confirmed by the positive and significant coefficient of the interaction term between EU SOX and firm age (Model 1). This evidence is confirmed by the sample split, where the negative effect of the regulatory change on underpricing is found to be driven by young firms (Model 2). Overall, the evidence confirms that our results on the effect of SOX-like regulatory changes on IPO underpricing are robust to the use of age as an alternative proxy for a firm's level of information asymmetry.

5.3 Regulated markets

Another potential concern that may cast doubts on the reliability of our evidence is that our sample includes exchange-regulated 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). Corporate governance codes are not mandatory on exchange-regulated 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 exchange-regulated 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 IPOs occurring on the regulated markets of the stock exchanges of our sample. Results of the second step regressions are reported in Table 8.

The evidence on IPO underpricing (Model 4) is robust to the sample restriction. The new corporate governance codes are found to significantly reduce underpricing, as documented by the negative and significant coefficient of the EU SOX dummy, and this reduction is more pronounced among small and HTKIS firm IPOs, as documented by the significant coefficients of the two interaction terms. As for IPO valuation (Model 5), we still find that 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 SOX-like provisions on underpricing and valuation. This documents that our evidence is robust to the exclusion of exchange-regulated market IPOs from the sample.

5.4 Bubble years

It is widely documented that underpricing and valuation of IPOs occurring during the tech bubble of 1999 and 2000 reached extremely high levels. These are classified as pre-SOX IPOs in our study, thereby raising the concern that the decrease in underpricing and 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 in 1999 and 2000, and report the results of the second step regressions on the restricted sample in Table 8. Concerning underpricing, the coefficient of the EU SOX dummy is still negative and significant, documenting that the regulatory change has decreased it (Model 6). The coefficients of the interaction terms with firm size and the HTKIS dummy are still positive and negative, documenting that this decrease has been more pronounced among small and HTKIS firms. Evidence on IPO valuation is also

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 7). We can therefore conclude that the evidence supporting our hypotheses on the decrease in underpricing and valuation of small and HTKIS firms after the regulatory change is not driven by the high values associated with IPOs occurring during the bubble years.

[TABLE 8]

6. Conclusions

Among the benefits that have been recognized to the introduction of the U.S. SOX Act and similar regulations in Europe, the decrease in IPO underpricing has received considerable attention. On an information asymmetry-based perspective, stricter disclosure requirements have reduced the ex-ante level of uncertainty regarding firm value faced by investors, therefore requiring a lower compensation in the form of underpricing to participate in IPOs. This paper complements this view by documenting that the costs brought by the stricter disclosure requirements have offset the benefits in terms of reduced information asymmetry for certain types of firms. In particular, direct compliance costs have become particularly onerous for small firms, and indirect loss of confidentiality costs have become particularly relevant for high-tech and knowledge-intensive firms. Our analysis shows how the benefits and costs of the new SOX-like corporate governance codes have affected companies going public in 16 European stock exchanges over the last two decades, depending on their characteristics.

We document that the decrease in underpricing is more pronounced among firms facing a higher ex-ante level of information asymmetry, i.e. small and high-tech and knowledge-intensive firms. The decrease in underpricing, however, is not accompanied by an increase in IPO valuation. In fact, small and high-tech and knowledge-intensive firms going public after the regulatory change receive a lower valuation at the IPO. Consistent with the larger reduction in underpricing for small and high-tech firm IPOs, we also document a more favorable (less unfavorable) long run performance by these firms, as the downward adjustment over

time becomes less pronounced. Overall, this study sheds further light on the economic consequences of European SOX-like regulatory changes. We show that both benefits, in terms of decreased underpricing, and costs, in terms of increased compliance and loss of confidentiality, are in place.

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Table 1. European SOX-like corporate governance codes. Governance codes adopted by Member States of the EU, by date of entry-into-force corporate relative to the U.S. SOX (July 2002).

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

Table 2. Sample. Sample composition of 3,789 IPOs taking place in Europe (Athens, Madrid, Budapest, Cyprus, Euronext, Frankfurt, Dublin, Ljubljana, London, Luxembourg, 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 firm belonging to HTKIS industries, as defined by the Eurostat (2009) sectorial classification.

	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
Frankfurt	606	306.2	22.1	287	47.4	408	67.3
London	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

Table 3. Descriptive statistics. Descriptive statistics of the sample of 3,789 IPOs occurring in Europe (Athens, Madrid, Budapest, Cyprus, Euronext, Frankfurt, Irish, Ljubljana, London, Luxembourg, 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.

	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*
Underpricing (%)	28.6	5.5	12.2	5.9	16.4***	-0.4
Tobin's Q	3.7	2.2	3.8	1.9	1.5	0.3**
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
Prior 30 day underpricing (%)	28.7	12.7	17.4	10.9	11.3***	1.8***
	Small firms		Large firms		Difference	
Panel B. Firm size	(1,894 IPOs)		(1,895 IPOs)		Small - Large firms	
Underpricing (%)	23.6	6.3	16.8	5.3	6.8***	1.0*
Tobin's Q	5.3	2.7	2.2	1.7	3.1***	1.0***
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*
Prior 30 day underpricing (%)	24.3	11.7	21.5	11.6	2.8	0.1
	HTKIS firms		Other firms		Difference	
Panel C. HTKIS status	(2,162 IPOs)		(1,627 IPOs)		HTKIS - Other firms	
Underpricing (%)	22.5	5.8	17.2	5.9	5.3**	-0.1
Tobin's Q	3.6	2.2	4.0	1.9	-0.4	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
Prior 30 day underpricing (%)	24.4	11.8	21.0	11.4	3.4	0.4*

Table 4. Determinants of the going public decision. Descriptive statistics of the samples of European private firms and IPO firms, and probit regression on the likelihood of going public. The sample is composed of 611,143 firm-year observations during 1995-2012. The dependent variable of the probit regression equals 1 in case the company goes public in a given year (companies are dropped from the sample after conducting an IPO). EU SOX dummy is equal to 1 after the adoption of the SOX-like regulatory change (governance code) by each country. Firm size is the log of pre-IPO inflation-adjusted annual sales (€m). Firm age is the log of 1 + age (in years) at the IPO, where age is the difference between IPO year and founding year. Profitability is the firm's Return on Assets. Leverage is book value of debt divided by book value of assets. Industry Q is the median Tobin's Q value of firms going public in the European exchanges of our sample operating the same industry (SIC 1-digit). Industry (SIC 1-digit), year, and country fixed effects are included. ***, **, and * indicate significance at the 1, 5, and 10 percent levels respectively.

	Firms going public	Firms staying private	Difference public-private	Probit reg. (IPO=1)
EU SOX dummy				0.04
				(0.49)
Firm size (sales, €m)	337.0	23.4	313.6***	0.59***
	(23.2)	(6.1)	(17.1***)	(77.10)
Firm age (years)	13.6	26.1	-12.5***	-0.86***
	(7.0)	(20.0)	(-13.0***)	(-53.43)
Profitability (%)	-11.2	4.9	-16.1***	-0.01***
	(0.1)	(3.1)	(-3.0***)	(-16.92)
Leverage (%)	26.1	11.7	14.4***	0.02***
	(14.5)	(2.4)	(12.1***)	(3.15)
Industry Q	2.7	2.3	0.4***	0.14***
	(2.6)	(2.4)	(0.2***)	(6.70)
Constant				-6.73***
				(-23.26)
Pseudo R-squared				0.69
Firm-year observations	3,791	607,352		611,143

Table 5. The effect of EU SOX on IPO underpricing. Heckman's second step regression on IPO underpricing, defined as the difference between first day closing price and offer price, divided by offer price. Mills' ratios are obtained from the first step estimation reported in Table 4. Independent variables are defined in Appendix A. Pre-(post-) SOX IPOs occurred 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 firm belonging to these industries, as defined by the Eurostat (2009) sectorial classification. Industry (SIC 1-digit), year, country, and market fixed effects are included. ***, **, and * indicate significance at the 1, 5, and 10 percent levels respectively.

	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	-0.09***			-0.71***	-0.12***	-0.03	-0.04	-0.12***	-0.06*	-0.61**
	(-3.70)			(-2.94)	(-3.02)	(-1.02)	(-1.11)	(-3.28)	(-1.95)	(-2.44)
Firm size	-0.03***	-0.07***	0.01	-0.05***	-0.02	-0.02**	-0.03***	-0.04***	-0.03**	-0.05***
	(-3.98)	(-4.55)	(1.33)	(-4.71)	(-0.56)	(-2.10)	(-3.94)	(-3.21)	(-2.26)	(-4.51)
HTKIS	0.03	0.07	0.00	0.03	0.03	0.01	0.08**			0.07**
	(1.01)	(1.30)	(0.20)	(1.01)	(0.60)	(0.33)	(2.20)			(1.99)
EU SOX * Size				0.04***						0.03**
				(2.58)						(2.31)
EU SOX * HTKIS							-0.09**			-0.08*
							(-2.18)			(-1.86)
Firm age	-0.02**	-0.04**	0.01	-0.02*	-0.02	-0.02*	-0.02*	0.01	-0.05***	-0.02*
	(-1.98)	(-2.46)	(1.25)	(-1.93)	(-0.87)	(-1.71)	(-1.83)	(0.43)	(-3.39)	(-1.82)
Underwriter reputation	-0.03***	-0.02*	-0.02***	-0.03***	-0.04**	-0.01**	-0.03***	-0.03***	-0.02**	-0.03***
	(-3.95)	(-1.84)	(-3.03)	(-3.87)	(-2.55)	(-2.15)	(-3.95)	(-3.32)	(-2.12)	(-3.88)
VC backing	-0.03	-0.11***	0.04**	-0.03	-0.05	-0.01	-0.03	-0.01	-0.05*	-0.03
	(-1.38)	(-2.95)	(2.28)	(-1.30)	(-1.54)	(-0.49)	(-1.31)	(-0.41)	(-1.76)	(-1.26)
IPO Dilution	0.01	0.03	0.01*	0.01	0.00	0.02	0.01	0.01	0.03	0.01
	(1.15)	(1.03)	(1.80)	(1.19)	(0.08)	(1.54)	(1.24)	(0.87)	(1.43)	(1.27)
Leverage	-0.04	0.03	-0.02	-0.04	0.04	-0.07*	-0.04	0.00	-0.08*	-0.04
	(-1.17)	(0.48)	(-0.66)	(-1.23)	(0.64)	(-1.86)	(-1.14)	(0.09)	(-1.78)	(-1.20)
Pre-IPO market return	24.30***	26.20***	8.85*	24.39***	28.70***	17.19***	24.85***	27.86***	21.83***	24.84***
	(4.67)	(3.00)	(1.79)	(4.69)	(3.41)	(2.93)	(4.78)	(3.91)	(2.93)	(4.78)
Prior 30 day underpricing	0.07***	0.31***	0.02*	0.07***	0.04**	0.22***	0.07***	0.05***	0.13***	0.07***
	(4.82)	(7.00)	(1.73)	(4.94)	(2.43)	(7.37)	(4.87)	(3.33)	(4.29)	(4.97)
Mills' ratio	-0.03*	-0.05*	-0.01	-0.02*	-0.03	-0.01	-0.03*	-0.04*	-0.02	-0.02*
	(-1.95)	(-1.91)	(-1.17)	(-1.71)	(-1.45)	(-0.80)	(-1.93)	(-1.83)	(-1.26)	(-1.72)
Constant	1.06***	1.73***	-0.03	1.38***	0.91**	0.66***	1.02***	1.22***	0.86***	1.31***
	(6.91)	(6.19)	(-0.24)	(7.02)	(2.06)	(3.38)	(6.61)	(5.43)	(4.27)	(6.59)
Observations	3,789	1,858	1,931	3,789	1,894	1,895	3,789	2,162	1,627	3,789
Wald Chi-squared	192	177.6	37.0	199.0	142.1	109.6	197.0	128.9	84.50	202.7

Table 6. The effect of EU SOX on IPO valuation. Heckman's second step regression on Tobin's Q, defined as the ratio of the market value of assets to the book value of assets, where the market value is calculated as the sum of the book value of assets and the market value at the offer price of common stock minus the book value of common stock. Mills' ratios are obtained from the first step estimation reported in Table 4. Independent variables are defined in Appendix A. Pre-(post-) SOX IPOs occurred 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 firm belonging to these industries, as defined by the Eurostat (2009) sectorial classification. Industry (SIC 1-digit), year, country, and market fixed effects are included. ***, **, and * indicate significance at the 1, 5, and 10 percent levels respectively.

	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	-0.16			-2.22***	-0.38**	0.22**	0.05	-0.36**	0.07	-1.80**
	(-1.60)			(-2.75)	(-2.20)	(2.47)	(0.36)	(-2.55)	(0.46)	(-2.18)
Firm size	-0.52***	-0.61***	-0.45***	-0.59***	-0.25***	-0.31***	-0.52***	-0.64***	-0.42***	-0.59***
	(-19.67)	(-15.00)	(-12.83)	(-15.68)	(-2.97)	(-9.17)	(-19.64)	(-16.12)	(-11.80)	(-15.37)
HTKIS	0.12	0.25**	-0.03	0.11	0.13	0.05	0.32***			0.29***
	(1.59)	(2.32)	(-0.25)	(1.49)	(1.04)	(0.59)	(2.93)			(2.64)
EU SOX * Size				0.12**						0.10**
				(2.57)						(2.27)
EU SOX * HTKIS							-0.38**			-0.33**
							(-2.54)			(-2.23)
Firm age	-0.09***	-0.11**	-0.05	-0.09***	-0.20***	-0.01	-0.09***	-0.06	-0.12***	-0.08***
	(-2.91)	(-2.48)	(-1.20)	(-2.75)	(-3.38)	(-0.32)	(-2.75)	(-1.28)	(-2.68)	(-2.63)
Underwriter reputation	0.13***	0.15***	0.10***	0.14***	0.09*	0.13***	0.13***	0.16***	0.11***	0.13***
	(5.82)	(5.24)	(2.82)	(5.92)	(1.75)	(6.43)	(5.79)	(5.25)	(3.05)	(5.89)
VC backing	-0.05	-0.05	-0.07	-0.04	0.01	-0.04	-0.04	0.04	-0.18	-0.04
	(-0.64)	(-0.47)	(-0.66)	(-0.58)	(0.09)	(-0.55)	(-0.57)	(0.41)	(-1.64)	(-0.52)
IPO Dilution	-0.03***	-0.06***	-0.03***	-0.03***	-0.04***	-0.02***	-0.03***	-0.03***	-0.03**	-0.03***
	(-6.22)	(-3.84)	(-4.75)	(-6.20)	(-4.51)	(-3.49)	(-5.99)	(-5.18)	(-2.40)	(-6.00)
Leverage	-0.18	-0.17	-0.10	-0.18	-0.24	-0.39***	-0.17	-0.01	-0.31*	-0.18
	(-1.43)	(-0.89)	(-0.61)	(-1.47)	(-1.16)	(-3.02)	(-1.41)	(-0.04)	(-1.87)	(-1.45)
Pre-IPO market return	-9.12	-55.9**	46.78*	-8.75	-16.68	0.09	-7.02	-17.91	14.11	-6.93
	(-0.50)	(-2.43)	(1.74)	(-0.48)	(-0.56)	(0.00)	(-0.39)	(-0.76)	(0.50)	(-0.38)
Mills' ratio	-0.21***	-0.23***	-0.22***	-0.21***	-0.29***	-0.17***	-0.21***	-0.26***	-0.16**	-0.21***
	(-4.59)	(-3.24)	(-3.59)	(-4.53)	(-3.90)	(-3.28)	(-4.56)	(-4.09)	(-2.41)	(-4.55)
Constant	12.11***	13.81***	9.42***	13.28***	7.89***	7.91***	11.94***	14.05***	10.28***	13.00***
	(25.66)	(19.58)	(12.16)	(20.25)	(5.70)	(12.89)	(25.10)	(20.90)	(15.86)	(19.50)
Observations	3,789	1,858	1,931	3,789	1,894	1,895	3,789	2,162	1,627	3,789
Wald Chi-squared	536.8	359.7	210.9	544.3	74.4	264.5	544.2	364.0	178.8	550.0

Table 7. The effect of EU SOX on IPO long-run performance. Heckman's second step regression on 5-year buy-and-hold abnormal return (BHAR) of IPOs. The first row reports average (and median) values. Mills' ratios are obtained from the first step estimation reported in Table 4. Independent variables are defined in Appendix A. Pre-(post-) SOX IPOs occurred 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 firm belonging to these industries, as defined by the Eurostat (2009) sectorial classification. Industry (SIC 1-digit), year, country, and market fixed effects are included. ***, **, and * indicate significance at the 1, 5, and 10 percent levels respectively.

	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)
5-year BHAR (%)		-39.8	-20.1		-41.7	-18.2		-38.9	-17.8	-30.1
		(-74.9)	(-41.1)		(-66.8)	(-41.1)		(-62.1)	(-46.3)	(-55.3)
EU SOX	-0.30			0.97	-0.43	-0.18	-0.41	-0.41	-0.04	0.77
	(-0.63)			(1.32)	(-0.69)	(-0.25)	(-0.84)	(-0.82)	(-0.04)	(1.02)
Firm size	0.09***	0.11***	0.07**	0.13***	0.24***	0.07**	0.09***	0.15***	0.04	0.12***
	(4.14)	(3.06)	(2.45)	(4.72)	(3.14)	(2.01)	(4.14)	(5.57)	(0.91)	(4.59)
HTKIS	-0.16*	-0.32**	-0.03	-0.16*	-0.25**	-0.07	-0.24**			-0.23**
	(-1.66)	(-2.00)	(-0.27)	(-1.68)	(-2.01)	(-0.49)	(-2.24)			(-2.11)
EU SOX * Size				-0.07**						-0.07**
				(-2.28)						(-2.05)
EU SOX * HTKIS							0.17*			0.14
							(1.68)			(1.35)
Firm age	0.02	0.06	-0.03	0.02	-0.02	0.04	0.02	0.03	0.02	0.02
	(0.83)	(1.51)	(-0.96)	(0.85)	(-0.62)	(1.11)	(0.77)	(0.93)	(0.40)	(0.79)
Underwriter reputation	0.01	-0.01	0.03*	0.01	0.04	-0.01	0.01	-0.00	0.04	0.01
	(0.70)	(-0.40)	(1.78)	(0.64)	(1.62)	(-0.46)	(0.68)	(-0.00)	(1.22)	(0.63)
VC backing	0.01	-0.01	0.00	0.00	-0.00	-0.00	0.01	0.02	-0.01	0.00
	(0.13)	(-0.07)	(0.08)	(0.06)	(-0.00)	(-0.06)	(0.11)	(0.41)	(-0.09)	(0.05)
IPO Dilution	-0.01	-0.06	0.01	-0.01	0.01	-0.01	-0.01	-0.01	-0.01	-0.01
	(-0.44)	(-0.96)	(0.47)	(-0.41)	(0.24)	(-0.39)	(-0.46)	(-0.33)	(-0.17)	(-0.43)
Leverage	0.05	0.05	0.02	0.05	-0.03	0.02	0.05	0.22**	-0.08	0.05
	(0.63)	(0.36)	(0.24)	(0.64)	(-0.32)	(0.12)	(0.63)	(2.08)	(-0.54)	(0.65)
Pre-IPO market return	-10.03	-14.17	-5.08	-9.92	-29.49*	8.42	-10.44	-13.71	-7.45	-10.27
	(-0.80)	(-0.78)	(-0.31)	(-0.79)	(-1.94)	(0.42)	(-0.83)	(-1.01)	(-0.31)	(-0.82)
Mills' ratio	0.04	-0.04	0.10**	0.03	0.08	-0.06	0.04	0.03	0.06	0.03
	(1.03)	(-0.58)	(2.23)	(0.74)	(1.61)	(-0.63)	(1.02)	(0.73)	(0.78)	(0.76)
Constant	-0.01	-0.82	-1.35**	-0.58	-2.02	0.25	0.06	-0.82	1.10	-0.47
	(-0.02)	(-1.07)	(-2.03)	(-1.13)	(-1.60)	(0.34)	(0.14)	(-0.65)	(1.40)	(-0.90)
Observations	3,458	1,784	1,674	3,458	1,729	1,729	3,458	2,030	1,428	3,458
Wald Chi-squared	293.6	207.2	72.9	299.2	216.6	130.2	296.7	279.2	89.0	301.2

Table 8. Robustness tests: firm age, regulated markets, bubble years. Heckman's second step on: underpricing, with firm age as alternative proxy for information asymmetry, and young firms defined as those with an age at IPO below the sample median (Models 1-3); underpricing and Tobin's Q on the subsample of IPOs occurring on regulated markets (Models 4-5) and excluding IPOs occurring during bubble years 1999 and 2000 (Models 6-7). Independent variables are defined in Appendix A. Industry (SIC 1-digit), year, country, and market fixed effects are included. ***, **, and * indicate significance at the 1, 5, and 10 percent levels respectively.

	Firm age vs. underpricing			Regulated market IPOs		Bubble years excluded	
	All	Young	Old	Underpricing	Tobin's Q	Underpricing	Tobin's Q
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
EU SOX	-0.17***	-0.13***	-0.05	-1.90***	-5.28***	-0.79***	-1.95**
	(-3.98)	(-4.16)	(-1.43)	(-3.73)	(-4.53)	(-2.64)	(-2.23)
Firm size	-0.03***	-0.02**	-0.04***	-0.09***	-0.51***	-0.06***	-0.60***
	(-3.96)	(-2.26)	(-2.76)	(-4.76)	(-12.06)	(-3.95)	(-14.23)
HTKIS	0.02	-0.03	0.09**	0.16**	0.36***	0.08*	-0.07**
	(0.90)	(-0.71)	(2.11)	(2.32)	(2.88)	(1.70)	(-2.16)
Firm age	-0.04***	-0.03	-0.03	-0.04**	-0.09**	-0.02*	0.22*
	(-2.95)	(-1.27)	(-1.17)	(-2.02)	(-2.02)	(-1.72)	(1.89)
EU SOX * Firm size				0.09***	0.28***	0.04**	0.12**
				(3.46)	(4.52)	(2.37)	(2.42)
EU SOX * HTKIS				-0.16*	-0.36*	-0.10**	-0.28*
				(-1.74)	(-1.71)	(-1.98)	(-1.76)
EU SOX * Firm age	0.04**						
	(2.23)						
Underwriter reputation	-0.03***	-0.04***	-0.01	-0.01	0.12***	-0.04***	0.14***
	(-3.95)	(-4.57)	(-1.39)	(-1.31)	(5.24)	(-4.58)	(5.78)
VC backing	-0.03	-0.04	-0.02	-0.14***	-0.02	-0.03	-0.06
	(-1.27)	(-1.54)	(-0.50)	(-3.36)	(-0.22)	(-1.07)	(-0.73)
IPO Dilution	0.01	0.01	0.03	-0.02	-0.02**	0.01	-0.03***
	(1.23)	(0.50)	(1.25)	(-0.70)	(-2.34)	(0.67)	(-5.87)
Leverage	-0.05	-0.08*	0.00	0.02	-0.58***	-0.05	-0.19
	(-1.27)	(-1.74)	(0.07)	(0.24)	(-3.58)	(-1.16)	(-1.49)
Pre-IPO market return	24.65***	35.04***	14.90**	24.08**	1.08	31.72***	-1.61
	(4.74)	(4.85)	(2.01)	(2.45)	(0.05)	(5.42)	(-0.09)
Prior 30 day underpricing	0.07***	0.04***	0.18***	0.22***		0.03**	
	(4.87)	(2.80)	(5.57)	(5.55)		(2.04)	
Mills' ratio	-0.03**	-0.03*	-0.02	-0.02	0.13**	-0.04***	-0.00
	(-2.08)	(-1.65)	(-1.06)	(-0.77)	(2.09)	(-2.68)	(-0.07)
Constant	1.10***	1.00***	0.98***	2.09***	11.67***	1.49***	13.16***
	(7.14)	(5.34)	(4.21)	(6.16)	(15.99)	(5.56)	(17.80)
Observations	3,789	1,917	1,872	1,736	1,736	2,918	2,918
Wald Chi-squared	197.3	144.6	96.8	179.9	336.1	159.7	460.7

Appendix A. Variable definitions

Variable	Definition
Underpricing	(First day closing price - offer price) / offer price
Tobin's Q	Market value of assets / book value of assets, where market value = book value of assets + market value of common stock at offer price - book value of common stock
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 size	Log of pre-IPO inflation-adjusted annual sales (€m)
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
Firm age	Log of 1 + age (in years) at the IPO, where age is the difference between IPO year and founding year
Underwriter reputation	Market share of the lead underwriter measured by IPO proceeds raised in the four main European stock exchanges (London, Euronext, Frankfurt, Milan) during 1995-2012
VC backing	Dummy equal to 1 for venture capital-backed IPOs
IPO dilution	Primary shares sold at IPO / pre-IPO shares outstanding
Leverage	Book value of debt / book value of assets, pre-IPO
Pre-IPO market return	Average daily return of the stock exchange index where the company goes public in the 30 days prior to IPO
Prior 30 day underpricing	Average underpricing of the stock exchange where the company goes public in the 30 days prior to IPO

Appendix B. Correlation matrix

		(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)	Prior 30 day underpricing	-0.06***	-0.02*	0.03*	0.02	0.01	-0.01	-0.02	0.01***	0.05***