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Stock-financed M&As of newly listed firms

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Abstract Newly listed firms are increasingly active in mergers and acquisitions (M&As). The "stock as currency" motivation explains why firms engage in stock-financed acquisitions after their Initial Public Offering (IPO). We extend its implications by focusing on the role played by stock liquidity, which entails potential benefits not only for prospective acquirers, but also for targets. We find that 16.3 % of the population of 3433 firms going public in Europe from 1995 to 2009 become acquirers within 3 years of the IPO, while 16.8 % are targeted. Firms with more liquid stocks are more likely to acquire and complete a larger number of stock-financed acquisitions. More liquid firms are also more likely to be acquired, and at higher valuations. Our firm-level findings, supported by time-series regressions, imply that firms should time their IPO based on liquidity considerations to facilitate subsequent M&A activity as either acquirer or target.

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1 Introduction

Newly listed firms use their publicly traded stocks to acquire other firms. Popular examples of such aggressive strategies include Yahoo!, which completed six stock-financed acquisitions soon after going public, Google's acquisition of YouTube entirely through stocks, and Facebook's acquisition of WhatsApp. Consistent with the "stock as currency" motivation, Fig. 1 documents that going public is a turning point of a firm's acquisition activity, and particularly of the use of stocks as means of payment. While stocks are almost never used by private acquirers, they are employed by one-third of newly listed acquirers. Coherent with market timing and windows of opportunity theories, firms may time their Initial Public Offering (IPO) during periods of temporary overvaluations to facilitate their subsequent acquisition activity using publicly traded shares (Ibbotson and Jaffe 1975; Loughran and Ritter 1995). The creation of publicly traded stocks to be used as an alternative currency to cash is indeed ranked by firm managers as the most influential reason to take the company public (Brau and Fawcett 2006).

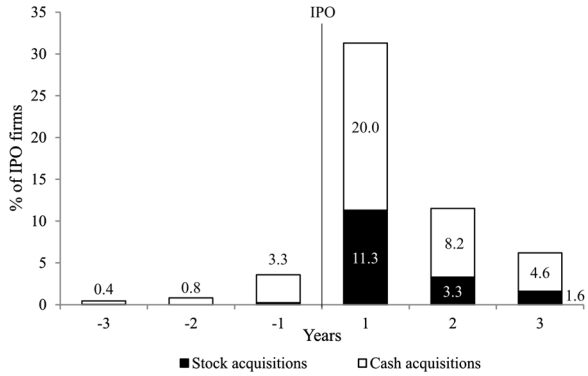

Fig. 1 Fraction of firms that become acquirers before and after the IPO

While finance papers have recently focused on how going public facilitates growth by means of acquisitions (e.g., Brau et al. 2012; Celikyurt et al. 2010; Hovakimian and Hutton 2010; Hsieh et al. 2011), a parallel stream of research in entrepreneurship (e.g., Audretsch and Lehmann 2007; Bonardo et al. 2010; Lehmann et al. 2012; Meoli et al. 2013; Xiao 2015) has modeled the market for corporate control as a matching mechanism among established and entrepreneurial firms with regard to assets (Gans and Stern 2000; Granstrand and Sjölander 1990), innovation (Acs and Audretsch 1988; Hall 1990; Lehmann and Schwerdtfeger 2016), and labor specialization (Lichtenberg et al. 1987; Lichtenberg and Siegel 1990). Our paper links these theoretical frameworks by identifying in stock liquidity the channel through which an IPO determines the success of a newly listed firm's Mergers and Acquisitions (M&A) activity both as acquirer and as target. The theoretical motivation goes as follows. From an acquirer's point of view, the use of liquid stocks as currency enlarges the scope of feasible targets, which is consistent with a market timing theory of the going public decision. For targets, more liquid stocks represent more easily redeployable investments in the eye of potential acquirers, which should increase their willingness to pay and, consequently, a target's likelihood of receiving a favorable acquisition bid. Not all IPO firms, however, are able to develop liquid trading in the aftermarket. For instance, most companies going public on European second-tier markets, such as London's Alternative Investment Market, tend to become illiquid after the first year of trading (Vismara et al. 2012). While going public makes it easier to find a trading counterpart, the extent to which a certain level of liquidity is achieved after the IPO remains crucial for the success of the newly listed firm on the financial markets.

The study of post-IPO M&As is of current interest, as a significant fraction of firms going public in both the United States and Europe is acquired within 3 years, on average at higher valuations than those obtained by similar targets who sell out as private companies. The IPO is growing as an intermediate step of a value-maximizing divesture strategy, where companies are sold soon after going public (Chemmanur et al. 2016). Furthermore, recent evidence that small stand-alone firms are increasingly struggling with becoming and remaining profitable suggests that the importance of getting big fast has increased over time, and so has their propensity to be acquired (Gao et al. 2013; Ritter et al. 2013). The necessary condition for an IPO to effectively facilitate a firm's M&A activity is, however, that its shares can be used as means of exchange in M&A deals. This implies that IPO firms need to be able to develop liquid trading after going public.

Our paper extends the existing literature along two dimensions. First, we link the IPO literature to M&A studies. Massa and Xu (2013) report that public acquirers pay higher takeover premiums for targets with more liquid stocks. They find that deals involving more liquid targets are more likely to be completed and to show positive abnormal returns after the announcement. This rationale applies to our study in that we document, for the first time, that a higher level of stock liquidity after going public facilitates a firm's M&A activity as both acquirer and target. Newly listed shares are indeed increasingly used as currency in M&A deals soon after the IPO. Second, existing evidence on seasoned equity offerings shows that new shares are usually offered at a discount in private placements as compared to public offerings (e.g., Kim and Shin 2004; Kothare 1997; Qian 2011). By showing that a higher stock liquidity after the IPO increases the valuation at

which firms are targeted, we argue that considerations about liquidity affect the initial exit choice between direct sales and IPOs when firms factor in the latter the opportunity of being acquired at higher valuations (Chemmanur et al. 2016).

Empirically, we focus on the population of 3433 firms going public on the stock exchanges of the four largest European economies (Euronext, Frankfurt, London, and Milan) from 1995 to 2009, and monitor their M&A activity. We find that a similar fraction of these firms, approximately 16 %, either become stock acquirers or are targeted within 3 years of the IPO. Consistent with previous studies, we find that going public triggers the merger activity of our sample firms, and opens the possibility to conduct stock-financed deals, whose incidence increases from 2 % of the acquisitions completed in the 3 years prior to IPO to 21 % in the 3 years post-IPO. Our multivariate analyses document that IPO firms that are able to develop more liquid trading, as measured by bid-ask spread, turnover, and Amihud's (2002) illiquidity ratio, are significantly more likely to become stock acquirers and, if so, complete a larger number of stock-financed acquisitions. On the target's side, a higher level of stock liquidity increases a firm's likelihood of being targeted shortly after going public. When this occurs, the valuation at which the firm is acquired increases with liquidity. Finally, we employ time-series regressions to validate that stock liquidity explains the variation in IPO activity and related acquisitions over time. Overall, we document that the availability of publicly traded stocks associated with an IPO is beneficial not only for prospective acquirers, but also for potential targets.

The remainder of this paper is organized as follows. Section 2 provides the theoretical framework and the hypotheses. Section 3 describes the research design, while Sect. 4 reports the econometric results, including robustness tests. Section 5 presents the results of the time-series analysis. Finally, Sect. 6 discusses the conclusions of our research and their implications.

2 Theory and hypotheses

2.1 IPO firms as acquirers

Periods of high M&A activity are correlated with high market valuations (Maksimovic and Phillips 2001). Starting from Manne (1965), the Q-theory of mergers predicts that a firm's investment rate should rise with its Q ratio, with mergers representing a channel through which capital flows to better projects and better management. Consistent with this theory, merger activity increases in the presence of high Q dispersion, with high Q firms acquiring low Q firms (Jovanovic and Rousseau 2002). This view has been recently challenged by Rhodes-Kropf and Viswanathan (2004), who question why, if stock-financed merger waves are triggered by temporary overvaluation, targets are willing to accept overvalued stocks as currency. Rhodes-Kropf and Robinson (2008) emphasize the role played by asset complementarity and search costs, resulting in an empirical pattern that is better characterized as "like buys like" rather than "high buys low." Shleifer and Vishny (2003) provide a behavioral explanation of merger waves, with market participants being aware that a temporary mispricing will correct itself in the long run.

The influence of stock liquidity in the M&A market is far less explored. Previous studies show that liquidity promotes the adoption of managerial incentive schemes that alleviate agency conflicts (Jensen and Meckling 1976), has beneficial effects on corporate governance (Edmans et al. 2013), increases firm value and performance (Amihud and Mendelson 1986), and stimulates trading by knowledgeable investors that make stock prices more informative (Subrahmanyam and Titman 2001). Massa and Xu (2013) document that stock liquidity in the M&A setting is differently appreciated based on the public status of the potential acquirer, thereby influencing the acquirer's selection of the target and willingness to pay for it.

An even more important role is played by stock liquidity when we consider the M&A activity of newly listed firms, since the IPO setting is typically characterized by a considerable extent of information asymmetry between issuers and investors. This concern can be alleviated by the firm's ability to develop liquid trading in the aftermarket, thereby leaving investors with the option to liquidate their investment swiftly and with limited adverse effects on price. As a result, the market recognizes a higher valuation to more liquid stocks (Silber 1991). This enlarges the scope of feasible targets because, everything else equal, the stock price of more liquid acquirers will be higher. Acquirers with more liquid stocks are therefore able to propose more favorable acquisition bids to targets that would otherwise be too costly using cash or less liquid stocks as means of payment. Therefore, a

first important channel through which liquidity facilitates stock-financed acquisitions is better valuation.

A second important channel through which liquidity facilitates a firm's post-IPO acquisition activity is its signaling power. Stock liquidity is perceived as a credible signal of firm quality and has been used in the financial literature as an accurate proxy for a firm's degree of information asymmetry (e.g., Copeland and Galai 1983). Moreover, stock liquidity reflects the characteristics of the underlying assets, with higher levels of liquidity being typically associated with better quality assets. For instance, Gopalan et al. (2012) find a positive relation between corporate liquidity and stock liquidity, that is, firms with higher availability of cash also have more liquid stocks. This link may play a crucial role in shaping the attitude of a potential target towards an acquisition bid. Specifically, for a given takeover bid, a target firm should be more willing to agree to be acquired if the bid is formulated by a firm whose stocks are highly liquid. Given that, in our setting, we consider acquisition bids formulated by newly listed firms, information about their level of stock liquidity is immediately observable by potential targets.

We therefore expect a higher level of stock liquidity to facilitate a newly listed firm's acquisition activity financed by stocks. Based on these arguments, we formulate the following hypotheses:

H1a A firm's likelihood of conducting stock acquisitions shortly after the IPO increases with its stock liquidity.

H1b A firm's number of stock acquisitions conducted shortly after the IPO increases with its stock liquidity.

2.2 IPO firms as targets

Searching for potential acquirers is costly as it entails consumption of time and resources. A sequential divestiture strategy using an IPO may be attractive relative to a direct sale if it serves to raise the firm's profile and reduce uncertainty (Shen and Reuer 2005). The contextual move from the private to the public domain increases the level of a firm's disclosure and eases access to information. This makes the process of going public responsive to adverse selection problems by increasing the amount of information available on firms, especially for those that suffer from a larger degree of ex-ante information asymmetry (Bonardo et al. 2010; Meoli et al. 2013). Also, the IPO places a price on the firm, thereby alleviating valuation challenges for would-be investors and improving efficiency in the M&A market. As a consequence, existing shareholders of private firms can consider maximizing their payoff by selling their equity stake after taking the company public, rather than accepting an acquisition bid when still private. The valuation at which a listed firm is acquired is indeed likely to benefit from a liquidity premium (Silber 1991).

Transaction costs theory predicts that, in financial markets, investors weigh the costs of trading against the expected gains from executing a transaction. As a result, transaction costs affect market participants both in a direct (the transaction costs payment) and indirect (the deviation from the optimal investment strategy associated with the no-transaction cost case) way. Since liquidity is a measure of asset redeployability, higher liquidity implies lower transaction costs. In the M&A market, the level of liquidity of a target firm is important in determining the extent of transaction costs incurred by both the same target and the potential acquirer. Owners of a private firm willing to sell (a fraction of) their equity have to search for a counterpart that agrees to formulate an acquisition bid, often resulting in a more opaque sale process and involving significantly fewer competing bids compared to the case in which the firm's shares are traded on an organized exchange (Officer 2007). Among publicly traded firms, those that are able to develop greater liquidity provide shareholders with easier exit options. Taken together, these arguments imply that the likelihood of a firm receiving an acquisition bid should increase with its level of liquidity. We therefore formulate the following hypothesis:

H2 A firm's likelihood of being targeted shortly after the IPO increases with its stock liquidity.

2.3 The valuation of IPO firms as targets

An increasing fraction of firms is acquired shortly after going public (Gao et al. 2013; Ritter et al. 2013) and recent evidence shows that the payoffs obtained by firms that sell out after going public or filing for an IPO is higher than that obtained in a private transaction (Brau et al. 2010; Lian and Wang 2012). A number of studies have focused on several benefits brought by the IPO process, such as reduced information asymmetry (Ragozzino and Reuer 2007), increased bargaining

power (Zingales 1995), and the possibility to invest the fresh capital in new value-maximizing projects (Poulsen and Stegemoller 2008) that allow firms to be acquired at more favorable terms after going public. Whether their ability to develop liquid trading is a determinant of their valuation as target firms remains unexamined. Chemmanur et al. (2016) document that the valuation premium obtained by newly listed firms over similar private targets increases with the level of aftermarket stock liquidity.

In line with our previous hypothesis, the main theoretical arguments justifying a higher valuation for more liquid firms are related to information asymmetry and transaction costs issues. Higher stock liquidity implies a higher level of transparency associated with the firm, since a larger number of traders exchange its shares, thereby increasing the visibility of the firm and making its stock price more informative. This lowers the degree of uncertainty faced by potential acquirers. Higher stock liquidity also implies lower transaction costs because the acquirer will inherit the target's characteristics, and more liquid targets will result in higher liquidity of the merged entity. As suggested by the literature on illiquidity discounts (e.g., Officer 2007), we expect acquirers to recognize a positive value to these characteristics, which would increase their willingness to pay for more liquid firms, resulting in a higher valuation at which the target firm is acquired. Based on these arguments, we formulate the following hypothesis.

H3 The valuation at which a firm is acquired shortly after the IPO increases with its stock liquidity.

3 Research design

3.1 Sample

Our sample is composed of 3433 IPOs taking place on the stock exchanges of the four largest European economies, namely the U.K., France,[1] Germany, and Italy, during the period 1995–2009. The population of European IPOs is obtained from the EurIPO database, which has been used in previous IPO studies (e.g., Chambers and Dimson 2009; Judge et al. 2015). We keep track of each firm's involvement in M&A activity within the first 3 years of the IPO by matching the population of IPOs with the Thomson Financial SDC Mergers and Acquisition database. This allows us to identify IPO firms that become acquirers or are targeted within 3 years of the IPO.

Table 1 presents the year distribution of the sample. Of the 3433 IPO firms, 558 (16.3 %) completed at least one stock acquisition, and 577 (16.8 %) were targeted during the first 3 years of life as a public company. Therefore, the percentage of firms that become acquirers and targets shortly after going public is similar. The table suggests that not only does IPO activity occur in waves, as widely documented by prior literature (e.g., Ritter 1984), but also that a similar pattern is followed by the fraction of IPO firms that subsequently engage in M&As. Acquisition activity by newly listed firms reaches its peak in 2003 (27.2 % of firms), while none of the firms going public in 2009 became acquirers within 3 years. The IPO firms' propensity to be targeted seems instead characterized by less pronounced fluctuations. Last, we note that 87 firms in our sample completed at least one acquisition before being acquired within 3 years of the IPO. These account for 2.5 % of the sample, and 15.1 % of the target firms. On average, these firms complete 1.6 acquisitions before being acquired, with the first acquisition occurring 6 months after the IPO, and the sellout occurring 20 months after the IPO. As these firms exhibit the characteristics that make them suitable both to formulate and receive successful acquisition bids, we consider them as both acquirers and targets in our econometric analysis.

Table 2 describes the M&A activity of firms shortly after conducting an IPO. Panel A documents that the number of acquisitions made by our sample firms sharply increases once they go public, from 308 acquisitions in the 3 years before the IPO to 3711 in the following 3 years. In particular, the importance of stock-financed acquisitions surges from 1.9 to 20.7 % of all acquisitions completed in the 3-year period before and after the IPO. This confirms the fundamental role played by IPOs in facilitating firms' subsequent acquisition activity and the use of stocks as acquisition currency, as suggested by prior literature (e.g., Celikyurt et al. 2010). Panel B reports the number of firms that are acquired post-IPO. The numbers indicate that a firm's propensity to be acquired increases with time elapsed from its IPO, given that 127 of 577 firms (22 %) are acquired in the

[1] From 2005, we consider Euronext, a pan-European stock exchange including France, Belgium, Netherlands, and Portugal exchanges.

Table 1 Sample composition

Annual distribution of 3433 firms going public in Euronext, Frankfurt, London, and Milan stock exchanges from 1995 to 2009

Year	No.	Acquirers		Targets		Acquirers, then targets
	IPOs	No.	%	No.	%	No.
1995	78	10	12.8	21	26.9	1
1996	206	23	11.2	37	18.0	4
1997	200	28	14.0	33	16.5	2
1998	251	44	17.5	47	18.7	6
1999	333	68	20.4	54	16.2	15
2000	535	107	20.0	87	16.3	21
2001	180	28	15.6	21	11.7	3
2002	107	19	17.8	11	10.3	2
2003	81	22	27.2	7	8.6	1
2004	275	63	22.9	42	15.3	8
2005	393	62	15.8	72	18.3	10
2006	389	51	13.1	68	17.5	10
2007	331	27	8.2	63	19.0	3
2008	53	6	11.3	9	17.0	1
2009	21	0	0.0	5	23.8	0
Total	3433	558	16.3	577	16.8	87

Table 2 M&A activity by IPO firms

Pre- and post-IPO M&A activity of 3433 firms going public during 1995–2009

		Years to/since IPO (0 = IPO year)						3 years	3 years	Ratio
		−3	−2	−1	1	2	3	pre-IPO	post-IPO	post/pre
Panel A. No. M&As as acquirer										
Deals as acquirer	No.	50	78	180	1684	1234	793	308	3711	12.0
Stock-financed	No.	1	0	5	344	264	161	6	769	128.2
	%	2.0	0.0	2.8	20.4	21.4	20.3	1.9	20.7	–
Cash-financed	No.	49	78	175	1340	970	632	302	2942	9.7
Panel B. No. M&As as target										
Deals as target	No.	–	–	–	127	215	235	–	577	–
Stock-financed	No.	–	–	–	15	40	24	–	79	–
	%	–	–	–	11.8	18.6	10.2	–	13.7	–
Cash-financed	No.	–	–	–	112	175	211	–	498	–

first year post-IPO, 215 (37.3 %) in the second year, and 235 (40.7 %) in the third year. Of these deals, 13.7 % are financed using stocks.

3.2 Variables

The explanatory variable of our study is the stock liquidity that each IPO firm is able to develop in the aftermarket. We construct three different proxies that are suggested by prior finance studies measuring stock liquidity (e.g., Massa and Xu 2013). These are based on: (1) bid-ask spread, (2) turnover, and (3) Amihud's illiquidity ratio. The bid-ask spread variable, which directly measures the transaction costs of trading, is defined as the average of the daily bid-ask spread, divided by the midpoint of bid and ask prices. The turnover variable, which accounts for the intensity of trading activity, is defined as the average ratio of daily traded shares divided by post-IPO shares outstanding. Amihud's (2002) illiquidity ratio, which captures the

response of price to order flow, is defined as the average ratio of the daily absolute return of a firm's stock to the monetary trading volume on that day. Following Vismara et al. (2012), we compute these three measures over the period starting from 1 month after the IPO and ending at the minimum between 13 months after the IPO date and 1 month before the M&A (if any). The first month post-IPO is excluded because liquidity may be affected by price stabilization by financial intermediaries.

We then employ a set of control variables drawing upon prior studies on IPOs and M&As.[2] Firm attributes such as size and age are important proxies of a firm's level of information asymmetry that may determine their involvement in the market for corporate control. We therefore define *firm size* as the natural logarithm of pre-IPO annual sales, and *firm age* as the natural logarithm of one plus the difference between IPO year and the firm's founding year, as in Audretsch et al. (2009). We include firm *leverage*, defined as the ratio of pre-IPO total debt to total assets, because more indebted firms tend to be more financially distressed while, at the same time, the presence of credit relationships may reduce uncertainty (James and Wier 1990). Profitability is defined as operating profit (EBITDA) over total assets, as in Bonardo et al. (2011) and Massa and Xu (2013). This ratio, also known as Return On Assets (ROA), is included among our regressors since firms that are doing well may be more likely either to acquire or to draw the attention of potential acquirers (Caprio et al. 2011). As a further proxy for the extent of information asymmetry, we include the *top underwriter* dummy, equal to 1 if the IPO is led by a top-tier underwriter, that is, having an updated Carter and Manaster (1990) rank of 8 or above.[3] Since a venture capitalist's (VC) incentives to formulate or agree to post-IPO acquisition bids may differ from those of other existing shareholders (Bayar and Chemmanur 2011), we include the *VC backing* dummy, equal to 1 if a VC is among the firm's pre-IPO shareholders. The identification of VC-backed IPOs was based on a detailed examination of the 'Other significant shareholders' section of the offering prospectus, which includes standard disclosure requirements in Europe. The market-to-book ratio is the ratio the company's market capitalization at IPO prices over its equity book value. This multiple, one of the most widely used by investment banks when valuing IPOs (Paleari et al. 2014), is a widely accepted measure of firm valuation in scientific articles. In line with the most recent literature in corporate finance, in our cross-sectional analysis, we decompose this measure into the *misvaluation* and *growth opportunities* components, following Rhodes-Kropf et al. (2005) who point out their importance in shaping a firm's role of acquirer or target. These are defined as the logarithm of the ratio between the firm's intrinsic value and book value, and the firm's market value and intrinsic value, respectively.[4] Current market conditions are controlled for by introducing a *market momentum* variable, defined as the average daily return of the stock exchange index where the company goes public in the 30 days prior to the IPO. Finally, industry dynamics might affect our results. Firms in the high-tech sector may benefit more from liquidity because they rely more on stock market feedback to learn about the value of their output. For instance, the compensation of their top managers typically includes equity-based contracts. To address this point, we employ a measure of *M&A intensity*. In the same vein as Celikyurt et al. (2010), we divide the number of deals involving a European target completed in the same year and industry (2-digit SIC level) of the firm going public over the total number of deals completed in the same industry over the entire sample period.

3.3 Methodology

We test our hypotheses in a multivariate, cross-sectional setting. We test Hypothesis 1a, related to an IPO firm's likelihood of becoming an acquirer,

[2] A correlation matrix for the independent variables employed in the multivariate analysis is reported in Appendix 1. The variance inflation factors (VIFs) associated with each model specification all fall well below the acceptable benchmark of 10, indicating multicollinearity is not a concern.

[3] Data from Migliorati and Vismara (2014).

[4] We compute a firm's intrinsic value as a linear function of book value of equity, net income (i.e., the growth of book value of equity), and leverage, following Fu et al. (2013).

by means of a probit model. The dependent variable is a dummy equal to 1 if the firm completed at least one stock acquisition within 3 years of the IPO. We then test Hypothesis 1b, related to the number of completed stock acquisitions, using a zero-truncated negative binomial model on the subsample of acquirers. The distribution properties of this variable make the negative binomial preferable over a Poisson model, which requires no overdispersion.

To address sample selection bias, we simultaneously test Hypotheses 2 and 3 in a two-step Heckman selection model. This allows us to control for the existence of unobservable factors, such as insiders' private information about firm quality, that may simultaneously affect both the probability of a firm self-selecting its treatment, that is, being acquired post-IPO, and the treatment outcome, that is, the valuation obtained in the acquisition. The objective is therefore to test, controlling for unobservable factors, whether stock liquidity significantly affects not only a firm's likelihood of being acquired but also its valuation. In the first step, the likelihood of being acquired is estimated using a probit model, with the dependent variable being a dummy equal to 1 if the firm is targeted within 3 years of the IPO. To ensure a proper identification of the selection, we employ M&A intensity in the first stage. We expect M&A intensity to affect the likelihood of being targeted but not the valuation premium for the following reasons. In the first stage, an IPO firm's propensity to be acquired is likely to be affected by current M&A dynamics occurring in its industry, as suggested by prior literature (e.g., Ahern and Harford 2014). In the second stage, we expect the firm-specific valuation premium to be less affected by industry-specific considerations, since it is calculated with respect to a matched firm within the same industry.[5] In the second step, valuation premium (defined below) is the dependent variable in an OLS model, and the inverse Mills ratios, obtained for each firm in the first stage, are included as regressors.

Following previous studies (e.g., Bayar and Chemmanur 2012), valuation premium is defined as the logarithm of the ratio between the valuation obtained by the IPO firm in the post-IPO acquisition and that obtained by a private propensity score-matched target firm. Conceptually, it represents the premium gained by selling out after going public over the valuation the same firm could have obtained by selling out when still private. We estimate propensity scores by means of a logit regression on the population of European private firms that went public (from EurIPO database) and were targeted (from Thomson SDC) during 1995–2009, with the IPO dummy as the dependent variable (1 if the firm goes public, 0 if it is acquired as private target) and using firm size, age, leverage, and market momentum as independent variables. Then, for each industry (2-digit SIC level) and year combination, we match each IPO firm with the private target having the closest propensity score. Valuation premium is then defined as the log of the ratio of the Enterprise Value to Sales (EV/Sales) at which the IPO firm and its private match are acquired:

$$\text{Valuation premium}_i = \log\left(\frac{\text{EV/Sales}_i}{\text{EV/Sales}_{\text{peer},i}}\right)$$

4 Results

Table 3 presents some descriptive statistics of IPO firms that become acquirers and targets within 3 years of going public. The two groups look similar in terms of stock liquidity, with acquirers being slightly more liquid in terms of turnover (3.2 vs. 2.2 %) and illiquidity ratio (2.4 vs. 3.5), but slightly less liquid in terms of bid-ask spread (5.1 vs. 4.2 %). Significance is however weak in the difference between the mean values and non-existent between median values. Predictably, firms that become acquirers are larger in size than those that are targeted (291.1 vs. 135.7 €m in annual sales), but tend to go public at an earlier stage of their life (9.7 vs. 13.7 years of age). The misvaluation and growth opportunities components of the market-to-book ratio differ significantly between the two groups. Misvaluation is higher among IPO firms that become acquirers because these firms can take advantage of using overvalued stocks to pay for targets. At the same time, less overvalued firms are more attractive towards potential acquirers since they

[5] We empirically tested whether M&A intensity affects valuation premium by including it as a regressor in the second step, and found that its coefficient was not statistically different from zero.

Table 3 Descriptive statistics

	Acquirers (558)		Targets (577)		Difference	
	Mean	Median	Mean	Median	Mean	Median
Bid-ask spread (%)	5.1	3.3	4.2	2.9	0.9*	0.4
Turnover (%)	3.2	0.9	2.2	0.9	1.0*	0.0
Illiquidity (%)	2.4	0.4	3.5	1.1	−1.1*	−0.7**
Firm size (sales, €m)	291.1	10.3	135.7	23.4	155.4	−13.1***
Firm age (years)	9.7	3.0	13.7	6.0	−4.0***	−3.0***
Leverage (%)	20.6	6.6	30.1	20.4	−9.5***	−13.8***
Profitability (%)	3.2	4.4	1.3	2.5	1.9	1.9**
Top-tier underwriter (%)	9.3	0.0	19.6	0.0	−10.3***	0.0***
VC backing (%)	44.6	0.0	31.9	0.0	12.7***	0.0***
Misvaluation Ln(M/V)	1.2	1.0	0.4	0.1	0.8***	0.9***
Growth opportunities Ln(V/B)	0.3	0.3	0.4	0.4	−0.1***	−0.1***
M&A intensity (%)	6.8	4.4	6.7	4.4	0.1	0.0
Market momentum (%)	0.03	0.05	0.04	0.05	−0.01	0.00

Descriptive statistics of firms that become stock acquirers and targets in the 3 years following the IPO. ***, **, and * indicate significance at the 1, 5, and 10 % levels, respectively, from the test for the difference in means (*t* test) and medians (Wilcoxon-Mann–Whitney test) between acquirers and targets

represent cheaper targets. On the other hand, prospective targets are found to embed larger growth opportunities, which may be one of the reasons why they attract takeover bids.

4.1 IPO firms as acquirers

Table 4 presents the results of the empirical tests of Hypotheses 1a and 1b. Models 1–3 employ our three different proxies for stock liquidity in a probit regression model where the dependent variable is equal to 1 if the firm becomes a stock acquirer within 3 years of the IPO. This is aimed at testing Hypothesis 1a, predicting that a firm's likelihood of conducting stock acquisitions shortly after the IPO increases with its stock liquidity. Consistent with our hypothesis, we find that liquidity is strongly and positively associated with the likelihood of becoming a stock acquirer regardless of which liquidity proxy is used. The coefficients reveal that firms able to develop greater liquidity in the aftermarket, that is, characterized by narrower bid-ask spreads (Model 1), higher share turnover (Model 2), and lower illiquidity ratios (Model 3), are more likely to become stock acquirers. In terms of economic impact, a one standard deviation decrease in bid-ask spread and illiquidity increases the propensity to acquire by 2.4 and 7.4 % respectively, while a one standard deviation increase in turnover increases this likelihood by 1.3 %.[6]

Among the control variables, we find that smaller, younger, and more profitable firms are more likely to become acquirers, arguably because they are in a growth phase of their business. Firms with a larger misvaluation component of their market to book ratio are also more likely to conduct a stock-based acquisition, given the opportunity to use overvalued stocks as currency and therefore bid for otherwise too expensive targets. Finally, firms operating in industries with intense M&A activity are significantly more likely to become acquirers.

Models 4–6 employ our three different proxies for stock liquidity in a zero-truncated negative binomial regression model, where the dependent variable is the number of stock acquisitions completed by firms that became acquirers within 3 years of their IPO. This model aims at testing Hypothesis 1b, which predicts that a firm's number of stock acquisitions conducted

[6] We obtain the economic impact by estimating the marginal effect associated with each liquidity measure, and multiply it by the corresponding standard deviation.

Table 4 Probability to acquire and number of acquisitions post-IPO

	Acquirer likelihood			Number of acquisitions		
	Bid-ask (1)	Turnover (2)	Illiquidity (3)	Bid-ask (4)	Turnover (5)	Illiquidity (6)
Liquidity	−1.47***	0.57***	−3.25**	−3.96**	1.21**	−10.93***
	(−2.69)	(2.65)	(−2.05)	(−2.34)	(2.02)	(−2.70)
Firm size	−0.05***	−0.04**	−0.05***	−0.00	−0.00	−0.00
	(−2.69)	(−2.28)	(−2.75)	(−0.08)	(−0.03)	(−0.04)
Firm age	−0.12***	−0.12***	−0.10***	−0.33***	−0.33***	−0.23***
	(−3.86)	(−3.82)	(−3.30)	(−3.58)	(−3.56)	(−2.92)
Leverage	0.15	0.13	0.16	0.45	0.39	0.51
	(1.26)	(1.11)	(1.34)	(1.16)	(0.99)	(1.49)
ROA	0.54**	0.52**	0.52**	−0.17	−0.07	−0.12
	(2.09)	(2.07)	(2.13)	(−0.20)	(−0.09)	(−0.18)
Top-tier underwriter	−0.02	−0.00	−0.03	0.31	0.33	0.28
	(−0.21)	(−0.03)	(−0.31)	(0.99)	(1.03)	(0.97)
VC backing	0.15**	0.15**	0.10	0.26	0.25	0.42*
	(2.16)	(2.26)	(1.47)	(1.09)	(1.02)	(1.84)
Ln(M/V)	0.06	0.06	0.06*	0.28***	0.26**	0.24***
	(1.63)	(1.63)	(1.65)	(2.86)	(2.57)	(2.65)
Ln(V/B)	0.02	0.02	0.03	−0.15	−0.12	0.07
	(0.31)	(0.33)	(0.44)	(−0.24)	(−0.19)	(0.11)
M&A intensity	4.48**	4.59***	4.40**	3.22	2.95	3.93*
	(2.52)	(2.58)	(2.43)	(1.50)	(1.30)	(1.94)
Market momentum	7.28	7.27	5.68	18.76	35.08	17.81
	(0.47)	(0.47)	(0.36)	(0.30)	(0.54)	(0.32)
Ln(alpha)				18.96***	20.12***	19.52***
				(11.69)	(10.37)	(5.69)
Constant	−0.11	−0.31	−0.12	−18.66***	−17.59***	−19.57***
	(−0.25)	(−0.76)	(−0.29)	(−19.30)	(−22.50)	(−5.61)
Pseudo R^2 (%)	7.1	7.1	8.7	4.6	4.7	4.5
Observations	3433	3433	3433	558	558	558

Probit regressions on the likelihood of IPO firms to become stock acquirers (Models 1–3) and zero-truncated negative binomial regressions on the number of stock-financed acquisitions (Models 4–6) within 3 years of the IPO. Industry, year, and country fixed effects are included. Heteroskedasticity corrected clustered robust t-statistics are in parentheses. ***, **, and * represent statistical significance at the 1, 5, and 10 % levels, respectively

shortly after the IPO increases with its stock liquidity. Consistent with our hypothesis, the coefficients of all our three liquidity proxies document that liquidity is positively associated with the number of stock acquisitions completed by a given IPO firm. Firms characterized by narrower bid-ask spread, larger turnover, and lower illiquidity ratios tend to complete a larger number of stock-financed acquisitions. Among the control variables, the factors that significantly explain the likelihood of becoming a stock acquirer are found to play a similar role on the number of acquisitions. Overall, our evidence documents that IPO firms characterized by more liquid stocks face a higher likelihood of using them in an acquisition and, conditioned on this event, to complete a larger number of stock-financed acquisitions.

Table 5 Probability to be acquired post-IPO and valuation premium

	Target likelihood			Valuation premium		
	Bid-ask (1)	Turnover (2)	Illiquidity (3)	Bid-ask (4)	Turnover (5)	Illiquidity (6)
Liquidity	−1.51**	0.93**	−0.45**	−5.55***	0.80**	−0.43
	(−2.48)	(2.16)	(−2.07)	(−6.04)	(2.08)	(−0.13)
Firm size	0.03	0.05***	0.04**	−0.05**	−0.03	−0.03
	(1.61)	(2.79)	(2.53)	(−2.40)	(−1.13)	(−1.12)
Firm age	−0.16***	−0.15***	−0.15***	−0.01	0.01	0.01
	(−5.62)	(−5.46)	(−5.20)	(−0.15)	(0.13)	(0.12)
Leverage	0.32***	0.23**	0.26**	0.16	0.03	0.03
	(2.75)	(2.02)	(2.28)	(1.00)	(0.17)	(0.20)
ROA	−0.41*	−0.50**	−0.52**	−0.29	−0.37	−0.36
	(−1.65)	(−2.03)	(−2.14)	(−0.91)	(−1.12)	(−1.09)
Top-tier underwriter	0.24**	0.26***	0.25***	0.27**	0.38***	0.37***
	(2.45)	(2.75)	(2.67)	(2.30)	(3.11)	(3.11)
VC backing	−0.22***	−0.20***	−0.20***	−0.02	−0.03	−0.03
	(−3.16)	(−2.81)	(−2.93)	(−0.22)	(−0.25)	(−0.25)
Ln(M/V)	−0.43***	−0.45***	−0.45***			
	(−11.02)	(−11.59)	(−11.60)			
Ln(V/B)	1.05***	1.02***	1.04***			
	(7.01)	(7.00)	(7.08)			
M&A intensity	5.87***	6.68***	6.48***			
	(3.28)	(3.87)	(3.77)			
Market momentum	−15.52	−16.51	−16.25	−16.30	−10.89	−10.85
	(−0.94)	(−1.02)	(−1.00)	(−0.69)	(−0.45)	(−0.45)
Mills lambda				0.26*	0.29*	0.30*
				(1.67)	(1.89)	(1.92)
Constant	−1.21***	−1.79***	−1.68***	2.01***	1.10**	1.11**
	(−2.67)	(−4.23)	(−3.97)	(3.78)	(2.01)	(2.04)
Pseudo R^2 (%)	20.1	20.0	20.2			
Wald Chi^2				130.0	97.6	87.6
Observations	3396	3396	3396	540	540	540

Two-step Heckman selection model. The first step is a probit regression on the likelihood of firms to be targeted within 3 years of the IPO (Models 1–3). The second step is an OLS regression on valuation premium (Models 4–6). Industry, year, and country fixed effects are included. Heteroskedasticity corrected clustered robust t-statistics are in parentheses. ***, **, and * represent statistical significance at the 1, 5, and 10 % levels, respectively

4.2 IPO firms as targets and their valuation

Table 5 presents the results of our two-step Heckman selection model on a firm's likelihood of being targeted shortly after the IPO, and on the valuation premium obtained by being acquired after the IPO over being acquired when still private. Models 1–3 show the results of the first stage, where the dependent variable is a dummy equal to 1 if the firm was targeted within 3 years of the IPO. This first stage is aimed at testing Hypothesis 2, according to which stock liquidity increases a firm's likelihood of being targeted shortly after the IPO. Consistent with our hypothesis, the coefficients of our three liquidity proxies are all significant with the expected sign. IPO firms characterized by a higher level of aftermarket liquidity, as measured by bid-ask spread, turnover, and illiquidity ratio, are therefore more likely to be targeted. In terms of economic impact, a one standard deviation decrease in bid-ask spread and illiquidity increases the likelihood of being targeted by 3.3 and 6.3 % respectively, while a one standard deviation increase in turnover increases this likelihood by 3.3 %.

A comparison of the above economic impacts with those associated with the likelihood of becoming an acquirer reveals that the influence of the three liquidity

proxies on the two likelihoods is not homogeneous. In particular, a one standard deviation variation in bid-ask spread and turnover exerts a greater impact on the likelihood of being targeted, while the same variation in the illiquidity measure has a greater impact on the propensity to acquire. This can be partly explained by the definition of the illiquidity measure, which is based on returns. The larger the returns of the IPO firm's stock over the considered period, the lower the illiquidity measure. While positive stock returns undoubtedly facilitate a firm's acquisition activity, since they enlarge the scope of feasible targets by opening the possibility to use overvalued stocks as currency, their implication for prospective targets is not as straightforward. On one hand, positive returns may signal superior firm quality and therefore attract a larger number of potential acquirers, thereby increasing the likelihood of receiving a favorable acquisition bid. On the other hand, positive returns result in higher valuation, which could deter potential acquirers.

Among the control variables, we find that younger and more leveraged firms, which probably embed greater growth options but also suffer from more severe financial constraints, are more likely to be acquired. Firms affiliated with prestigious underwriters are also more likely to be acquired, arguably due to the effective quality signal conveyed by the presence of a reputable bank, while VC-backed firms are less likely to be acquired shortly after the IPO. Predictably, we find that less overvalued firms face a higher likelihood of being acquired since these firms tend to be cheaper targets, and firms embedding greater growth opportunities are more attractive towards potential acquirers. Finally, firms operating in industries characterized by more intense M&A activity are more likely to be acquired.

Models 4–6 show the results of the second stage, where the dependent variable is the valuation premium at which IPO firms are acquired compared to the valuation they could have obtained by selling out before going public. This second stage is aimed at testing Hypothesis 3, predicting that the valuation at which a firm is acquired shortly after the IPO increases with its stock liquidity. Consistent with our hypothesis, we find that firms with narrower bid-ask spread and higher share turnover receive higher valuation premia. We do not find, however, supporting evidence when liquidity is proxied by the illiquidity ratio. Finally, the significant coefficient of the Mills lambda indicates that there indeed exist unobservable factors that affect both a private firm's likelihood of being acquired and its valuation premium.

4.3 Robustness tests

4.3.1 Cox proportional hazard models

In this subsection, we perform a robustness test for Hypotheses 1a and 2 on a firm's likelihood of becoming an acquirer and target within 3 years of the IPO. The limitation of probit models employed in the previous section is that they do not take into account the time between the IPO and the subsequent M&A. Therefore, an acquisition completed in the first year after the IPO is treated in the same fashion as an acquisition completed in the third year. We address this issue by estimating a Cox proportional hazard model, which allows us to assess the conditional probability of an event, given that it has not occurred up to the current time (i.e., the hazard rate). The positive (negative) effect of an independent variable is therefore interpreted as an accelerator (decelerator) of the time to event and, therefore, increasing (decreasing) the probability of the event. Results are reported in Table 6.

In Models 1–3, the event of interest is the acquisition completed by an IPO firm within 3 years of its listing date. The coefficients of our explanatory variables reveal that liquidity, as measured by our three proxies, are always significant at the 1 % level with the expected sign. Therefore, our evidence concerning an IPO firm's likelihood of becoming an acquirer is robust to the adoption of an alternative model that accounts for time considerations. In Models 4–6, the event of interest is the takeover of an IPO firm within 3 years of its listing date. The coefficients of the bid-ask spread and illiquidity variables confirm the influential role that is played by stock liquidity, although with weaker statistical significance, while the coefficient of the turnover variable is not found to explain the likelihood of being acquired in this setting.

4.3.2 Acquirer-target firms

In this subsection, we check the robustness of our results with respect to the presence of firms that were involved in multiple M&A activities. The fact that 87 firms of our sample conducted at least one acquisition before being acquired within 3 years of the IPO may produce mixed effects on the likelihoods to acquire and be acquired. To better disentangle their respective determinants, we therefore repeat our multivariate analyses by excluding these 87 observations. Table 7 reports the results aimed at testing our hypothesis 1a

Table 6 Robustness test: Cox proportional hazard models

	Acquirer			Target		
	Bid-ask (1)	Turnover (2)	Illiquidity (3)	Bid-ask (4)	Turnover (5)	Illiquidity (6)
Liquidity	−3.44***	0.71***	−3.09***	−1.64**	−0.65	−1.64**
	(−3.56)	(5.05)	(−3.37)	(−2.17)	(−1.24)	(−1.74)
Firm size	0.05***	0.07***	0.06***	0.02	0.03	0.02
	(2.84)	(4.41)	(3.65)	(0.94)	(1.50)	(1.13)
Firm age	−0.08***	−0.07***	−0.06**	−0.22***	−0.22***	−0.21***
	(−2.84)	(−2.78)	(−2.11)	(−5.65)	(−5.67)	(−5.41)
Leverage	0.11	0.06	0.09	0.22	0.20	0.22
	(1.01)	(0.54)	(0.88)	(1.61)	(1.50)	(1.64)
Profitability	0.55**	0.48**	0.47**	−0.62*	−0.62*	−0.64**
	(2.38)	(2.14)	(2.16)	(−1.95)	(−1.93)	(−2.01)
Top-tier underwriter	−0.09	−0.07	−0.08	0.44***	0.47***	0.46***
	(−0.95)	(−0.69)	(−0.86)	(3.69)	(3.88)	(3.82)
VC backing	0.08	0.10	0.04	−0.28***	−0.27***	−0.29***
	(1.34)	(1.53)	(0.69)	(−2.97)	(−2.93)	(−3.05)
Ln(M/V)	−0.02	−0.02	−0.02	−1.04***	−1.04***	−1.03***
	(−0.47)	(−0.44)	(−0.56)	(−9.80)	(−9.86)	(−9.82)
Ln(V/B)	−0.11	−0.11	−0.12	−0.81***	−0.81***	−0.81***
	(−1.52)	(−1.51)	(−1.63)	(−6.83)	(−6.85)	(−6.80)
M&A intensity	4.90***	5.23***	4.91***	9.60***	9.48***	9.62***
	(3.13)	(3.34)	(3.16)	(4.51)	(4.47)	(4.54)
Market momentum	24.51	23.89	24.67	−27.69	−26.41	−27.33
	(1.56)	(1.52)	(1.57)	(−1.35)	(−1.29)	(−1.33)
Wald Chi^2	148.5	165.0	140.7	345.2	347.0	344.7
Observations	3433	3433	3433	3433	3433	3433

Cox proportional hazard model on the likelihood of IPO firms to become stock acquirers and targets within 3 years of the IPO. Industry and year fixed effects are included. Heteroskedasticity corrected clustered robust t-statistics are in parentheses. ***, **, and * represent statistical significance at the 1, 5, and 10 % levels, respectively

and 2 on a firm's likelihood of becoming acquirer and target within 3 years of the IPO.

On the acquirer's side, all our three proxies for a firm's stock liquidity remain significantly correlated with the likelihood of acquiring. Compared to the full sample estimates, the level of statistical significance of the turnover and illiquidity coefficients decreases from 1 to 5 %, and from 5 to 10 %, respectively, partly due to the smaller number of observations. Similarly, on the target's side, all our three liquidity proxies are still significant determinants of the likelihood of being acquired. Compared to the full sample estimates, the level of statistical significance of the turnover coefficient decreases from 5 to 10 %. Overall, after excluding firms that became both acquirers and targets within 3 years of their IPO, our hypotheses on the role played by stock liquidity on the likelihoods of acquiring and being acquired still find empirical support.

5 Time series analysis

The liquidity literature has established cross-sectional and time-series patterns. The results reported in previous sections validate our hypotheses using a firm-level empirical analysis. From a different perspective, if liquidity matters, we expect its impact not to be limited to firm-level considerations, but to be evident also at a macro level. We therefore investigate whether stock liquidity is able to explain the variation of IPO activity over time. This level of analysis delivers robustness with regard to the financial implications of the study, but also opens the opportunity to draw managerial implications. So far, we have indeed investigated measures of liquidity at an individual stock-level. While this is consistent with our hypotheses, it does not allow us to derive any ex-ante recommendations. While we prove that more liquid

Table 7 Robustness test: exclusion of acquirer-target firms

	Acquirer likelihood			Target likelihood		
	Bid-ask (1)	Turnover (2)	Illiquidity (3)	Bid-ask (1)	Turnover (2)	Illiquidity (3)
Liquidity	−1.44***	0.53**	−2.91*	−1.50**	0.87*	−0.43**
	(−2.65)	(2.49)	(−1.84)	(−2.40)	(2.04)	(−1.97)
Firm size	−0.06***	−0.05**	−0.06***	0.02	0.04**	0.04**
	(−2.90)	(−2.55)	(−2.95)	(1.21)	(2.26)	(1.98)
Firm age	−0.10***	−0.10***	−0.09**	−0.14***	−0.13***	−0.12***
	(−2.72)	(−2.68)	(−2.29)	(−4.45)	(−4.36)	(−4.11)
Leverage	0.19	0.17	0.21	0.36***	0.29**	0.31***
	(1.46)	(1.34)	(1.60)	(2.96)	(2.42)	(2.64)
ROA	0.72**	0.70**	0.69**	−0.24	−0.30	−0.33
	(2.37)	(2.35)	(2.40)	(−0.88)	(−1.13)	(−1.23)
Top-tier underwriter	0.10	0.12	0.10	0.31***	0.33***	0.33***
	(0.83)	(0.94)	(0.78)	(3.09)	(3.36)	(3.29)
VC backing	0.16**	0.18**	0.11	−0.22***	−0.19***	−0.20***
	(2.14)	(2.30)	(1.45)	(−2.91)	(−2.63)	(−2.75)
Ln(M/V)	0.09**	0.10**	0.09**	−0.44***	−0.45***	−0.45***
	(2.25)	(2.29)	(2.16)	(−10.48)	(−10.91)	(−10.90)
Ln(V/B)	0.04	0.04	0.05	0.96***	0.92***	0.93***
	(0.66)	(0.67)	(0.83)	(6.01)	(5.92)	(6.00)
M&A intensity	3.81*	3.85*	3.73*	4.51**	5.38***	5.22***
	(1.91)	(1.93)	(1.84)	(2.30)	(2.82)	(2.74)
Market momentum	0.31	0.20	−2.70	−18.72	−20.70	−20.17
	(0.02)	(0.01)	(−0.15)	(−1.10)	(−1.23)	(−1.20)
Constant	−0.19	−0.41	−0.22	−0.83*	−1.41***	−1.30***
	(−0.38)	(−0.81)	(−0.42)	(−1.71)	(−3.09)	(−2.87)
Pseudo R^2 (%)	7.8	7.8	9.5	18.3	17.5	18.0
Observations	3346	3346	3346	3309	3309	3309

Probit regressions on the likelihood of IPO firms to become stock acquirers (Models 1-3) and targets (Models 4–6) within 3 years of the IPO. 87 firms involved in multiple M&A activities are excluded. Industry, year, and country fixed effects are included. Heteroskedasticity corrected clustered robust t-statistics are in parentheses. ***, **, and * represent statistical significance at the 1, 5, and 10 % levels, respectively

firms are more likely to both acquire and get acquired after the IPO, and to pursue a higher number of stock-based acquisitions, how liquid the shares will be in the aftermarket is not clear to shareholders at the moment of the going public decision. We therefore investigate whether market liquidity impacts the quarterly number of IPOs and the number of IPO firms that subsequently acquire or are themselves acquired within 3 years.

We do so by employing a time-series methodology controlling for changes in market valuations. The role played by overall market valuation in shaping a firm's trade-off between merging and remaining independent has been widely documented in the literature. With respect to IPOs, market timing theories argue that firms tend to time their going public decision during periods of high valuations to take advantage of temporary misvaluation and investor enthusiasm. If, however, greater stock liquidity offers a further motivation to go public by facilitating subsequent M&A activity, both as acquirer and target, then we should expect that, after controlling for overall market valuations, more IPOs are conducted during periods characterized by higher market liquidity. In particular, more IPOs should be conducted by companies that are

willing to be actively involved in the M&A market shortly thereafter.

We test this conjecture using IPO volume as the dependent variable in a time-series regression. We adopt the same model specification as Gao et al. (2013), that is, a quarterly time-series regression of scaled IPO volume, and we add our three proxies for the level of stock liquidity among the set of independent variables.[7] In addition, we include an explicit measure of valuation that is specific to the IPO market, that is, the average market-to-book ratio implied by the offer price of recent IPOs, to better disentangle valuation and liquidity effects on IPO activity. The dependent variable is the number of IPOs conducted in each quarter scaled by real GDP of the countries covered by our sample, based on the assumption that the number of IPOs should be proportional to the size of the economy. Bid-ask spread, turnover, and illiquidity ratio are the average across all IPOs that took place from quarter $t - 8$ to $t - 4$. We choose this time window to avoid overlap and potential endogeneity issues during the period over which these variables and the dependent variable are observed.

Panel A of Table 8 reports the results of the time-series regressions on overall IPO volume. Results show that the level of stock liquidity associated with recent IPOs is able to explain current IPO activity. In particular, a larger number of companies go public in the presence of higher levels of stock liquidity, as proxied by narrower bid-ask spread, higher turnover, and lower illiquidity ratio associated with companies that have recently gone public. This documents that liquidity considerations are important in explaining IPO activity. In Panel B of Table 8, the dependent variable considers only the number of IPOs conducted by firms that become acquirers (Models 4–6) and targets (Models 7–9) within 3 years of going public. We find that the level of stock liquidity associated with recent IPOs drives the IPO activity of prospective stock acquirers, given the favorable terms at which these acquisitions can be conducted by using more liquid stocks as currency. A narrower bid-ask spread and a lower illiquidity ratio are positively associated with the number of companies that go public and become acquirers shortly thereafter, while no statistical evidence is found for the turnover variable. In addition, the level of stock liquidity associated with recent IPOs is found to explain IPO activity conducted by prospective targets, although with weaker statistical significance. Again, a narrower bid-ask spread and a lower illiquidity ratio are positively associated with the number of companies that go public and are acquired shortly thereafter, while the coefficient of the turnover variable is not significant. Interestingly, the coefficient of the market-to-book ratio of recent IPOs is positive and significant only when explaining the IPO activity of firms that become acquirers. These firms are indeed those that enjoy the greatest benefits from going public during periods of high market valuations, due to the stock as currency motivation. This is not the case for prospective targets, since firms going public during such periods may receive overoptimistic valuations, thereby deterring potential acquirers from formulating expensive takeover bids.

[7] The definitions of the independent variables are provided in Appendix 2.

6 Conclusions

An important link between the IPO and M&A markets has been identified in the "stock as currency" motivation to go public, according to which firms can use publicly traded stocks to acquire at terms that are more favorable. We document that the possibility to develop liquid trading in the aftermarket can facilitate M&A activity not only for prospective acquirers, as suggested by prior literature, but also for targets. Using the population of 3433 European IPOs from 1995–2009, we find that firms with more liquid stocks, as measured by bid-ask spread, share turnover, and Amihud's illiquidity ratio, are more likely to become stock acquirers and, if so, complete a larger number of stock-financed acquisitions within 3 years of the IPO. At the same time, more liquid firms are also more likely to receive an acquisition bid within 3 years of their IPO. Among newly listed targets, we document that those able to develop a higher degree of stock liquidity in the aftermarket are acquired at a better valuation.

We then shed light on the role played by market liquidity in explaining the variation of IPO activity over time. While market timing theories predict that a private firm's trade-off between going public or

Table 8 IPO activity over time

	Mean (Median)	Bid-ask (1)	Turnover (2)	Illiquidity (3)
Panel A. Quarterly scaled IPO volume				
Liquidity [$t-8$, $t-4$]		−3.20***	4.58**	−331.47***
		(−2.65)	(2.02)	(−3.43)
Time trend	30.50	−0.65*	−0.68**	−0.36
	(30.50)	(−1.90)	(−1.97)	(−1.25)
EU SOX-equivalent	0.52	−6.86	−5.38	−14.93*
	(1.00)	(−0.81)	(−0.61)	(−1.75)
EuroMID Index	1.66	25.32***	26.88***	22.84***
	(1.58)	(3.15)	(3.26)	(3.17)
M/B IPOs ($t-2$)	3.17	2.64	3.44**	2.45
	(2.99)	(1.61)	(2.06)	(1.50)
M/B small firms ($t-2$)	5.39	0.89	0.82	1.10*
	(3.74)	(1.37)	(1.13)	(1.81)
EuroMID return [$t-2$, $t-1$]	1.64	0.06	−0.03	0.05
	(2.20)	(0.38)	(−0.19)	(0.36)
Initial IPO return ($t-1$)	18.50	0.17**	0.17*	0.24***
	(11.50)	(2.21)	(1.86)	(2.82)
EuroMID future return [$t+1$, $t+4$]	5.40	0.09	0.07	0.07
	(5.88)	(1.14)	(0.86)	(1.02)
Real GDP growth [t, $t+3$]	1.22	1.23**	1.13***	1.35***
	(1.01)	(2.37)	(2.62)	(3.00)
Small firms with EPS ≥ 0 ($t-1$)	68.27	−0.86*	−0.35	−0.64
	(68.33)	(−1.67)	(−0.72)	(−1.53)
Quarter 1 dummy	0.25	−12.14***	−13.33***	−13.26***
	(0.00)	(−4.10)	(−4.45)	(−4.73)
AR(1)		0.34	0.35	0.32*
		(1.59)	(1.40)	(1.68)
Constant		75.09*	12.76	43.52
		(1.70)	(0.35)	(1.40)
Observations (quarters)		60	60	60
Wald Chi squared		204.9	238.7	244.4

	No. IPOs by acquirers			No. IPOs by targets		
	Bid-ask (4)	Turnover (5)	Illiquidity (6)	Bid-ask (7)	Turnover (8)	Illiquidity (9)
Panel B. Quarterly scaled IPO volume by prospective acquirers and targets						
Liquidity [$t-8$, $t-4$]	−0.56***	0.15	−88.23***	−0.40*	0.46	−41.03**
	(−3.12)	(0.38)	(−4.56)	(−1.84)	(1.21)	(−2.57)
Time trend	−0.20***	−0.20***	−0.07	−0.07	−0.08	−0.04
	(−2.78)	(−2.68)	(−1.02)	(−0.80)	(−0.98)	(−0.46)
EU SOX-equivalent	−0.20	−0.05	−1.65	−0.45	−0.58	−1.36
	(−0.11)	(−0.02)	(−0.86)	(−0.23)	(−0.31)	(−0.74)
EuroMID Index	3.33*	3.55*	1.00	4.22**	4.61***	3.73**
	(1.91)	(1.87)	(0.52)	(1.97)	(2.65)	(2.07)

Table 8 continued

	No. IPOs by acquirers			No. IPOs by targets		
	Bid-ask (4)	Turnover (5)	Illiquidity (6)	Bid-ask (7)	Turnover (8)	Illiquidity (9)
M/B IPOs ($t-2$)	0.86**	1.05***	0.79**	0.63	0.72	0.54
	(2.33)	(2.75)	(2.28)	(1.27)	(1.50)	(1.10)
M/B small firms ($t-2$)	0.38***	0.38***	0.50***	0.10	0.11	0.12
	(3.65)	(3.56)	(6.66)	(0.44)	(0.55)	(0.61)
EuroMID return [$t-2$, $t-1$]	0.03	0.02	0.07**	0.01	0.00	0.01
	(0.81)	(0.43)	(2.51)	(0.39)	(0.17)	(0.55)
Initial IPO return ($t-1$)	0.02	0.03*	0.05***	0.03	0.03	0.04**
	(1.55)	(1.69)	(3.77)	(1.58)	(1.50)	(2.51)
EuroMID future return [$t+1$, $t+4$]	0.01	0.01	−0.00	0.02	0.02	0.02
	(0.81)	(0.45)	(−0.06)	(1.46)	(1.58)	(1.50)
Real GDP growth [t, $t+3$]	0.11	0.09	0.19**	0.22**	0.22**	0.23**
	(1.06)	(0.99)	(2.20)	(2.15)	(2.50)	(2.38)
Small firms with EPS ≥ 0 ($t-1$)	−0.26**	−0.19	−0.21*	0.01	0.05	0.01
	(−2.07)	(−1.57)	(−1.95)	(0.13)	(0.58)	(0.17)
Quarter 1 dummy	−1.04	−1.27*	−1.14	−2.19***	−2.31***	−2.25***
	(−1.54)	(−1.88)	(−1.57)	(−3.45)	(−3.65)	(−3.79)
AR(1)	0.07	0.08	−0.05	0.30	0.27	0.28
	(0.28)	(0.29)	(−0.23)	(0.76)	(0.74)	(0.88)
Constant	20.46*	11.27	14.78*	−2.02	−6.93	−2.95
	(1.90)	(1.22)	(1.91)	(−0.22)	(−1.05)	(−0.46)
Observations (quarters)	60	60	60	60	60	60
Wald Chi squared	394.7	372.6	551.2	93.2	101.6	98.8

Quarterly time-series regressions using maximum likelihood estimation with residuals following an AR(1) process. In Panel A, the dependent variable is the number of IPOs (Models 1–3). In Panel B, it is the number of IPOs that became acquirers (models 4–6) and targets (models 7–9) within 3 years. Dependent variables are scaled by quarterly real GDP in € trillions (inflation adjusted). GDP data are from Eurostat. The 60 quarters are from the first quarter of 1995 to the last quarter of 2009. Robust Z-statistics are in parentheses. ***, **, and * represent statistical significance at the 1, 5, and 10 % levels, respectively

staying private becomes more favorable towards an IPO during periods of high market valuations, we document that stock liquidity considerations are also influential in this trade-off. While controlling for overall market valuations, we find indeed that more IPOs are conducted during periods of high stock market liquidity. In particular, more IPOs are conducted by firms that become actively involved in an M&A, either as acquirer or target, shortly after going public. This has important implications for the link between the IPO and the M&A markets. While the implications of valuation-based market timing theories are limited to prospective acquirers, due to the benefits of using overvalued stocks as acquisition currency, the advantages of timing the IPO decision based on liquidity considerations accrue both to prospective acquirers, which can use more liquid stocks as acquisition currency, and targets, which face a higher likelihood of receiving a favorable takeover bid due to their superior liquidity.

Appendix 1

See Table 9.

Table 9 Correlation matrix

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1)	Bid-ask spread	1											
(2)	Turnover	−0.048**	1										
(3)	Illiquidity	0.336***	−0.023*	1									
(4)	Firm size	−0.276***	0.037*	−0.057***	1								
(5)	Firm age	−0.117***	−0.018	0.033	0.399***	1							
(6)	Leverage	0.010	0.006	0.025	0.022	0.062*	1						
(7)	Profitability	−0.033*	0.006	−0.02	0.249**	0.092**	0.073**	1					
(8)	Top-tier underwriter	−0.146***	0.017	−0.036*	0.258***	0.018	0.045*	0.014	1				
(9)	VC backing	−0.012	0.008	−0.051*	−0.099**	−0.091***	−0.032	−0.030	0.031	1			
(10)	Ln(M/V)	0.041*	0.01	−0.004	−0.113*	−0.086**	−0.011	0.025	−0.041*	0.048**	1		
(11)	Ln(V/B)	0.027	−0.008	0.009	−0.061**	−0.052*	−0.021*	−0.023	0.023	0.005	−0.341***	1	
(12)	M&A intensity	−0.182***	0.040**	−0.029*	0.077*	0.113*	0.026	0.052*	0.005	−0.024	0.075***	0.047**	1
(13)	Market momentum	−0.091	0.007	−0.043*	0.048*	0.042*	0.024	−0.013	0.007	−0.033	0.032	−0.035	0.122**

Correlation coefficients among the independent variables employed in the multivariate analysis. ***, **, and * represent statistical significance at the 1, 5, and 10 percent levels, respectively

Appendix 2

See Table 10.

Table 10 Definition of independent variable used in the time series regression (Table 8)

Name	Definition
Liquidity [$t-8$, $t-4$]	Bid-Ask spread, Turnover, and Amihud's (2002) illiquidity ratio computed for IPOs during quarters $t-8$ to $t-4$
Time trend	Equals 1 for the first quarter of 1995 and increases by 1 for each quarter onwards
EU SOX-equivalent	Binary variable equal to 1 from the Q2 2002, when the implementation of SOX-like regulatory changes began in Europe
EuroMID index	Inflation-adjusted value of the FTSE EuroMid equity index (scaled at 1 for Q1 1995)
M/B IPOs ($t-2$)	Average market value at the offer price of firms going public in quarter t-2 divided by their book value
M/B small firms ($t-2$)	Sum of market value divided by the sum of book value of small firms (less than 250€m in annual sales) at quarter $t-2$
EuroMID return [$t-2$, $t-1$]	EuroMid return [$t-2$, $t-1$] is the FTSE EuroMid Index percentage return in quarter $t-1$
Initial IPO return ($t-1$)	Initial IPO return ($t-1$) is the average first day percentage return for IPOs in quarter $t-1$, defined as the difference between the first day closing price and the offer price divided by the offer price
EuroMID future return [$t+1$, $t+4$]	FTSE EuroMid Index percentage return in quarter $t+1$ to $t+4$
Real GDP growth [t, $t+3$]	Percentage growth in real GDP from quarter t to quarter $t+3$
Small firms with EPS ≥ 0 ($t-1$)	Percentage of small firms (less than 250€m in annual sales) with at least 3 years of trading history that have nonnegative EPS in quarter $t-1$
Quarter 1 dummy	Binary variable equal to 1 in the first quarter of each year and zero otherwise
AR(1)	Lagged error term

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