THE IMPACT OF IPO LOCKUP EXPIRATION

EUROPEAN EVIDENCE

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The Impact of IPO Lockup Expiration: European Evidence

Abstract:

This paper provides evidence that European firms experience systematic return and trading patterns around lockup expirations, but these effects depend on ownership structure and market liquidity. We find a pronounced negative price drift ahead of expiration, consistent with investors gradually positioning themselves for the increased supply of shares once insiders are allowed to sell. At the unlock date itself, trading activity rises sharply while price reactions remain muted, indicating that the event operates primarily as a liquidity shock rather than an information surprise. The post-unlock period shows a clear reversal in returns, particularly for non-VC/PE-backed firms, as temporary price pressure unwinds once insider-related uncertainty dissipates. These dynamics are strongest on exchanges with deeper liquidity and higher institutional participation, suggesting that reactions to lockup expirations reflect the joint interplay of insider incentives, information asymmetry, investor positioning, and exchange-level liquidity conditions.

Keywords:

Lockup expiration, Liquidity, Insider selling, Information asymmetry, Market microstructure, IPOs, Venture Capital, Private Equity

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1. Introduction

An Initial Public Offering (IPO) brings outside investors into the firm for the first time, creating a separation between informed insiders and uninformed public shareholders thereby giving rise to classic problems of information asymmetry and agency.

Lockup agreements are one of the main tools used to address these frictions. A lockup prevents pre-IPO shareholders from selling their shares for a fixed period after listing, typically 180 days. These restrictions usually apply to founders, executives, employees, and early financial investors such as venture capital (VC) and private equity (PE) funds. Lockups are contractual rather than legal requirements, negotiated with underwriters to support an orderly aftermarket. The terms, including the duration and the shareholders covered, are disclosed in the IPO prospectus.

These restrictions shape the trading environment after the IPO. While the lockup is in force, insiders cannot sell, and the free float is limited. This constrains the supply of shares available to trade. Secondary-market liquidity may be thin, and price discovery may be slow. When the lockup expires, this changes abruptly. Insiders are allowed to sell, the free float increases, and the market must absorb a potential wave of selling. The expiration date, often called the unlock date, therefore represents a discrete and predictable change in supply and in insider trading constraints.

Empirical evidence from U.S. markets shows that this predictable change matters. Field and Hanka (2001) find that U.S. IPOs in 1988–1997 experience significant negative abnormal returns and sharp volume spikes at lockup expiration. Brav and Gompers (2003) report similar patterns and an average unlock-day return of about -2% for VC-backed IPOs. These results indicate that although lockup terms are public, markets do not fully adjust to them in advance, and that underreaction, supply shocks, and trading frictions also play a role. Recognizing the narrow U.S. focus of this evidence, Bruton, G., Filatotchev, I., Chahine, S., and Wright, M. (2010) argue that IPO research should expand beyond the U.S. and examine how institutional and market conditions in other regions shape outcomes.

Evidence for European markets is much limited, and the market environment has changed markedly since the early U.S. studies. MiFID reforms, electronic order books, high-frequency trading, and harmonized disclosure standards have increased transparency and liquidity on Europe's major exchanges. Lockup terms are now more consistently disclosed and are accessible to market participants. It is therefore unclear whether the classic lockup effects documented for U.S. IPOs still apply in a modern European setting.

Against this background, this study addresses the identified research gap by investigating how lockup expirations affect post-listing stock returns and trading volumes around the unlock date and what these reactions imply about the current relevance of classic U.S.-based lockup theories in a modern European context. The analysis uses IPOs from 2009–2019 listed on the major European stock exchanges: London Stock Exchange in London, Deutsche Börse in Frankfurt, Euronext in Paris, Nasdaq Stockholm in Stockholm, and Borsa Italiana in Milan.

We focus on two main research questions:

1. How do stock returns and trading volumes adjust around IPO lockup expirations in major European equity markets?

2. To what extent do firm, ownership, and market characteristics explain these reactions?

Our empirical strategy follows the standard approach used in the IPO lockup literature, as established by Field and Hanka (2001). First, we conduct an event study to examine market reactions around lockup expirations. We compute cumulative abnormal returns (CAR) and abnormal trading volume (ATV) around each lockup expiration. CAR is measured relative to a market model. ATV is defined as actual turnover minus a benchmark level. We consider three windows: pre-unlock (-50 to -6 trading days), event window (-1 to +1 trading days), and post-unlock (+11 to +50 trading days). This setup allows us to track anticipatory price movements, the immediate reaction, and any subsequent reversal, along with the associated changes in trading activity. Secondly, we estimate OLS multivariate regressions with CAR and ATV in the event window (-1 to +1 trading days) as dependent variables, while controlling for ownership structure, firm characteristics, and exchange listing. Regressions are conducted for three subsamples of IPOs: All firms, Venture Capital- or Private Equity-backed (VC/PE), and neither Venture Capital- nor Private Equity-backed (non VC/PE).

Our findings suggest several interpretations. The negative pre-unlock drift indicates that investors discount expected insider selling well before the event. Stronger pre-unlock declines for VC/PE-backed and long-lockup firms match the idea that these issuers face higher perceived information risk. The small event-window CAR, combined with a strong volume spike, suggests that the unlock acts mainly as a liquidity shock rather than a pure information surprise. Prices adjust somewhat but do not collapse on the event day. Most of the repricing seems to occur gradually beforehand. The positive post-unlock CAR points to a return reversal once selling pressure fades and uncertainty about insider behavior is resolved. This is in line with short-horizon reversals studied by Jegadeesh and Titman (1993) and with models where temporary price pressure dissipates after order-flow imbalances clear. The multivariate regression results emphasize the roles of liquidity and market structure. Exchange dummies explain a large share of the variation in abnormal volume and matter for VC/PE-backed CARs. This suggests that microstructure features, depth, market-making technology, and the presence of sophisticated traders shape how lockup-release shocks are absorbed. In addition, viewed through the lens of Fama's (1970) semi-strong market efficiency, the results indicate only partial efficiency. Prices respond to known lockup dates, but the adjustment is slow and spread out. Pre-event drift and post-event reversal imply that information asymmetry and trading frictions still matter, but their impact is milder and more diffuse than in the earlier U.S. environment.

Although the market data we use are directly observable, the theoretical constructs they are intended to capture, moral hazard and information asymmetry, are not. These mechanisms depend on insiders' private information and incentives, and their influence is observable only through their impact on market-based proxies.

Thus, we interpret a positive price drift before the unlock as an indication that investors view continued insider ownership as a commitment signal, reducing concerns about moral hazard. In contrast, a price drop together with higher trading volume at expiration may suggest that insider sales are interpreted as revealing information the market did not previously have, reflecting the role of information asymmetry.

The remainder of the paper proceeds as follows. Section 2 reviews the theoretical background and related literature. Section 3 describes the data, variable construction, and empirical methodology. Section 4 presents the event-study and cross-sectional regression results. Section 5 interprets these findings in light of our hypotheses and the broader theories of information asymmetry, liquidity, and market efficiency. Section 6 concludes.

2. Literature Review

A. Fundamental Concepts & Related Literature

The literature starts from a simple tension with the Efficient Market Hypothesis (EMH). Lockup dates are disclosed in the prospectus and are therefore public information. Under the semi-strong form of market efficiency as formulated by Fama (1970), a pre-announced event should not generate abnormal returns when it occurs. Any rational price impact should be incorporated in advance.

Field and Hanka (2001) show that this is not what happens in U.S. IPOs. They find significant negative abnormal returns and sharp volume spikes at lockup expiration. Brav and Gompers (2003) confirm this pattern and report an average abnormal return on the day of the IPO unlock of about -2% for VC-backed IPOs. These papers treat lockup expirations as information and supply shocks: when insiders are allowed to sell, markets react as if new negative information arrives, even though the date was known. The presence of predictable event-window abnormal returns is hard to reconcile with semi-strong efficiency and suggests underreaction, limited attention, or trading frictions.

Later studies deepen this basic result by conditioning on firm and ownership structure. Bradley, Jordan, Yi, and Roten (2001) and Brav and Gompers (2003) show that venture-backed IPOs and firms with weaker governance experience larger post-expiration price declines. Evidence from the UK in Espenlaub, Goergen, and Khurshed (2001) points in the same direction, with more pronounced reactions among firms facing greater uncertainty and information asymmetry. These findings indicate that lockup effects are amplified when informational and agency problems are more severe. In EMH terms, the "anomaly" is not uniform but concentrated in settings where public information is less informative about fundamentals.

A second strand focuses on trading frictions and the mechanics of absorbing new supply. Ofek and Richardson (2003) show that short-selling increases before unlocks but is constrained by borrowing costs and the limited supply of lendable shares. Expected price declines cannot be fully arbitraged away. Field and Hanka (2001) and related work document that, even though the float expands and long-run liquidity improves, temporary price pressure persists as market makers absorb concentrated sell orders. In this strand, abnormal returns around lockups are seen

less as a pure violation of EMH and more as an outcome of limits to arbitrage and slow-moving capital in the presence of frictions.

More recent work adds an explicit contract and signaling view. Yung and Zender (2010) model lockup length and structure as part of the optimal IPO contract under asymmetric information and moral hazard. Lockups and their expirations are natural points at which private information and changes in incentives can surface in prices. Empirical papers in newer markets show that longer, stricter lockups are associated with stronger signaling effects and distinct post-IPO trading patterns, especially when disclosure and enforcement are weaker. In these settings, abnormal returns around unlocks are interpreted as rational responses to information that was only imperfectly reflected in prices ex ante.

Our study contributes to the literature in two main ways.

First, we show that lockup expirations in modern major European markets do not replicate the classic U.S. pattern. Instead of a large, sharply negative event-window CAR, we find a strongly significant CAR in the pre-unlock window, only mild and often insignificant abnormal returns around the unlock date, and a significant positive post-unlock reversal, combined with pronounced and persistent increases in ATV.

Second, we move beyond the limited existing European evidence, which mainly focuses on single exchanges, by analysing IPOs from London, Frankfurt, Paris, Stockholm, and Milan within a unified framework. This multi-market setting allows us to show that lockup reactions differ systematically across exchanges and ownership structures, and to relate these differences to variation in institutional features, disclosure, and liquidity provision.

3. Data, Methods, & Variables

A. The Sample

Our sample of IPOs spans from January 2009 to December 2019 across five major European equity markets: London, Frankfurt, Paris, Stockholm, and Milano. We begin by retrieving IPOs from the Security Data Corporation Platinum (SDC) database with an IPO offer date within this period. From SDC, we collect fundamental IPO characteristics, including issuing market, IPO offering date, lockup expiration date, venture-capital or private-equity backing, and information on locked-up shares and shares outstanding at the offer. We retrieve daily stock returns, trading volume, earnings announcement dates, and any potential seasoned equity offering dates over the sample period from the FactSet database in October 2025.

Our initial dataset contains 744 IPOs recorded in SDC Platinum. We require IPOs to have an identifiable IPO offering date within the sample period and a lockup period with a specified unlock date, documented by SDC. With these restrictions, our sample decreases to 431. To ensure internal validity and comparability, we exclude IPOs whose characteristics deviate materially from standard common-equity offerings. We also exclude IPOs whose unlock period overlaps with confounding

corporate events.

Specifically, we exclude mutual-to-stock conversions and non-common-stock offerings (ADRs, REITs, and unit offerings; 22 IPOs), penny stocks[1] and equity carve-outs (53 IPOs), IPOs with earnings announcements within 3 calendar days of the unlock date (19 IPOs), and IPOs with a seasoned equity offering (SEOs) within 15 calendar days of the unlock date (23 IPOs). To further ensure robustness, we require complete stock return and trading volume data for the 101-day event window centered on the unlock date. In line with empirical practice in short-horizon event studies, if an observation is missing on day t, we replace it with the most recent available value (i.e., day t–1). This approach preserves observations with immaterial data gaps while avoiding unnecessary loss of sample firms. Altogether, these sample restrictions and data requirements reduce the initial set of 744 IPOs to a final sample of 282 firms for the event-study and regression.

To avoid excluding otherwise informative IPOs, we adopt two pragmatic assumptions. For a subset of IPOs, we were unable to retrieve the original prospectus. At issuance, regulators did not require long-term public archiving of prospectuses. Many issuers and exchanges have since removed or reorganised online repositories. To mitigate this, we conducted manual searches using sources such as FactSet and London Stock Exchange Group (LSEG) databases. This helped us recover relevant share information. When the number of locked shares was not directly disclosed, we inferred it as shares outstanding at the offer minus primary shares, secondary shares, and any exercised overallotment. If lockup duration was not explicitly reported, we calculated it as the number of days between the IPO offer date and the lockup expiration date.

For IPOs that disclose multiple lockup agreements with different expiration dates, we select the lockup agreement that is most economically relevant for share supply and insider selling incentives. For most of our sample, this is the first unlock date. It typically represents the initial and most significant expansion of the tradable float.

To address potential selection bias from restricting the analysis to IPOs with complete return and volume data, we replicate our core tests on the broader sample of 431 IPOs with identifiable lockups. The magnitude and direction of the results remain materially unchanged. This confirms that the reduced sample of 282 IPOs does not distort the main findings.

B. Calculation of Cumulative Abnormal Returns

Cumulative abnormal returns (CARs) measure the stock price reaction to the lockup expiration after controlling for broad market movements. We follow the standard event-study approach in Field and Hanka (2001). For each IPO, we compare its daily return to the return on a broad home-market index[2] over a short event window

[1]We exclude IPOs with an offer price below €1, SEK 10, or £1 because these issues tend to exhibit extremely low liquidity and atypical trading behavior.

[2]We use home-market indices rather than a single pan-European index so that each IPO is benchmarked against the market that actually prices it. This captures local conditions, such as currency, trading hours, investor base, and country-specific news, and prevents country shocks (e.g. a UK-only event moving the FTSE) from being misclassified as firm-level abnormal returns.

around the unlock date. Meaning, IPOs are benchmarked against the main index of their respective exchange: CAC 40 for France, DAX Total Return for Germany, FTSE MIB for Italy, OMX Stockholm 30 for Sweden, and the FTSE 100 for the London.

On each day t in the window, we define the market-adjusted return as the stock's gross return relative to the gross market return. We compound these daily ratios over the window and subtract one. This gives the total market-adjusted price change attributable to the event.

Formally, for each firm i, the three-day CAR over the window t (-1 to +1 days) is calculated:

$$CAR_i = \left[\prod_{t=-1}^{+1} \left(\frac{1 + R_{i,t}}{1 + R_{m,t}} \right) - 1 \right] \tag{1}$$

where Ri,t is the return of firm i on day t and Rm,t is the return on the corresponding broad index for that firm's exchange (FTSEMIB, DAX, CAC, OMXS, or FTSE 100). CAR isolates abnormal returns from stock price changes driven by lockup expiration. This metric allows us to test for insider selling effects, market efficiency, and investor reaction, while filtering out unrelated market-wide factors.

Notably, the mean is assessed with a two-tailed t-test, whereas the median is tested using the Wilcoxon signed-rank test.

C. Calculation of Abnormal Trading Volume

Abnormal trading volume (ATV) measures the extent to which trading intensity around the unlock date differs from a firm's normal volume. In our setting, the event is the expiration of IPO lockups, when previously restricted shares become tradable. For each firm i, we benchmark event-day volume against its average daily volume in a pre-event estimation window from t = -50 to t = -6 days relative to the unlock date (t = 0).

Formally, we calculate ATV for firm i on day t as follows:

$$\text{Abnormal Volume } \varpi_{i,\tau} = \frac{V_{i,\tau}}{\frac{1}{45} \sum_{t=-50}^{-6} V_{i,t}} - 1 \tag{2}$$

Vi,t denotes the firm i's trading volume on day t. The denominator is the firm's average daily trading volume over the 45-day period from t = -50 to t = -6, excluding the event window. In the event study, we focus on the three-day window around the unlock date (-1 to +1 trading days). We compute average abnormal volume over this window to capture short-run trading reactions to lockup expiration. By scaling volume relative to each firm's own historical activity, we isolate the event-driven component of trading.

Notably, the mean is assessed with a two-tailed t-test, whereas the median is tested using the Wilcoxon signed-rank test.

D. Research Design and Variables

D1. Cross-Sectional Multivariate Regressions

We use cross-sectional multivariate OLS regressions to explain why abnormal market reactions differ across IPOs at the time of lockup expiration. Each IPO contributes a single observation, and the dependent variable is measured over the event window: either (i) the three-day cumulative abnormal return or (ii) log(1 + three-day abnormal trading volume). The design, therefore, exploits pure cross-sectional variation in how strongly firms react to the same type of event, rather than time-series dynamics.

The regression structure is similar to Field and Hanka (2001) and is tailored to key mechanisms in the lockup literature. The right-hand side groups firm and market characteristics into three blocks: (i) ownership and lockup design, capturing insiders' incentives and selling capacity; (ii) size, liquidity, and pre-unlock price behaviour, capturing information environment and trading conditions; and (iii) market and period indicators, capturing institutional differences across exchanges and cycles. We estimate ordinary least squares with heteroskedasticity-robust (HC1) standard errors to allow for unequal error variances across firms.

Combined with the event-study results, this framework allows us to move from asking whether "lockup expirations matter" to asking "for whom and under what conditions" they matter the most. The cross-sectional regressions show that differences in ownership structure, information asymmetry, or market environment reliably create stronger price pressure or larger volume surge. This lets us test if theoretical channels appear in the data.

D.2 Variables

In the cross-sectional regressions, the dependent variable is either the three-day cumulative abnormal return (CAR) or log(1 + three-day abnormal trading volume) around the unlock date. These two measures summarize the price reaction and the change in trading intensity at lockup expiration. The specification aims to explain why some IPOs exhibit stronger returns or larger volume surges than others.

To do so, we include several control variables at the firm, ownership, and market levels. The VCPE dummy identifies issuers backed by venture capital or private equity sponsors. It captures the presence of concentrated, information-advantaged shareholders with incentives to sell at lockup expiration. Market dummies for London, Stockholm, Milan, Frankfurt, and Paris absorb persistent differences in liquidity provision, transparency regimes, and microstructure across exchanges. Year dummies (2012–2014, 2015–2017, 2018–2019) control for broader market and regulatory conditions during the MiFID era, relative to the year 2009-2011. Each dummy variable equals 1 if the IPO belongs to the relevant category, and 0 otherwise.

To account for scale effects and skewed distributions, three regressors are entered in logarithmic form: a Size measure that scales firm value, RunUp, which captures pre-event valuation momentum and embedded expectations, and logAV, which proxies for the intensity of order-flow pressure around the event. Unlock-specific supply effects are captured by FractionLocked, measuring the relative shock to the tradable float at expiration. The inclusion of these variables and the structure of the regression are informed directly by the lockup-expiration literature, in particular by Field

and Hanka (2001) and Brav and Gompers (2003), who demonstrate the relevance of ownership structure and lockup design for explaining market reactions to unlock events. Additionally, drawing on the findings of Amihud (2002) and Spiegel and Wang (2005), who establish that liquidity plays a crucial role in the cross-section of stock returns, we include Pre-Turnover to represent baseline liquidity conditions. This variable is designed to capture how trading capacity and ownership dispersion influence the effect of the unlock shock on abnormal returns and volume. Formal variable definition, construction and regression equations details are provided in Appendix A.

F. Robustness Checks

The robustness of our results is of severe value. Therefore, in this subsection, we evaluate the reliability of our event study and our cross-sectional regressions. We also consider event-day robustness to ensure that abnormal returns are not driven by announcement-day noise or timing conventions, as well as by potential distortions arising from tax-motivated capital gains behavior. Notably, the diagnostics confirm that the regression design is well-conditioned and that inference is robust to plausible violations of OLS assumptions.

F.1 Is this a 180-day effect?

To verify that the documented abnormal return and volume patterns are driven by the expiration of IPO lockups rather than by an unrelated event that happens to occur 180 days after listing, we conduct a series of validity checks. There is no observable regulatory-, tax-, reporting-, or trading-rule event in European markets that systematically occurs 180 days after an IPO. Thus, there is no theoretical reason to expect a general day-180 reaction unrelated to lockup expirations. If a "day-180 effect" were driving the results, only firms with an exact 180-day lockup would exhibit abnormal behavior around this point. Table 3A further support that this is not the case, showing significant pre- and post-unlock returns across all lockup lengths. Lockups > 180 days indicates a pre-unlock return of –5.76% ($t = -3.87$) for lockups > 180 days, and similarly significant post-unlock reversals for both > 180 and < 180 days. Moreover, as the sample is explicitly cleaned for all SEOs (follow-on offerings) occurring within 15 trading days of the unlock date (transactions that are well-documented to generate substantial abnormal returns and trading volume), we eliminate the most credible alternative source of concentrated market reactions around this period, and any remaining price or volume effects must stem from the lockup expiration itself.

F.2 Winsorization

We winsorize to handle and dampen the influence of extreme outliers, likely idiosyncratic observations (thin-trading days, data glitches, split/price spikes, unusually large volume bursts) that can dominate event-study averages and OLS estimates in our relatively small sample. Specifically, for CAR, we trim the data at the 5th and 95th percentiles, capping values below the 5th and above the 95th percentile, to adjust the most extreme price moves while maintaining the integrity of the remaining cross-section. This approach stabilises event-window means and regression residuals and is standard in event studies. For ATV, where volume ratios

are far more right-skewed and susceptible to distortion when normal-period volume is low, we winsorize at the 1st and 99th percentiles, excluding capping below the 1st and above the 99th percentile, to control for a small number of large-volume spikes while preserving most of the economically relevant variation. We apply the 5/95 rule consistently to CAR and the 1/99 rule consistently to ATV in both the event study and the cross-sectional regressions to ensure coherent treatment of each variable and effective control for outliers. Notably, our main results remain robust to these specific winsorization thresholds.

F3. Multicollinearity, Heteroskedasticity, and Standard Error Structure

To ensure robust cross-sectional regressions, we account for the following factors.

We first assess multicollinearity using Variance Inflation Factors (VIFs) for all continuous regressors and dummy variables. VIFs measure how much the sampling variance of a coefficient is inflated by linear dependence on other covariates. Following Greene's (2018) econometric guidance, VIF values above 10 are typically considered indicative of problematic multicollinearity. In our specifications, VIFs range from 1.2 to 5.59, and the highest values occur for FractionLocked, reflecting the mechanical link to tradable shares, but remain well below conventional concern levels. One market dummy is omitted to avoid the dummy-variable trap. Full VIF tables for all CAR and ATV regressions (Tables 4) are reported in Appendix B. Overall, the diagnostics indicate that multicollinearity is moderate and does not materially distort coefficient estimates.

Cross-sectional regressions in abnormal returns and trading volume are likely heteroskedastic because firms differ in size, float, liquidity, and volatility. All reported regressions use HC1 heteroskedasticity-consistent standard errors, introduced by White in 1980 and subsequently refined by MacKinnon and White in 1985, in line with standard practice in asset-pricing and event-study research established by Fama and MacBeth (1973).

We also explore market-level clustering as a robustness check. Clustering by exchange allows arbitrary correlation of residuals across London, Frankfurt, Paris, Stockholm, and Milan, and is more meaningful than clustering by year, whereas clustering by firm is infeasible with one observation per IPO. However, the number of clusters is very small (five), and prior work by Cameron and Miller (2015) shows that cluster-robust standard errors with fewer than about 10 clusters are unstable and often downward-biased. HC1 robust standard errors are used for the main inference. The clustered estimates yield identical coefficient signs and magnitudes, reinforcing that our conclusions are not driven by the specific variance estimator. We now move to section IV, Empirical analysis.

E. Summary Statistics

Table 1 summarizes the characteristics of the 282 IPOs issued across major European markets between 2009 and 2019. For this period, on average, Venture capital or private equity backing is present in 36.5% of the sample. On average, firms sell 42.3% of their shares at the offering, while 57.7% of post-IPO shares remain subject to lockup restrictions. The mean lockup duration is approximately 264 days. The majority of firms adopt a 180-day lockup period (61.3%), whereas 37.2% impose longer lockups and only 1.4% use shorter ones.

Figure 1 illustrates the distribution of offer sizes. Most IPOs issue between 10% and 50% of shares outstanding, with the highest concentration in slightly above 20%. Very small and very large offerings account for only a small portion of the sample.

Table 1. Distribution of Full IPO Sample Across European Markets By IPO Year

Table 1 provides an overview of the full sample of 282 IPOs issued in major European equity markets between 2009 and 2019. For each IPO year, the table reports the number of issuances, the share of venture capital or private equity–backed firms, and key offering characteristics, specifically the mean fraction of shares sold and the mean fraction subject to lockup restrictions. The table also presents the average lockup length, measured in days, and the distribution of IPOs across different lockup-period categories (less than 180 days, equal to 180 days, and more than 180 days; LD is Lockup Days). All figures are expressed as percentages, except for lockup duration in days.

Issue Year	Sample Size	Fraction VC/PE (%)	Mean Fraction Sold (%)	Mean Fraction Locked (%)	Mean Lockup Days	LD< 180*Days*(%)	LD= 180*Days*(%)	LD$¿180 Days (%)
2009	2	50.0	76.6	23.4	180.0	0.0	100.0	0.0
2010	9	33.3	46.8	53.2	192.6	11.1	66.7	22.2
2011	9	33.3	38.5	61.5	261.1	0.0	66.7	33.3
2012	6	33.3	42.9	57.1	240.8	0.0	66.7	33.3
2013	20	60.0	34.8	65.2	243.8	0.0	75.0	25.0
2014	51	64.7	45.1	54.9	215.9	0.0	82.4	17.6
2015	55	43.6	43.4	56.6	246.2	0.0	69.1	30.9
2016	34	26.5	43.0	57.0	327.4	2.9	52.9	44.1
2017	42	14.3	42.6	57.4	307.1	0.0	45.2	54.8
2018	37	16.2	40.0	60.0	268.6	5.4	43.2	51.4
2019	17	23.5	37.0	63.0	298.5	0.0	41.2	58.8
Total	282	36.5	42.3	57.7	263.7	1.4	61.3	37.2

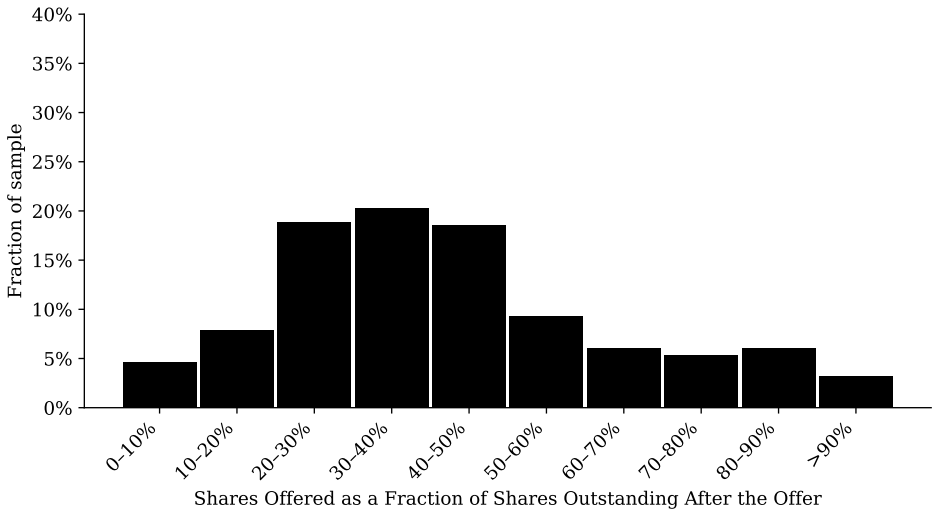


Figure 1. **Offer size distribution**. It presents the distribution of IPOs by lockup size for the full sample of 282 European offerings issued between 2009 and 2019.

4. Empirical Analysis

A. Abnormal Market Reactions Around the unlock date

In this section, we present a description of our empirical evidence on how IPO lockup expirations affect prices and trading activity in European equity markets in three stages. First, we report event-study results for cumulative abnormal returns

(CAR) and abnormal trading volume (ATV) around the unlock date. Second, we examine how these patterns vary across subsamples defined by ownership structure, lockup length, prior price performance, and listing market. Third, we run cross-sectional regressions to test whether firm, ownership, and market characteristics help explain the heterogeneity in unlock-window CAR and ATV. These regressions move beyond average effects and show which factors are most strongly associated with sharper price reactions or larger volume surges at expiration.

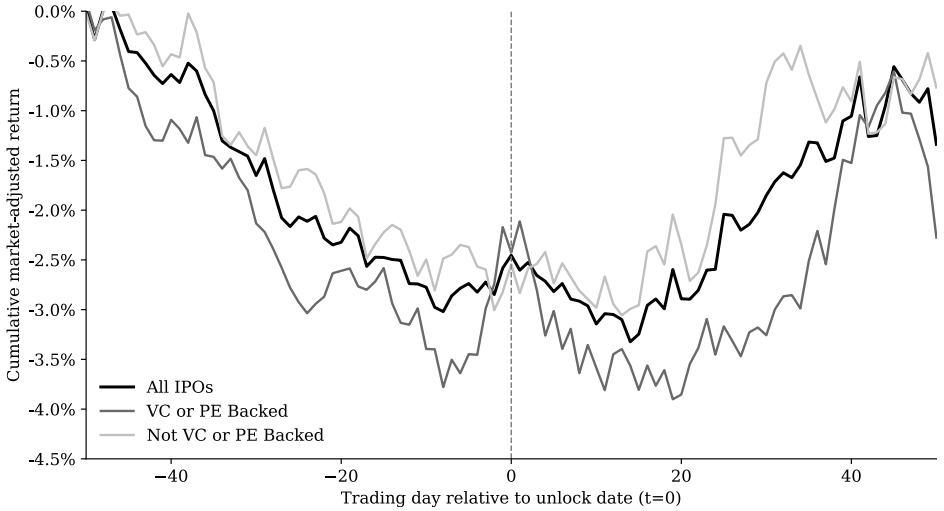


Figure 2. Market adjusted returns around the day of lockup expiration. The market adjusted return is measured relative to the main index for each market, e.g., IPOs listed on the London stock exchange are measured relative to the FTSE-100 Index and IPOs listed on Stockholm stock exchange against OMX 30. It reports the full sample of 282 IPOs from major European equity markets between 2009 and 2019.

Figure 2 plots the time series of cumulative market-adjusted returns over the 50 trading days around the lockup expiration, with day 0 marking the unlock date. The three lines represent all IPOs, VC/PE-backed IPOs, and non-VC/PE-backed IPOs.

All three series move together in the pre-unlock window, showing a steady downward drift as the unlock date approaches. The VC/PE-backed line lies consistently below the others during this period, while the non-VC/PE-backed full-sample line in between.

Around the unlock date (day 0), the series pauses briefly and then shows a small bump. Afterward, CARs continue to fall for the next 10 days (days +1 to +10). Following this short downturn, all three lines turn upward and begin to recover from approximately day +11 onward. In the post-unlock window (day +11 to +50), the non-VC/PE-backed line again leads, the VC/PE-backed line remains lowest, and the full-sample series is between them. By the end of the event window, the lines move closer together, but their relative order remains unchanged.

Table 2: Abnormal Returns Around Lockup Expiration

Table 2 reports the mean and median cumulative abnormal the full sample of 282 IPOs from major European equity markets between 2009 and 2019. Mean and Median are shown for various windows relative to the date of lockup expiration (Day 0) in percentages. T-statistics are shown in parentheses.

Mean CAR values are reported with two tailed t-test. Median CAR values are reported with Wilcoxon test. Stars denote statistical significance at the conventional levels 10%, 5%, and 1% (*, **, ***).

Period	**Mean CAR %**	**Median CAR %**
Day −50 to −6	−2.79***	
	(−3.38)	−2.42***
Day −5	0.07	
	(0.63)	0.07
Day −4	−0.06	
	(−0.46)	0.05
Day −3	0.06	
	(0.50)	−0.00
Day −2	−0.18*	
	(−1.77)	−0.07
Day −1	0.22*	
	(1.82)	0.09
Day 0	−0.05	
	(−0.40)	−0.11
Day +1	−0.00	
	(−0.03)	0.06
Day −5 to +1	**0.06**	
	(0.16)	−0.21
Day −1 to +1	**0.09**	
	(0.38)	−0.13
Day +2 to +10	−0.51	
	(−1.44)	−0.18
Day +11 to +50	2.50***	
	(2.97)	1.19**
Fraction negative (Day −1 to +1)	51.77%	
Sample size	282	

Table 2 reports the mean and median cumulative abnormal returns across the event windows surrounding lockup expiration. Consistent with the graphical evidence, the pre-unlock period from day –50 to –6 shows a sizable and statistically significant decline in the mean of –2.79% (t = -3.38) and the median of –2.42%, confirming that the price deterioration is broad-based and not driven by a handful of extreme observations. In the immediate days leading up to the unlock date, even though day -2 and day -1 show marginally significant abnormal returns, the average CAR for the window -5 to -1 shows small, statistically insignificant returns, indicating that most of the adjustment occurs earlier in the pre-event window rather than immediately before expiration. The unlock day itself (day 0) shows no meaningful abnormal return, and the short event window (–1 to +1) yields a near-zero CAR, with the median slightly negative, suggesting only modest short-run price pressure at the release of previously restricted shares.

The post-unlock windows show a different pattern. The CAR for day +2 to +10 is slightly negative (around –0.5%) and not statistically significant, and the median is close to zero. This suggests mild and noisy movements in the first two weeks after expiration. In contrast, the longer window from day +11 to +50 shows a positive and significant reversal: the mean CAR is +2.50% (t = 2.97), and the median is +1.19%. On average, prices recover much of the earlier decline in the month after the initial adjustment. About half of all firms record negative CARs in the immediate window (–1 to +1). This reinforces that the short-run reaction is mixed and small. More systematic movements occur before and well after the event. We now examine this in more detail.

Table 3A: Pre-unlock CAR (Day -50 to -6) For Various Subsamples

This table reports the cumulative abnormal returns (CARs) for various groups during the pre-unlock window. Means, t-statistics, sample sizes, and the percentage of firms with negative CARs are reported. CAR is winsorized at the 5th and 95th percentiles. The results are based on the full sample of 282 IPOs issued in major European equity markets between 2009 and 2019. Mean CAR values are reported with two tailed t-test. Stars denote statistical significance at the conventional levels 10%, 5%, and 1% (*, **, ***)

Group	Mean CAR%	t-stat	N	CAR % Negative
All firms	-2.79***	-3.38	282	57.45
VC or PE backed	-3.54**	-2.54	103	57.28
Not VC or PE backed	-2.35**	-2.30	179	57.54
London	-3.19**	-2.50	114	59.65
Stockholm	1.96	0.96	43	44.19
Frankfurt	-4.58**	-2.49	56	62.50
Paris	-5.49***	-2.90	52	63.46
Milano	2.07	0.55	17	41.18
Lockup < 180	9.41**	2.51	4	25.00
Lockup $= 180$	-1.26	-1.35	173	53.76
Lockup > 180	-5.76***	-3.87	105	64.76

Table 3A reports how various subsamples of the pre-unlock window (Day –50 to –6) exhibit widespread and economically meaningful negative abnormal returns. For the full sample, the mean CAR is –2.79% (t = –3.38), highly significant, indicating a broad downward price drift well ahead of the expiration date. The ownership split shows that VC/PE-backed IPOs fall the most, with a mean CAR of –3.54% (t = –2.54), which is statistically significant. Non-VC/PE-backed firms also decline, with a mean CAR of –2.35% (t = –2.30), likewise statistically significant. Across listing venues, London, Frankfurt, and Paris show sizeable negative pre-unlock CARs. London has a mean of –3.19% (t = –2.50), Frankfurt records –4.58% (t = –2.49), and Paris exhibits the most pronounced decline of –5.49% (t = –2.89). All three represent statistically significant negative returns. By contrast, Stockholm and Milan display small, positive, and statistically insignificant CARs, with means of +1.96% (t = 0.96) and +2.07% (t = 0.55), respectively, suggesting no systematic pre-unlock drift in these markets. Lockup duration also shows notable differences. IPOs with the standard 180-day lockup have a modest and statistically insignificant mean CAR of –1.26% (t = –1.35). Firms with lockups longer than 180 days experience a significantly larger decline of –5.76% (t = –3.87). The very small subsample with lockups shorter than 180 days (N = 4) shows positive but noisy CARs of +9.41% (t = 2.51), which is statistically significant but should be interpreted with caution due to the small sample size.

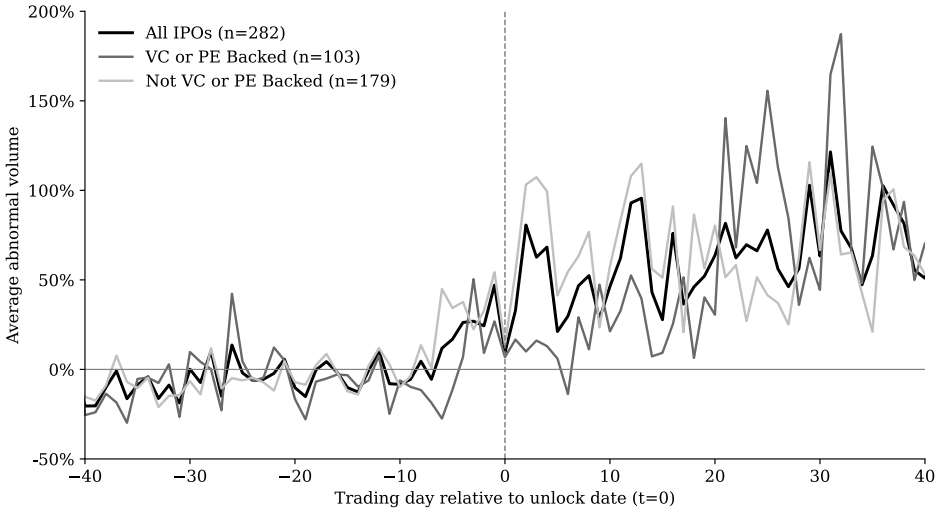


Figure 3. Abnormal trading volume around lockup expiration. Plots the average abnormal trading volume over the 40 days before and after the date of lockup expiration (Day 0) for the full sample of 282 IPOs from major European equity markets between 2009 and 2019. ATV is Winsorized at 1st an 99th percentile.

Having documented the price path around unlock in Figure 2 and Table 3A, Figure 3 turns to trading activity. The graph plots average abnormal trading volume over the 40 days before and after the unlock date for all IPOs, VC/PE-backed IPOs, and non-backed IPOs. Throughout most of the pre-unlock period (days –40

to roughly –12), ATV remains close to zero for all subsamples, indicating that the pronounced price declines occur without elevated trading activity early on.

Approximately 10 days before expiration, ATV begins rising steadily across all groups, suggesting that investors start adjusting positions as the unlock date approaches. At the unlock date and in the subsequent 10 trading days, ATV increases sharply. The full sample reaches peaks of roughly 50–80%, with non-VC/PE-backed IPOs at times exceeding 100%, and VC/PE-backed firms showing lower but qualitatively similar spikes.

Post-unlock activity remains persistently elevated, typically in the 40–100% range, indicating continued adjustment as the newly tradable shares are absorbed. The ATV seems to somewhat stabilize around +50% at the end of our event window.

Table 3B: Abnormal Returns and Volume Around the Lockup Expiration for Various Subsamples

Table 3B presents univariate descriptive statistics for the short event window (Day 1 to +1). The table reports abnormal percentage returns around the lockup expiration date for a range of subsamples. The "Risen" (Price has risen) and "Fallen" (Price has fallen) categories classify firms based on cumulative split-adjusted returns from the offer date to Day 6, six days prior to lockup expiry. The table also reports the fraction of firms with negative cumulative abnormal returns (CAR), as well as abnormal trading volume. T-statistics are in parenthesis. LD is Lockup Days. The results are based on the full sample of 282 IPOs issued in major European equity markets between 2009 and 2019. CAR is winsorized at 5th and 95th percentiles. ATV is winsorized at 1st and 99th percentiles. Mean CAR values are reported with two tailed t-test. Stars denote statistical significance at the conventional levels 10%, 5%, and 1% (*, **, ***)

	All	VC/PE	Not VC/PE	Risen	Fallen	London	Stockholm	Frankfurt	Paris	Milano	LD < 180	LD = 180	LD > 180
CAR Day -1 to +1	0.098	-0.002	0.156	0.289	-0.085	0.381	-0.119	0.117	-0.434	0.172	-1.844	0.037	0.273
	(0.47)	(-0.00)	(0.62)	(1.07)	(-0.27)	(1.31)	(-0.23)	(0.29)	(-0.99)	(0.16)	(-0.79)	(1.15)	(0.77)
Fraction with negative CAR	52%	54%	50%	50%	52%	48%	56%	54%	52%	59%	50%	53%	51%
Percent deviation from mean trading volume	34.57%***	25.66%	39.74%***	44.53%**	25.79%**	12.65%	57.00	86.73%**	19.02%	7.07%	45.15%	13.37%	70.15%***
	(3.16)	(1.60)	(2.72)	(2.40)	(2.05)	(0.86)	(1.60)	(2.54)	(1.21)	(0.41)	(0.71)	(1.15)	(3.15)
Sample size	282	103	179	138	144	114	43	56	52	17	4	173	105

Table 3B reports CARs and ATVs in the narrow unlock window (Days –1 to +1). Across all firms, price reactions remain negligible. The mean CAR is +0.10% (t = 0.47), indicating no statistically meaningful adjustment at the moment insiders regain selling ability. VC/PE-backed firms show essentially zero CAR, while non-backed firms record a slightly higher CAR of +0.16% (t = 0.62), though still insignificant. Differences across other subsamples are similarly modest. Price-risen firms show +0.29% (t = 1.07), while price-fallen IPOs exhibit –0.09% (t = –0.27), yet none of these effects are statistically significant.

In contrast, abnormal trading volume rises substantially. The full sample shows an increase of +34.57% (t = 3.16), which is statistically significant. VC/PE-backed firms experience +25.66% (t = 1.60), not statistically significant, whereas non-VC/PE-backed firms see a larger and significant +39.74% (t = 2.72). Price-risen IPOs exhibit a significant +44.53% (t = 2.40) increase, nearly double the +25.79% (t = 2.05) observed for price-fallen firms, which is also significant.

Substantial variation is evident across exchanges. Frankfurt-listed IPOs experience a significant +86.73% (t = 2.54) surge, markedly higher than London's +12.65%

(t = 0.86) and Stockholm's +57.00% (t = 1.60), the latter of which is not statistically significant. Lockup duration also matters. Firms with lockups longer than 180 days observe a significant +70.15% (t = 3.15) spike, more than five times the increase for standard 180-day lockups of +13.37% (t = 1.15), which is not statistically significant.

Taken together, Table 3B demonstrates that while prices remain essentially unchanged in the immediate unlock window, trading intensity increases sharply and systematically across ownership types, prior price trajectories, exchanges, and lockup durations.

Table 3C: Post-unlock CAR (Day +11 to +50) For Various Subsamples

Table 3C reports univariate descriptive statistics for the post-unlock window (Day +11 to +50). The table presents cumulative abnormal return (CAR) in percentages across a range of subsamples. T-statistics are in parenthesis . The "Risen" (Price has risen) and "Fallen" (Price has fallen) classifications are based on cumulative split-adjusted returns from the offer date to Day 6, six days prior to lockup expiry. The table also reports the fraction of firms with positive cumulative abnormal returnsThe results are derived from the full sample of 282 IPOs issued in major European equity markets between 2009 and 2019.CAR is winsorized at 5th and 95th percentiles. Mean CAR values are reported with two tailed t-test. Stars denote statistical significance at the conventional levels 10%, 5%, and 1% (*, **, ***)

	All	VC/PE	Not VC/PE	Risen	Fallen	London	Stockholm	Frankfurt	Paris	Milano	LU < 180	LU = 180	LU > 180
Mean CAR (%)	2.50***	1.48	3.08***	3.98***	1.08	2.57*	1.02	3.05	2.60	3.65*	24.51**	1.67*	3.03**
t-statistic	(2.97)	(1.21)	(2.75)	(3.53)	(0.88)	(1.85)	(0.56)	(1.54)	(1.23)	(1.71)	(2.50)	(1.71)	(2.02)
% CAR positive	53.90%	49.51%	56.42%	57.97%	50.00%	50.88%	53.49%	55.36%	51.92%	76.47%	75.00%	54.34%	52.38%
Sample size	282	103	179	138	144	114	43	56	52	17	4	173	105

Table 3C reports CARs for the post-unlock window (Days +11 to +50). For all firms, the mean CAR is +2.50% (t = 2.97), indicating that prices move up in the weeks following lockup expiry, and this effect is statistically significant. Ownership groups show clear differences. VC/PE-backed IPOs exhibit a smaller and statistically insignificant post-unlock increase of +1.48% (t = 1.21), while non-VC/PE-backed IPOs show a stronger and statistically significant increase of +3.08% (t = 2.75). Sorting on prior performance, price-risen firms show the highest and most robust post-unlock gains, with a mean CAR of +3.98% (t = 3.53), which is statistically significant. Price-fallen firms exhibit a modest and statistically insignificant mean CAR of +1.08% (t = 0.88). Across exchanges, post-unlock CARs are generally positive but vary in strength. London shows +2.57% (t = 1.85) and Milan +3.65% (t = 1.71), both of which are marginally significant. Frankfurt of +3.05%, (t = 1.54), Paris of +2.60% (t = 1.23), and Stockholm of +1.02% (t = 0.56) are all positive but statistically insignificant. Lockup-length subsamples also differ. IPOs with the standard 180-day lockup show a moderate but only marginally significant mean CAR of +1.67% (t = 1.71). Firms with longer lockups record a statistically significant mean CAR of +3.03% (t = 2.02). The less-than-180-day group again shows very large mean CARs of +24.51% (t = 2.50), although due to N = 4 these estimates remain highly sensitive to individual observations and should be interpreted with caution.

B. Cross-Sectional Multivariate Regression

We proceed with cross-sectional regressions, following standard practice in Field and Hanka (2001), to examine how firm, ownership, and market characteristics explain variation in market reactions to lockup expirations. Specifically, we estimate separate OLS models for our two dependent variables. The three-day cumulative abnormal return (CAR) and the three-day abnormal trading volume (ATV). For each outcome, we run three specifications: one for the full IPO sample, one for VC/PE-backed firms, and one for non-VC/PE-backed firms.

In line with standard event-study practice, the goal is to isolate systematic patterns in returns and identify systematic drivers of trading intensity, not to predict inherently noisy short-horizon outcomes.

B1. Cross-sectional Determinants of Abnormal Returns

Table 4: Cross-Sectional Multivariate OLS Regressions

Table 4 presents multivariate cross-sectional OLS regressions examining both cumulative abnormal returns (CAR) and abnormal trading volume (ATV) around the lockup expiration. All regression coefficients are reported in percentage terms. Three specifications are reported for both models: the full sample, IPOs backed by venture capital or private equity, and IPOs without such backing. The dependent variables are CAR and ATV for the short event window (Day 1 to +1). CAR is measured relative to each market's main index. ATV is measured as each IPO's three-day event-window trading volume relative to its average trading volume during the pre-event estimation window (Day 50 to 6). CAR is winsorized at the 5th and 95th percentiles. ATV is winsorized at the 1st and 99th percentiles. The fraction of post-IPO shares locked up is defined as the proportion of shares retained by pre-IPO shareholders. T-statistics are reported in parentheses. The analysis is based on the full sample of 282 IPOs issued in major European equity markets between 2009 and 2019. Mean CAR values are reported with two tailed t-test. Stars denote statistical significance at the conventional levels 10%, 5%, and 1% (*, **, ***).

	Three-day Abnormal Return (Percent)			Log(1 + Three-day Abnormal Volume)		
Dependent Variable	All	VC or PE backed	Not VC or PE backed	All	VC or PE backed	Not VC or PE backed
Intercept	-0.89		-0.58	19.68		47.31*
	(-1.05)		(-0.60)	(0.96)		(1.95)
Dummy variable for Venture capital- or Private Equity backing	-0.04	-1.1	0.00	-1.25	-56.16	0.00
	(-0.08)	(-0.59)	(0.20)	(-0.08)	(-1.15)	(1.10)
Dummy variable for London listing	0.41	0.76	0.70	-41.34***	-37.46**	-45.03**
	(0.93)	(1.27)	(1.31)	(-2.84)	(-2.11)	(-2.28)
Dummy variable for Stockholm listing	-0.45	0.75	-0.76	0.16	-25.96	31.72*
	(-0.89)	(0.85)	(-1.29)	(1.12)	(-1.08)	(1.86)
Dummy variable for Milano listing	0.04	-5.56***	0.46	-0.13	35.22	-4.28
	(0.04)	(-6.04)	(0.49)	(-0.01)	(1.08)	(-0.24)
Dummy variable for Frankfurt listing	-0.17	2.65**	-0.33	37.11***	-4.63	52.54***
	(-0.29)	(2.28)	(-0.47)	(2.58)	(-0.17)	(3.11)
Dummy variable for Paris listing	-0.71	0.32	-0.65	8.29	-23.34	12.36
	(-1.34)	(0.36)	(-1.04)	(0.58)	(-1.11)	(0.67)
Size = Log(Offer price × Shares Outstanding)	-0.04	-1.58**	0.20	-6.89	17.75	-9.89
	(-0.23)	(-2.09)	(0.98)	(-1.03)	(0.88)	(-1.30)
Run-up = Log(1 + cumulative return from IPO to Day -6)	0.15*	0.41	0.14**	-1.06	11.47	-1.90
	(1.76)	(1.01)	(2.05)	(-0.55)	(1.19)	(-0.93)
Dummy variable for 2012–2014 (relative to 2009–2011)	1.12	3.05***	0.16	-17.37	-22.15	-27.69
	(1.40)	(2.62)	(0.15)	(-0.86)	(-0.63)	(-1.11)
Dummy variable for 2015–2017 (relative to 2009–2011)	1.94**	3.84***	0.77	-22.84	-15.13	-27.52
	(2.47)	(3.84)	(0.79)	(-1.16)	(-0.43)	(-1.20)
Dummy variable for 2018–2019 (relative to 2009–2011)	1.25	2.17*	0.49	-8.50	-34.87	-7.58
	(1.56)	(1.66)	(0.50)	(-0.41)	(-0.67)	(-0.33)
Fraction of post-IPO shares locked up	0.029*	1.77	-0.06	-13.84	68.64	-53.69
	(0.028)	(0.97)	(-0.05)	(-0.41)	(1.38)	(-1.25)
Turnover_Pre	-853.83	-3022.96**	91.83	-17 975.49	-16 439.62	-25 486.52
	(-1.36)	(-2.23)	(0.20)	(-0.90)	(-0.40)	(-1.10)
CAR Three-day abnormal return (percent)				5.27***	4.82	5.52**
				(2.59)	(1.41)	(2.19)
LogAV	0.56***	0.46	0.57**			
	(2.76)	(1.49)	(2.31)			
Adjusted R^2	0.0350	0.1991	-0.0095	0.0507	-0.0024	0.0739

Table 4 reports cross-sectional OLS regressions with the three-day unlock-event CAR as the dependent variable. Across the full sample, only a few characteristics significantly explain return variation. The strongest predictor is abnormal volume, which enters positively and significantly at +0.56% (t = 2.76), indicating that IPOs with heavier trading during the unlock window also experience larger price reactions. Run-up is marginally positive at +0.15% (t = 1.76), suggesting weak continuation of pre-unlock performance. The 2015–2017 period dummy is also significantly positive at 1.94 (t = 2.47), pointing to generally more favorable market conditions during those years. Other variables, in- cluding exchange dummies, ownership status, size, float, and pre-unlock turnover, are insignificant, suggesting that they alone do not explain cross-sectional varia- tion in CAR. As before, the large magnitude of the pre-turnover coefficient reflects the tiny scale of the underlying turnover measure, and its insignificance indicates that baseline liquidity ahead of expiration does not systematically shape the unlock- window price response for the full sample.

Among VC/PE-backed firms, several determinants become economically and statistically more meaningful. Market location plays a notable role. Frankfurt-listed IPOs exhibit significantly higher CARs of 2.65 (t = 2.28), while Milan shows a strong and highly significant negative coefficient of –5.59% (t = –6.04), underscoring substantial cross-exchange heterogeneity in how institutional-backed firms react to unlock dates. Time-period effects are again pronounced: the 2015–2017 dummy is strongly positive at +3.84% (t = 3.84), and 2012–2014 is also significant at 3.05 (t = 2.62), suggesting that broader market conditions exert a stronger influence on VC/PE-backed issuers. Pre-unlock turnover is significantly negative at –3022.96 (t = –2.23), indicating that firms with unusually active trading prior to expiration experience more muted price adjustments during the unlock window, consistent with partial incorporation of expected selling pressure before the event. Other characteristics, including size, float, and run-up, are statistically insignificant in this group, suggesting that they alone do not explain cross-sectional variation in abnormal returns.

For non-VC/PE-backed firms, the pattern is somewhat simpler. The strongest and most consistent predictor remains abnormal volume, which enters significantly at +0.57% (t = 2.31), reinforcing the central role of trading intensity in driving price adjustments for this group. Run-up is also significantly positive at +0.14% (t = 2.05), indicating that prior price performance modestly carries over into the unlock window. None of the exchange dummies, size variables, lockup characteristics, or turnover measures shows explanatory power. Notably, the slightly negative adjusted R^2 reflects the high idiosyncratic noise in short-window returns for non-VC/PE-backed firms rather than a misspecified model. In this setting, low explanatory power is expected, and importantly, the signs, sizes, and significance of the key coefficients are stable across specifications.

B.2 Cross-Sectional Determinants of Abnormal Volume

The second part of Table 4 reports the cross-sectional OLS regressions with the three-day ATV as the dependent variable. Across the full sample, several exchange effects emerge sharply. London is associated with significantly lower abnormal volume of –41.34% (t = –2.84), whereas Frankfurt shows a large positive effect of

+37.11% (t = 2.58). These results highlight substantial cross-market heterogeneity in trading responses to unlock events, consistent with the idea that liquidity conditions differ meaningfully across European exchanges. The three-day CAR enters positively and marginally significantly at +5.27% (t = 2.59), indicating that larger price reactions are associated with heavier trading, a pattern consistent with comovement between returns and liquidity during the unlock window. Other firm-level characteristics, including size, run-up, ownership, float, and pre-unlock turnover, do not significantly explain trading volume. Among VC/PE-backed firms, the market-specific differences persist. London again shows significantly lower abnormal volume of –37.46% (t = –2.11), while no other covariates are statistically significant, suggesting that exchange-level factors dominate the trading response for this group.

For non-VC/PE-backed firms, the exchange effects are even more pronounced. London shows a strong negative coefficient of –45.03% (t = –2.28), Stockholm also enters negatively at –31.72% (t = –1.86), and Frankfurt remains strongly positive at +52.54% (t = 3.11). These sharp differences indicate that trading volume around the unlock is highly sensitive to exchange-level liquidity environments. The three-day CAR is positive but statistically insignificant at +5.52% (t = 2.19), implying a weaker link between price reactions and trading intensity for non-VC/PE-backed firms relative to the full sample and VC/PE-backed issuers. Other covariates, such as run-up, size, and year effects, are insignificant, suggesting that these factors alone do not explain cross-sectional variation in abnormal volume.

5. Interpretation of Empirical Evidence

In this section, we evaluate a set of hypotheses motivated by our empirical findings on return and volume patterns around lockup expirations. The analysis focuses on explaining the observed dynamics, such as the pre-unlock drift, the reaction at expiration, and the post-event adjustment through mechanisms proposed in the theoretical and empirical literature. For each hypothesis, we relate our evidence to prior studies, highlighting where our results align with established findings and where they diverge.

We consider, first, whether the patterns we observe are consistent with anticipatory repricing under asymmetric information, where investors progressively discount the stock as insider selling becomes imminent. We then examine ownership structure effects, assessing whether VC/PE-backed firms whose insiders are often better informed and more inclined to sell exhibit stronger market reactions than non-backed IPOs. We also discuss hypotheses related to liquidity and trading shocks, where the unlock serves as a liquidity event that attracts arbitrage activity and order-flow imbalances. Further, we evaluate whether the short-term price movements reflect temporary price pressure or a more persistent shift in demand. Finally, we consider post-expiration reversals and whether return behavior after the unlock supports interpretations based on temporary selling pressure or suggests broader underreaction.

A. Anticipatory Market Repricing Ahead of Lockup Expiration

Here, we aim to evaluate our first hypothesis, which states that investors reprice IPO firms before the lockup expires. This implies that prices should drift down in

the pre-unlock window, while the narrow unlock window itself should show little additional reaction. Primarily, this links information asymmetry with semi-strong market efficiency, i.e., news about insider selling is anticipated and incorporated gradually, not only on the unlock day.

Theoretical work on asymmetric information gives a clear mechanism. In signaling models, Leland and Pyle (1977) and Myers and Majluf (1984) argue that insiders who plan to sell soon reveal weaker private information about future cash flows. Outside investors then discount the stock as the unlock approaches. Moral-hazard models, as described by Holmström and Tirole (1993), add that insiders may reduce effort as their lockup constraint weakens. Hence, both channels imply a gradual downward drift ahead of expiration. Therefore, in an efficient market, Fama (1970) argues this drift should start well before the lockup date and leave only a small residual move when the restriction is actually lifted.

The IPO lockup literature documents similar patterns. Field and Hanka (2001) find a negative three-day CAR around U.S. lockup expirations, but also report price pressure building up in the month before. Patatoukas and co-authors show that U.S. prices often begin to decline about 10 trading days before expiry, in line with increased short selling by informed traders. Our European evidence, however, is more mixed.

Our pre-unlock results are consistent with the anticipatory repricing story. Illustrated in Figure II, and quantified in Table 2, we observe over days –50 to –6 a clear and statistically significant negative CAR for the full sample, –2.79% (t=3.38). Table 3A makes it evident that the decline is stronger for IPOs backed by VC/PE investors and for firms that already underperformed before the window. It is also more pronounced for long lockups and for some large, liquid exchanges such as Frankfurt and Paris. These patterns fit the idea that anticipatory discounting is most intense when ex ante information asymmetry is high and when sophisticated investors have the tools and incentives to trade on it.

The behavior by ownership type is particularly informative. VC/PE-backed firms show a steeper pre-unlock decline than other IPOs. This mirrors U.S. evidence, as shown by Jordan et al. (2000) and Brav and Gompers (2003), that negative abnormal returns around lockup events are concentrated in VC-backed issues. Venture investors are better informed about fundamentals and about their own exit plans. Public investors, therefore, have stronger reasons to anticipate insider selling and to demand a higher discount as the unlock date approaches. Hence, our findings suggest that this mechanism operates, to some extent, in European markets as well.

Lockup length tells a similar story. IPOs with lockups longer than 180 days experience much larger pre-expiration declines than those with shorter commitments. This, however, is anticipated and linked to theory. Longer lockups are often negotiated when information asymmetry at the IPO is particularly severe or when underwriters want a stronger commitment signal, as argued by Brav and Gompers (2003) and Yung and Zender (2010). As expiration nears, the protection offered by these contracts erodes, and investors rationally expect insiders (who were locked precisely because of higher uncertainty) to sell once they are allowed to. The stronger pre-unlock drift in long-lockup firms is therefore consistent with information-based pricing rather than market overreaction.

The univariate test (Table 3A), which lists the market, also supports our first hypothesis. The most pronounced negative drift occurs on exchanges with deep liquidity and high institutional participation. At these venues, informed investors, hedge funds, and market makers can short-sell or gradually unwind positions as the unlock date approaches. This matches the mechanism described by Brunnermeier and Pedersen (2005), where funding and market liquidity interact to amplify the effect of predictable order imbalances. In contrast, smaller or less liquid markets exhibit weaker, less systematic pre-unlock patterns, consistent with greater frictions in executing anticipatory trades.

A crucial implication of this hypothesis is that the narrow unlock window should not contain much new information. Our evidence is consistent with this. The three-day CAR around the expiration date is close to zero and statistically insignificant in the full sample and in all subsamples. This stands in contrast to the U.S. findings by Field and Hanka (2001) and Brav and Gompers (2003), who report average event-window drops of around –1.5% to –2%. One interpretation is that European markets in our sample period process lockup information more gradually and possibly more efficiently. Better disclosure rules, tighter short-selling constraints at the time of earlier U.S. studies, and the growth of derivatives and lending markets in Europe may all contribute to earlier incorporation of insider-selling expectations. There is also additional contrasting evidence worth noting. Brav and Gompers (2003) interpret the negative event-window CAR in the U.S. as inconsistent with fully rational expectations, arguing that investors are surprised by insider sales despite public information about lockup terms. Our results point in the opposite direction. Most of the adjustment happens before the contractual date, and the event day itself is largely a non-event for prices. This suggests that, at least in our European setting, lockup expirations behave less like anomalies and more like scheduled ownership changes that markets anticipate well in advance. Overall, our first hypothesis is supported. We see a clear and economically meaningful negative drift in the pre-unlock window, strongest precisely where information asymmetry and insider incentives are likely to be most severe. At the same time, the unlock-window CAR is close to zero, consistent with semi-strong efficiency. The evidence, therefore, points to a systematic, information-driven repricing of IPOs well ahead of the lockup date, rather than a sudden adjustment when the contractual restriction actually expires.

B. Ownership Structure Shapes Market Reactions

Next, our second hypothesis examines whether VC/PE-backed IPOs exhibit stronger price and volume reactions around the lockup date. The idea is that concentrated, sophisticated blockholders create clearer selling incentives and sharper information events than dispersed founders or small insiders.

Theoretical and empirical work supports this view. Venture capital and private equity investors are typically better informed, hold large stakes, and operate with defined exit horizons, as shown by Gompers (1996) and Metrick and Yasuda (2010). Their presence both certifies the issue at the IPO and creates a predictable "overhang" once lockups end. Brav and Gompers (2003) and Bradley, Jordan, and Yi (2003) show that U.S. lockup effects are concentrated in VC-backed IPOs, where in-

sider sales signal information and free up large blocks of stock. Investors, therefore, monitor VC/PE lockups more closely and may start adjusting portfolios earlier and more aggressively. As demonstrated in section A, our pre-unlock results are consistent with this mechanism. VC/PE-backed firms display a clearly more negative return drift in the –50 to –6 window than non-backed IPOs. The exact magnitudes are reported in Table 3A, but the pattern is robust. Ownership by sophisticated financial sponsors is associated with stronger anticipatory repricing. This is in line with the notion that markets expect these investors to sell once allowed and that their potential exit is more informative about firm quality than sales by less-informed insiders.

Ownership also shapes how the pre-unlock drift varies across other characteristics.

For VC/PE-backed IPOs, the decline is especially pronounced among issues that already performed poorly before the window and among firms with longer lockups. This fits information-asymmetry models in which adverse signals are amplified when prior performance is weak or initial uncertainty is high. It also resonates with the findings of Brav and Gompers (2003), who show that VC-backed firms with more uncertain fundamentals exhibit larger post-IPO price adjustments.

The event window returns, however, tell a more nuanced story. For both VC/PE-backed and non-backed firms, CAR in the –1 to +1 window is small and statistically insignificant. We do not observe the sharp negative unlock-day drops reported for U.S. VC-backed IPOs in the 1990s, as documented by Field and Hanka (2001) and Brav and Gompers (2003). Instead, most of the adjustment for VC/PE-backed firms appears to occur earlier, consistent with our first hypothesis, the anticipatory repricing story, and with a more gradual, European style of price discovery. In this sense, ownership structure affects when prices react more than it affects the raw magnitude of the event-window CAR. The post-unlock window provides further evidence on ownership.

The post-unlock window provides further evidence on ownership. Table 3A shows that non-VC/PE-backed IPOs experience a stronger positive reversal in the +11 to +50 CAR than VC/PE-backed firms. This suggests that temporary price pressure and subsequent correction are more pronounced when owners are less sophisticated and perhaps slower to trade ahead of the event. VC/PE-backed stocks have already moved down before expiration, leaving less room for a sharp bounce afterwards. This pattern contrasts with some U.S. studies that find large, one-off drops and partial reversals precisely in VC issues. Our results indicate that European markets with active institutional investors may spread this adjustment over a longer horizon.

Ownership also matters for trading activity, though the evidence is mixed. Figure 3 shows that VC/PE-backed IPOs often exhibit very sharp volume spikes around the unlock date and higher day-to-day volatility in abnormal volume. This is consistent with large block trades, coordinated selling programs, and active participation by hedge funds and arbitrageurs. However, the average abnormal volume in the narrow –1 to +1 window is not significantly higher for VC/PE-backed firms than for other IPOs, and in some specifications, the non-VC/PE group shows a slightly larger mean ATV. Thus, our second hypothesis is only partly supported on the volume side. Ownership clearly shapes how and when trading responds, but it does not

produce a uniformly stronger average volume response in the unlock window.

Table 4 further deepens this picture. In the CAR regressions, the VC/PE-backed subsample shows richer structure, exchange dummies, time dummies, and pre-unlock turnover all matter. Returns for VC/PE-backed IPOs are higher on some exchanges and lower on others, and they depend on how actively the stock was traded before expiration. This indicates that VC/PE ownership interacts with market microstructure and liquidity, rather than acting as a stand-alone driver. By contrast, the non-VC/PE subsample is mainly explained by contemporaneous abnormal volume and recent price run-up, with little role for listing venue or turnover. In the volume regressions, Table 4, VC/PE status is associated with different sensitivities to the fraction of locked shares and to the listing market, again pointing to a distinct trading environment around these issues.

Taken together, these pieces of evidence suggest that our second hypothesis is broadly, but not fully, supported. Ownership by VC/PE investors clearly intensifies pre-unlock repricing and creates a richer cross-sectional pattern in returns and trading around expiration. At the same time, we do not find uniformly stronger negative CAR in the narrow event window, nor consistently higher average abnormal volume, as some U.S. studies report. For European IPOs in our sample period, VC/PE backing appears to shift the timing and structure of market reactions towards earlier and more gradual adjustment rather than simply amplifying the short-run lockup effect.

C. Unlock Events Trigger Liquidity and Trading Shocks

Now, we will examine our third hypothesis, which states that lockup expirations cause liquidity shocks. When previously locked shares become tradable, investors rebalance, and liquidity providers adjust. We should therefore see a sharp increase in abnormal trading volume around the unlock date.

The lockup literature documents exactly this pattern. Field and Hanka (2001) find that U.S. IPOs experience a large volume spike in the week of expiration and that average trading volume remains about 40% higher afterwards. Bradley et al. (2001) and Brav and Gompers (2003) report similar jumps for large U.S. samples. These studies interpret the spike as a direct consequence of insiders selling for the first time and the market absorbing a larger free float. The broader microstructure literature also links large order imbalances to temporary volume and price dislocations, as shown by Chan and Lakonishok (1993) and Campbell, Grossman and Wang (1993).

Our time-series evidence strongly supports our third hypothesis. Figure 3 shows that abnormal trading volume is close to zero and often slightly negative in the distant pre-unlock period. Roughly ten days before expiration, volume begins to trend upward across all subsamples. This anticipatory rise suggests that informed investors and liquidity providers start to reposition before the event, consistent with our first hypothesis. At the unlock date itself, average abnormal volume jumps sharply for the full sample and remains elevated for several weeks. The exact magnitudes by day and group are reported in Table 3B and are large in economic terms, with mean abnormal volume in the –1 to +1 window clearly above zero for most subsamples. The pattern is noisy at the daily level, but the shape is clear. Quiet pre-period, sharp event spike, and a prolonged high-volume phase afterwards.

The cross-section of volume responses reveals more detail and makes it evident that markets differ systematically. Some exchanges, such as Frankfurt, show very pronounced abnormal volume at unlock, while others exhibit more muted reactions. This aligns with evidence from Jain (2005) and Chiyachantana et al. (2004) that trading institutions and market design affect how order imbalances translate into volume and price movements. Our volume regressions confirm that exchange dummies explain a substantial share of the cross-sectional variation in log abnormal volume. Listing venues are therefore a key component of the liquidity shock, not just the existence of a lockup.

Ownership and share supply also matter, but in more nuanced ways. For VC/PE-backed IPOs, the fraction of shares subject to lockup is positively associated with abnormal volume during the unlock window. This suggests that when a larger block of informed insider shares becomes tradable, more trading takes place as these investors rebalance and outside investors adjust their positions. This result is consistent with Field and Hanka's (2001) interpretation of volume spikes as driven by pre-IPO shareholders selling down large blocks. For non-VC/PE-backed firms, however, the relation is weaker and in some specifications even negative. Here, volume shocks seem to be driven more by exchange characteristics and short-term trading than by the mechanical release of large locked blocks.

The interaction between volume and returns also supports the liquidity-shock view. In the CAR regressions, log abnormal volume is one of the strongest predictors of unlock-window returns. Stocks that trade more heavily in the -1 to $+1$ window also display larger price reactions. In the reverse direction, when we regress log abnormal volume on three-day CAR (window -1 to +1), the price reaction enters with a positive coefficient in the full sample, though the effect is weaker in the subsamples. This two-way relationship is consistent with models in which liquidity provision responds to order flow, and prices adjust more when trading is intense, as described by Campbell, Grossman and Wang (1993). Volume and returns, therefore, appear jointly determined around unlock events, rather than one being purely exogenous.

Compared to U.S. evidence, our volume shocks are similar in shape but somewhat different in persistence. Field and Hanka (2001) report a spike, followed by a higher, but stable, new level of trading volume. In our European sample, post-unlock abnormal volume remains high but also quite volatile. This suggests a more extended adjustment process, with trading intensity fading only gradually. One possible explanation is that European ownership structures are often more fragmented, and that institutional investors unwind or accumulate positions over a longer horizon rather than in a single burst of trading.

However, it is important to acknowledge that there is also some contrasting evidence in the European lockup literature. A few studies on individual markets report weaker or insignificant volume responses, especially for smaller exchanges or earlier sample periods. Our results indicate that once we pool several major European markets and focus on more recent IPO cohorts, the liquidity shock becomes clearer. This underscores the importance of liquidity provision and institutional trading capacity in transforming a contractual unlock into a measurable market event.

Given this, the evidence for our third hypothesis is strong. We observe a clear and

economically meaningful surge in abnormal trading volume around lockup expirations. The increase starts shortly before the event, peaks in the immediate window, and remains elevated afterwards. Its size and persistence vary across ownership types and exchanges, but the qualitative pattern is robust. These findings support the view that lockup expirations act as liquidity and trading shocks to the market, driven by the release of previously constrained insider shares and by investors' and liquidity providers' responses to this predictable change in supply.

D. Temporary Price Pressure and the Downward-Sloping Demand Curve

Subsequently, our fourth hypothesis evaluates whether this reflects a downward-sloping demand curve for the stock or simply temporary price pressure. The theory is simple. When the lockup expires, a large block of insider shares becomes tradable. Short-run supply increases. If investor demand is not perfectly elastic, the price must fall to convince marginal buyers to absorb the new supply, as shown by Shleifer (1986) and Kaul, Mehrotra and Morck (2000). In that case, we expect a negative event-window CAR, and the decline should be stronger when more shares are unlocked or when trading volume is larger. The event-study literature distinguishes two related hypotheses: (i) the price-pressure hypothesis, as described by Harris and Gurel (1986), stating that order-flow imbalances cause a temporary price move that later reverses, (ii) the downward-sloping demand curve hypothesis, stating that the price impact is permanent because demand curves for individual stocks slope down, as argued by Shleifer (1986). Harris and Gurel's S&P 500 study is the classic reference: they find a jump in prices at index inclusion and a later reversal, and interpret this as pure price pressure. Shleifer and, later, Kaul et al., show cases in which price changes after index events do not reverse, and interpret this as evidence of downward-sloping demand.

Lockup studies have applied the same logic. Field and Hanka (2001) and Ofek and Richardson (2003) document negative abnormal returns around U.S. lockup expirations, especially when a large fraction of shares becomes tradable. Because these price drops are not fully reversed, they interpret part of the effect as a demand-curve phenomenon: more supply leads to a lower equilibrium price.

Our data show a more moderate pattern. The CAR path around the unlock date has three steps. First, we see a clear negative drift in the pre-unlock window, which we attribute to anticipatory repricing under our first hypothesis. Second, there is a small additional decline in the days immediately after the unlock. Third, in Table 2 and Table 3A the +11 to +50 window, CAR turns positive and shows a statistically significant reversal. This shape is exactly what the price-pressure hypothesis predicts, i.e. a short-run dip when selling pressure materialises, followed by recovery once order flow normalises, as described by Harris and Gurel (1986).

However, the effect is mild. The three-day CAR in the –1 to +1 window is close to zero and statistically insignificant for the full sample and for all subsamples. We do not see the large, sharp drops of –1.5% to –2% reported for U.S. IPOs in the 1990s, as documented by Field and Hanka (2001) and Brav and Gompers (2003). This suggests that, while some short-lived price pressure exists, the immediate unlock effect is weaker in our European setting.

The cross-sectional evidence is even less supportive of a strong demand-curve

channel. If a downward-sloping demand curve were the main driver, we would expect (i) more negative event-window CAR when abnormal volume is high, and (ii) more negative event-window CAR when the fraction of locked shares is larger.

We find the opposite. In the CAR regressions, log abnormal volume during the unlock window is positively associated with CAR. Stocks that trade more heavily around the event tend to have slightly higher, not lower, returns. The fraction locked is generally insignificant and does not explain variation in event-window CAR. Graphical checks that mimic Field and Hanka's volume–return plots show a relationship that is essentially flat. High-volume unlocks do not cluster in the lower tail of the CAR distribution.

The most plausible interpretation is therefore as follows. There is mild, temporary price pressure when insider selling and rebalancing flows actually hit the market. This explains the small post-unlock dip we see in the graph. But the effect is quickly reversed and is not systematically stronger when the supply shock is larger. Using the framework of Harris and Gurel (1986), our data support the price-pressure hypothesis but not the downward-sloping demand curve hypothesis.

Modern European market structure helps explain this outcome. Major exchanges now feature narrow spreads, deep order books, and fast, automated liquidity provision. Fragmented trading venues and MiFID-driven best-execution rules allow large orders to be split and internalised with small price concessions. In such an environment, short-run demand for individual stocks is close to elastic at the event horizon. Liquidity providers can absorb lockup-related selling without large or permanent price changes.

Therefore, our fourth hypothesis receives partial support. We observe a temporary post-unlock dip followed by a reversal, consistent with short-lived price pressure. But we find no evidence that this effect scales with the size of the supply shock or that it leaves a permanent imprint on prices. Our results, therefore, do not support a strong downward-sloping demand curve at lockup expiration and instead point to small, transient liquidity effects in otherwise highly liquid European markets.

E. Stock Return Reversal Following Lockup Expiration

Lastly, our fifth hypothesis states that returns should rebound after the lockup expiration. As temporary selling pressure and order imbalances fade, prices are expected to partially reverse, generating positive post-unlock CAR. This idea is closely related to short-horizon return reversals in the asset pricing literature, as described by Jegadeesh and Titman (1993).

The mechanism is straightforward. Around the unlock date, insider selling and investor rebalancing can temporarily push prices below fundamental value, especially if liquidity is finite or risk-averse intermediaries demand compensation to absorb the flow. Once this pressure disappears and the new ownership structure stabilizes, the need for a discount vanishes. Prices then move back up toward a more "normal" level. In this view, negative pre- or near-event returns and positive post-event CAR are two sides of the same adjustment process.

Short-term reversals are a well-documented phenomenon. Jegadeesh and Titman (1993) show that U.S. stocks that underperform over short horizons tend to outperform over the subsequent weeks, consistent with temporary price pressure, liq-

uidity effects, or investor overreaction that later corrects. Similarly, Kaul, Mehrotra, and Morck (2000) find similar behavior around index events: supply shocks cause short-lived dislocations followed by partial reversals.

Our post-unlock results are consistent with our fifth hypothesis. In the +11 to +50 window, we observe positive and statistically significant CAR for the full sample. The exact values are reported in Table 3C, but the key point is that returns change sign relative to the pre-unlock period. Stocks that had declined ahead of expiration show a clear rebound once the event is behind them. This pattern fits a reversal story: some of the earlier discount is unwound as the market absorbs insider sales, and uncertainty about the unlock outcome is resolved.

The behavior across subsamples provides more structure. Non-VC/PE-backed IPOs display a particularly strong post-unlock rebound. These firms often show meaningful negative drift before the event but then outperform in the +11 to +50 window. This may reflect slower anticipatory trading by their insiders and investors. If less sophisticated owners do not fully adjust before expiration, more of the selling pressure occurs around the event and is then undone afterward. The stronger reversal for non-VC/PE-backed firms is consistent with this slower, more frictional adjustment process.

VC/PE-backed IPOs show a more muted reversal. Their pre-unlock decline is steeper, but post-unlock CAR is smaller and less precisely estimated, consistent with our first- and second hypotheses. By the time the lockup actually expires, much of the information and exit risk is already priced in. As a result, there is less scope for a sharp bounce after the event. In other words, where anticipatory repricing is stronger, post-event reversal is weaker.

The cross-sectional regressions are also in line with a reversal mechanism. Stocks that experienced higher trading intensity and stronger short-run reactions around the unlock date do not suffer persistent losses. Instead, the main determinants of unlock-window CAR are liquidity and prior performance, not firm fundamentals or lockup features. This suggests that the pre- and near-event price moves are driven more by temporary factors in trading and expectations than by permanent changes in the firm's value. The positive CAR in the post-unlock window is then a natural correction once these temporary forces fade.

Compared to earlier studies, our reversal is somewhat stronger relative to the size of the event-window effect. According to Field and Hanka (2001), there is a sizeable negative CAR around U.S. unlock dates and only partial reversal afterward. In our European sample, the event-window CAR is close to zero, but the pre-unlock drift is clearly negative, and the post-unlock CAR is clearly positive.

This has an important implication. The reversal we observe does not simply mirror a classic anomaly in which markets "overreact" to the unlock and then correct their mistake. Instead, it reflects the joint outcome of anticipatory repricing, mild temporary price pressure, and the gradual resolution of uncertainty about insider behavior. European investors appear to discount lockup risk early but still require some compensation for absorbing selling pressure. Once this process is complete and ownership is rebalanced, prices rise again.

6. Conclusion

This study examines how European equity markets respond to IPO lockup expirations, focusing on price dynamics, trading activity, information asymmetry, ownership structure, liquidity, and market microstructure. Using 282 IPOs across five major exchanges between 2009 and 2019, we combine an event-study approach with cross-sectional regressions to uncover the mechanisms behind market reactions to these predictable changes in insider selling constraints.

Our results reveal a clear pattern of anticipatory repricing, with prices drifting downward well before expiration, most strongly for VC/PE-backed firms and for IPOs with longer lockups, consistent with asymmetric information and insider-incentive explanations. The event-window CAR, by contrast, is near zero for all subsamples, indicating that modern European markets incorporate lockup information gradually rather than through abrupt unlock-day drops, as documented in earlier U.S. studies.

Trading activity exhibits a different but complementary dynamic. Abnormal trading volume begins to rise roughly ten days before expiration, surges in the narrow event window, and remains elevated thereafter. This pattern aligns closely with liquidity-shock interpretations, as constrained insider shares become tradable, markets must absorb new supply and rebalance ownership. Yet, unlike earlier U.S. evidence, these volume shocks do not translate into large negative event-day returns, highlighting the depth and efficiency of contemporary European equity markets.

Price adjustments around expiration are modest and temporary. A small decline immediately after the unlock is followed by a statistically significant reversal in the +11 to +50 day window. This reversal is strongest for non-VC/PE-backed IPOs, consistent with slower anticipatory trading and greater sensitivity to temporary order-flow imbalances. Together with the absence of strong relationships between event-window CAR and the fraction of locked shares, the evidence supports a transitory price-pressure mechanism rather than a downward-sloping demand curve with permanent effects. Ownership structure further shapes these patterns. VC/PE-backed IPOs exhibit stronger anticipatory drift, more complex volume and return dynamics, and greater sensitivity to market structure, yet they do not show the sharp event-window drops found in earlier U.S. data. Their adjustment process is earlier and more diffuse, consistent with the presence of sophisticated investors and well-developed trading environments.

Finally, our multi-market setting shows that exchange-level characteristics influence both price and volume reactions. Equity markets explain a substantial share of abnormal trading volume and part of the cross-sectional return variation, underscoring the importance of liquidity provision, transparency regimes, and market depth in absorbing lockup-related supply shocks.

Taken together, the evidence indicates that European lockup expirations no longer generate abrupt anomalies. Instead, they produce anticipatory repricing, predictable liquidity shocks, and temporary price pressure followed by a reversal, all of which are mediated by ownership structure and market microstructure. These patterns suggest that semi-strong efficiency is more closely observed in this setting: markets incorporate publicly available lockup information gradually and systemati-

cally, and any short-run disturbances are limited and temporary.

7. Limitations

We follow Field and Hanka (2001) and compute market-adjusted CARs using gross returns. This approach is simple, transparent, and avoids the need for an estimation window, which is important in IPO settings where firms have limited trading histories. However, we acknowledge that this method is not without limitations. By using the market index as the sole benchmark for expected returns, we implicitly assume that firm-specific risk differences and industry-level shocks are negligible over the event window. Importantly, we do not adjust returns for beta or any risk-factor exposure, such as those implied by the CAPM or Fama–French models. These assumptions may not hold perfectly, particularly for young and volatile IPOs. Given the very short three-day window examined here, we expect any resulting bias to be small, but we recognise that the measure provides only an approximation of true abnormal performance.

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APPENDIX

Appendix A: Definition of Variables

Dependent Variables

Cumulative Abnormal Return (CAR): The three-day cumulative abnormal return for firm i over the event window (t = –1, 0, +1) relative to the lockup-expiration date. CAR is calculated as the compounded ratio of the firm's gross return to the corresponding home-market index return (FTSE, DAX, CAC, OMXS, or FTSE MIB), minus one. The measure isolates the market-adjusted price reaction attributable specifically to the unlock event, following MacKinlay (1997) and Field and Hanka (2001). CAR is winsorised at the 5th and 95th percentiles and expressed in decimal form.

Abnormal Trading Volume (ATV): The natural logarithm of one plus the average abnormal trading volume over the same three-day window (t = –1 to +1). Abnormal volume is defined as the ratio of event-period trading volume to the firm's average daily trading volume in the estimation window (t = –50 to –6), minus one. This transformation reduces skewness and allows percentage-based interpretation. Abnormal volume is winsorised at the 1st and 99th percentiles before logging.

Independent Variables

VCPE Dummy: Indicator variable equal to 1 if the IPO issuer is backed by venture capital or private equity investors at the time of listing, and 0 otherwise. This variable captures the ownership structure relevant for information asymmetry and potential insider selling intensity.

Market Dummies: Indicator variables for each exchange—London, Stockholm, Milan, Frankfurt, and Paris—equal to 1 if the IPO is listed on the corresponding market. One market serves as the omitted base category. These controls capture differences in trading mechanisms, disclosure environments, and market microstructure across European exchanges.

Year-Group Dummies: Indicator variables for the IPO year grouped into 2012–2014, 2015–2017, and 2018–2019, with 2009–2011 as the base period. These dummies control for time-varying regulatory conditions, market liquidity, and cycle effects in European IPO activity.

Size: Natural logarithm of firm size at the time of the IPO, measured as post-offer market capitalization (note that the size variable is computed based on the offer price in EUR for each IPO regardless of where they are listed). This variable captures cross-sectional differences in firm scale, which may affect trading behaviour and sensitivity to unlock events.

Run-up: Natural logarithm of the pre-unlock price run-up, measured as the percentage change in the stock price from the offer date to day –6 relative to the lockup expiration. Run-up proxies for pre-event valuation momentum and potential overreaction that may reverse around the unlock date.

Abnormal volume: Natural logarithm of the average daily trading volume during the estimation window (t = –50 to –6). This measures baseline liquidity and order-flow intensity. In CAR regressions, logAV is included as a control for differences in underlying trading activity that may influence abnormal returns.

FractionLocked: The fraction of total post-IPO shares subject to lockup at the time of the offering, calculated as locked-up shares divided by total shares outstanding after the IPO. This variable captures the potential supply shock at expiration and reflects insiders' retained ownership.

Pre-Turnover: Average daily turnover in the estimation window (t = –50 to –6), measured as trading volume divided by shares outstanding. This serves as a liquidity proxy indicating how actively a stock trades prior to the unlock. Higher pre-unlock turnover may reduce price pressure effects or signal informed trading ahead of the event.

CAR three day pct : Measures the cumulative abnormal return over the three-day unlock window (Day 1 to +1). The variable is winsorized at the 5th and 95th percentiles and expressed in percentage terms. When used as an independent variable in the abnormal volume (AV) regression, it captures whether IPOs with stronger short-window price reactions also experience differential abnormal trading volume, controlling for VC/PE backing, market and year fixed effects, firm size, pre-unlock price run-up, lockup fraction, and pre-event liquidity

HC1 specifications

CAR regression (dependent = CAR_m1_p1, winsorized 5/95, decimal)

$$\begin{aligned} CAR_i = \alpha &+ \beta_1 VCPE_i + \beta_2 London_i + \beta_3 Stockholm_i + \beta_4 Milano_i + \beta_5 Frankfurt_i + \beta_6 Paris_i \\ &+ \beta_7 Size_log_i + \beta_8 RunUp_i + \beta_9 logAV_i \\ &+ \beta_{10} Year_{2012\text{–}2014,i} + \beta_{11} Year_{2015\text{–}2017,i} + \beta_{12} Year_{2018\text{–}2019,i} \\ &+ \beta_{13} FractionLocked_i + \beta_{14} Turnover_pre_i + \varepsilon_i \end{aligned}$$

AV regression (dependent = logAV, winsorized 1/99)

$$\begin{aligned} logAV_i = \alpha &+ \gamma_1 CAR_3day_pct_i + \gamma_2 VCPE_i + \gamma_3 London_i + \gamma_4 Stockholm_i + \gamma_5 Milano_i \\ &+ \gamma_6 Frankfurt_i + \gamma_7 Paris_i + \gamma_8 Size_log_i + \gamma_9 RunUp_i \\ &+ \gamma_{10} Year_{2012\text{–}2014,i} + \gamma_{11} Year_{2015\text{–}2017,i} + \gamma_{12} Year_{2018\text{–}2019,i} \\ &+ \gamma_{13} FractionLocked_i + \gamma_{14} Turnover_pre_i + u_i \end{aligned}$$

Both regressions are fitted with HC1 heteroskedasticity-robust standard errors.

Appendix B: VIF Diagnostics for CAR and ATV Regression

Table 1: Variance Inflation Factors (VIF) for CAR Regression

Variable	All firms	VC/PE-backed	Not VC/PE-backed
VC/PE dummy	1.896	31.936	–
Stockholm dummy	1.623	1.408	1.668
Milano dummy	1.220	1.069	1.304
Frankfurt dummy	2.393	2.443	2.703
Paris dummy	2.121	2.146	2.045
Size (log)	4.667	2.244	3.824
Run-up	1.080	1.131	1.121
Year 2012–2014	2.453	4.302	1.663
Year 2015–2017	3.241	4.036	2.807
Year 2018–2019	2.353	2.556	2.564
Fraction locked	5.781	1.345	5.261
Turnover (pre)	1.374	1.255	1.409
Log abnormal volume	1.121	1.105	1.159

Notes: This table reports Variance Inflation Factors (VIF) for the CAR regression across three samples: all firms, VC/PE-backed firms, and non-VC/PE-backed firms. A missing VIF value (NaN) is denoted by "–".

Table 2: Variance Inflation Factors (VIF) for ATV Regression

Variable	All firms	VC/PE-backed	Not VC/PE-backed
VC/PE dummy	1.895	31.075	–
Stockholm dummy	1.592	1.406	1.608
Milano dummy	1.214	1.104	1.290
Frankfurt dummy	2.293	2.476	2.581
Paris dummy	2.101	2.146	2.022
Size (log)	4.646	2.372	3.794
Run-up	1.089	1.118	1.133
Year 2012–2014	2.456	4.517	1.516
Year 2015–2017	3.306	4.409	2.806
Year 2018–2019	2.369	2.567	2.572
Fraction locked	5.756	1.338	5.154
Turnover (pre)	1.378	1.301	1.400
CAR (3-day pct)	1.054	1.384	1.031

Notes: This table reports Variance Inflation Factors (VIF) for the ATV regression across three samples: all firms, VC/PE-backed firms, and non-VC/PE-backed firms. Missing values (NaN) are shown as "–".

AI Appendix

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