DO IPOS AFFECT PRICES OF OTHER ASSETS?

EVIDENCE FROM A SWEDISH SETTING

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Do IPOs affect prices of other assets? Evidence from a Swedish Setting

Abstract:
This paper looks at effect of IPOs on both market and industry returns through using a sample of 149 IPOs between 2005-2022. We find evidence that sizeable IPOs depress market returns during the pre-offering period where the impact is negatively correlated with size. Through looking at the covariance between IPOs and industries we find that IPOs permanently decreases industry returns on the listing day where the covariance and the return have an inverse relationship. This depressive effect is amplified when we look at the impact of large IPOs as they have an additional depressive effect on industry returns during the pre-offering period, offering date and listing period. We find support for a portfolio rebalancing hypothesis where industry prices depress due to a substitution effect.

Keywords:

Market price, Market return, Initial public offering, IPO, Industry covariance, Asset pricing, Supply shock

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1. Introduction

The behavior of security prices has traditionally been explained and researched from the angle of investor preferences, focusing on factors such as risk aversion (Braun and Larrain, 2009). Moreover, most of the literature surrounding initial public offerings (IPOs) is centered around the IPO event itself such as underpricing structures and market conditions rather than the impact of an IPO on other assets. Supply has traditionally been assumed to be fixed (Lucas, 1978) or perfectly elastic (Cox, Ingersoll, and Ross, 1985), under these assumptions potential IPO effects are not considered. Given that IPOs represent the introduction of a new asset into the market, often with substantial value, it is probable that they will also exert outward effects on the broader market (Braun and Larrain).

Braun and Larrain (2009) study the empirical effect of supply on other asset prices through conducting an event study on 254 IPOs in 22 emerging markets and find that assets that covary highly with an IPO will exhibit a permanent decreased return post issuance. Shi, Sun and Zhang (2018) extend this analysis by looking at the effect of an IPO on market returns in China through observing 1121 IPOs during the sample period of 1996-2016. They find that a sizeable IPO has a transitory effect on market prices as market returns initially depress but reverse as liquidity constraints ease.

We do a geographical extension by investigating the effects of 149 IPOs on both market and industry returns between 2005-2022 in Sweden. The methodology for investigating the market return is based on of Shi.et.al.'s (2018) paper while the methodology for the industry effect is based off Braun and Larrain's (2009) paper. Braun and Larrain focus on emerging markets while Shi et.al concentrate on China, both markets which differ greatly along multiple dimensions. As such, there is a notable gap in literature regarding effect of asset supply on returns of other assets within a developed and well-established market Sweden (Svensk Värdepappersmarknad, n.d.). Exploring IPO dynamics in Sweden could provide valuable insights into how supply shocks influence asset returns in a different market environment.

Sweden has one of Europe's most robust equity markets from both the viewpoint of investors and companies. The Swedish equity market ranks amongst the largest in Europe in regards to market capitalization relative to GDP (Svensk Värdepappersmarknad, n.d.). Agari (2024) reports that as of 2021, Sweden has Europe's deepest capital market and has second prior to that. Furthermore, Stockholm experienced a record-breaking year for IPOs with a collective total surpassing France, Spain and Germany combined in 2021 (Svensk Värdepappersmarknad, n.d.). Agari further reports that between 2014-2024, 501 companies have been listed in Sweden which is more than the total number of IPOs in Germany, France, Spain, and Netherlands.

Sweden's market depth with its broad range of assets and IPOs can be attributed to the investing culture prevalent in the country. Equity markets have attracted "everyone from the man on the street to very engaged private banking investors, entrepreneurs, but also the small and mid-cap investment community" (Agari, 2024). The presence of large institutional investors has also been a key driver in SMEs getting listed as it gives comfort and confidence to both businesses and individual investors. This strong investment culture has been supported and encouraged by the Swedish government. As an example, in 2012, the state introduced a savings account, ISK which allows individuals to invest without tax reporting frictions. Further, in the 1990s, the government started allowing people to invest part of their pension accounts in funds of their choice. There are also youth groups such as Aktiespararna which go to schools and educate students aged 16-18 about finance and investing.

These features combined have resulted in great involvement of the Swedish population in the stock market. Kaustia, Conlin, & Luotonen (2023) find that Sweden has one of the highest stock market participations in Europe[1] at 60%. In comparison, Spain and Italy have a stock market participation rate of 10%. The authors also observe that regulatory quality is a key determinant for stock participation and Sweden scores the second highest at 1.80 after Switzerland. When it comes to financial literacy, Klapper, Lusardi, & van Oudheusden (2024) report that Sweden is amongst the countries with the highest financial literacy rates in the world with over 65% of adults being financially literature. On the other hand, China and large parts of South Asia and South America have some of the lowest rates of financial literacy in the world.

The Swedish market also has strong international appeal as over 40% of share ownership stems from foreign investors as reported by the Svensk Värdepappersmarknad (n.d.). There are two explanations for this, first, equity raising is not as easy in other parts of Europe due to the lack of investment culture which makes it especially difficult for smaller companies and second, since the capital markets are deep in Sweden there are more available companies to aid in valuation and further required analysis. The Swedish culture and system have also translated into the stock market returns with Swedish indexes outperforming their peers (Agari, 2024).

We observe no direct significant effect of IPOs on market return in Sweden during the IPO window. However, we do find a significant effect that IPOs depress market prices by an average of 0.013 percentage points on the offering day when regressing using size as the independent variable during our sample period. This implies that the IPO needs to be large enough for investors to sell stocks that do not covary with the IPO to collect funds. We however do not observe that market prices rebound which implies that there is no price pressure theory in play, rather the results seem to support the portfolio rebalancing theory which yields a permanent decrease of prices (Shi.et.al, 2018).

To further explore the portfolio rebalancing theory, we extend our analysis by employ Braun and Larrain's (2009) methodology and sub-setting the market into industries. We explore the impact of IPOs on industry returns by studying the relationship between IPO industry and 11 sets of industry portfolios. Regressing covariance as an explanatory variable we observe an inverse relationship between IPO industry covariance and returns. The analysis shows that there is an average depressive effect on industry returns on the listing day of -0.54 percentage points. There is no significant effect on any other date in the IPO window due to limits to arbitrage from uncertainty (De Long et al., 1990; Shleifer and Vishny, 1997). When we interact covariance and size, we find that large IPOs depress market-adjusted returns for pre-offering, and pre-listing by 0.68 and 0.41 percentage points respectively and depresses excess return by 0.43 percentage points on the offering day likely due to reduction of uncertainty. These results indicate that a significant value of existing holdings is sold before offering to subscribe when it first gets offered as opposed to before it is listed on the market. We also find that market prices are depressed regardless of size and solely on covariance on the listing day. These findings support a portfolio rebalancing theory as there is a permanent decrease on market prices as observed by Braun and Larrain rather than the price pressure story observed by Shi.et.al. (2018). There is also support for the downward-sloping demand of stocks theory as both covariance and size drive price depression (Grossman and Stiglitz, 1980).

[1] The study looks at a sample of 19 European countries. The countries from lowest to highest participation rate is: Poland, Hungary, Greece, Estonia, Italy, Spain, Portugal, Slovenia, Austria, Israel, Netherlands, Czech Republic, Luxembourg, Germany, France, Belgium, Switzerland, Denmark, Sweden.

2. Literature review

Historically there has been a lack of research on the impact of supply on market prices (Braun and Larrain, 2009). When it comes to level of supply, Hong et.al. (2008) finds that market-to-book ratios across the United States have a negative relationship with the measure of relative asset supply (ratio of a state's total book equity to total personal income) in a specific state. Other literature has focused on change in supply and specifically the price effect of equity issues. Baker and Wurgler (2000) observes that market price levels fall after a period of active issuance. Furthermore, Ofek and Richardson (2000) document that an increase in supply caused by the expiration of IPO lockups results in a lower price of recent IPOs. Supply effects have also been found in the fixed-income market which Newman and Rierson (2004) show by studying a substantially large bond issuance of Deutsche Telekom and find that this depresses the prices of bonds of other European telecommunications firms.

Braun and Larrain (2009) are the first to study the empirical effect of changes in supply on *other* assets through studying the impact of IPOs on prices of other assets in the market. They conduct an event study on over 254 IPOs in 22 emerging markets and show that IPOs permanently affect the entire cross section of prices across different securities or assets within their respective markets during the month of issuance. Furthermore, Braun and Larrain find a negative relationship between covariance and price decline i.e. portfolios that have a high covariances with the IPO experience a greater decline in prices compared to other portfolios in the month of issuance. Securities which were similar to the IPO assets in terms of size and book-to-market ratios also experienced a relative price decline. The magnitude of these effects increases when the supply shock increases. A high covariance between the IPO industry and an asset indicates that the IPO is a good substitute for previously held similar assets and therefore are impacted to a larger degree. The authors suggest that a portfolio rebalancing takes place where demand is constant and downward-sloping which means that investors obtain the new IPO asset at the expense of existing assets which results in depressed industry return.

Shi et. al. (2018) extends these findings by investigating whether sizable IPOs have a negative impact on the overall market price in China with a sample of 1121 IPOs during their sample period of 1996-2016. Their initial hypothesis is that a large supply shock in the form of an IPO may crowd out demand for other stocks in the market which builds upon Braun and Larrain's model of downward-sloping demand. There is anecdotal evidence which suggests that IPOs have a negative impact on market prices from both previous IPOs and regulations to protect against depressed market prices enforced by the China Securities Regulatory Commission (CSRC). Furthermore, in China, investors are required to post the funds when subscribing to an IPO and these funds are locked-in till the listing date. During most of the sample period, IPO subscribers froze the required funds for their orders and most IPOs were heavily oversubscribed. They find evidence that sizable IPOs depress the market return both on offering day as well as listing day. Furthermore, the IPO has a depressing effect on market return from the day before the offering until the end of the frozen period which implies that IPOs can impact market returns even if there is a substantial external capital flow into the market. This effect is found to be transitory and provides support for price pressure theory as the market price bounces back on both post-listing day and the unfrozen day.

Our paper contributes to existing literature through providing a new geographical perspective of the Swedish market which differs greatly from past geographies both on a macro and micro level. Compared to both China and emerging markets, Sweden has a substantially higher financial literacy rate which is likely to impact investor behavior and stock market reactions

(Klapper et.al., 2024). Also, both China and emerging markets are not internationally integrated. As emphasized by Braun and Lorrain (2009), emerging markets are small and incompletely integrated with international markets while Shi et.al. (2018) points out that the Chinese market is largely isolated from international portfolio capital flows, both providing a distinct sample unaffected by external factors. In contrast to this, Sweden attracts large amount of foreign funds with 40 percent of share ownership coming from out of Sweden (Svensk Värdepappersmarknad, n.d.). The final distinct difference is the investment culture which is unique to Sweden (Agari, 2024). The investment culture has given the Swedish population more investment knowledge and experience which could impact investor behavior.

China and Sweden also differ greatly when it comes to participation. Sweden has the highest stock market participation of 60% (Kaustia et.al., 2023) in Europe while in China it is less than 10% (Gao & Fok, 2015). Stock market participation rates can also reflect the level of market efficiency. Higher participation rates may suggest a more mature and efficient market where prices quickly adjust to new information, potentially mitigating the impact of IPOs on market prices. Another key difference is that the Chinese IPO market has a lot of zealous speculation which is characterized by high rates of underpricing and oversubscription. This suggests that there is a significant impact on market dynamics besides individual stocks which may impact the results as Sweden does not have the same clear speculation (Shi.et.al., 2018). Lastly, the regulations and policies surrounding IPOs differs greatly. Wilhelm and Ljungqvist (2003) suggest that lockups and their subsequent expirations may result in increased speculative trading in the market. Sweden does not have frozen periods, lock-up periods or CSRC moratoriums which alleviates some of the speculation and liquidity constraints compared to what China faces during the events of IPOs and may therefore impact the results (Pousette and Tipner, 2023).

3. Models of relative pricing

Models of relative pricing explain the effect Braun and Larrain (2009) observe in which a new asset can impact prices.

3.1. Capital Asset Pricing Model

Merton (1980) provides a model of market risk premium in an environment where investors exhibit Constant Relative Risk Aversion (CRRA) preferences:

$$E(r_m) - r_f = \gamma \sigma_m^2 \quad (1)$$

In Equation 1, γ represents the investors' coefficient of relative risk aversion and σ_m^2 is the variance of the market's returns, which quantifies the level of risk in the market. The expected return of individual assets relative to the risk-free rate is determined by their market beta β_i which measures the asset's return sensitivity relative to the market.

which measures the asset's return sensitivity relative to the market.

$$E(r_i) - r_f = \beta_i[E(r_m) - r_f] = \gamma\sigma_{i,m} \quad (2)$$

In Equation 2, σ_{im} is the covariance between the asset *i* and the market. β_i is defined as the as the ratio of this covariance to the market variance $\beta_i = \frac{\sigma_{i,m}}{\sigma_m^2}$.

With the introduction of a new IPO the market dynamics can experience significant changes specifically when it comes to how existing assets correlate with the market and each other. This is modeled by changing the covariance structure and influencing the expected returns. The change in expected returns because of an IPO can be shown as the following:

$$\Delta E(r_i) = \gamma\omega_{ipo}\sigma_{i,ipo} - \gamma\sum_{j=1}^{n}(\omega_{j,0} - \omega_{j,1})\sigma_{ij} \quad (3)$$

Equation 3 highlights two primary effects: 1) direct effect: the first term shows the impact of the introduction of an IPO based on its covariance with asset *i* and scaled by the IPO's weight in the market ω_{ipo}. This term is positive if there is a positive covariance which implies an increase in the expected return due to a higher risk premium, 2) indirect effect: the second term aggregates the changes in market weightings and covariances for existing assets which has a dampening effect of the IPO's covariance with assets. This effect is particularly important when there is a significant shift in market weights.

For the entire market, the IPO influence can be observed by analyzing its beta relative to the market:

$$\Delta E(r_m) = \gamma\omega_{ipo}[\sigma_{m,ipo} - \sigma_m^2] = \gamma\omega_{ipo}\sigma_m^2[\beta_{ipo} - 1] \quad (4)$$

Equation 4 shows that the effect of an IPO on the market's average return is dependent on whether the IPO's market beta is above or below one which indicates how changes in market composition influences risk premiums. As markets become more integrated and market capitalization includes a broader array of assets, the individual impact of a single IPO may be reduced.

3.2. Downward-sloping demand of stocks

Braun and Larrain (2009) formalize a model of downward-sloping demand to explain the portfolio rebalancing effect. Studying the downward-sloping demand curves of stocks is key in understanding market dynamics and investor behavior as a response to IPOs. This concept is a contrast to flat demand curves which are typically assumed in frictionless benchmarks like the CAPM model previously discussed. Stocks are downward sloping if there are market frictions which limit arbitrage opportunities and therefore indicate limited risk bearing capacity

in the market and ability to adjust to shocks (De Long et al., 1990; Shleifer, 1986; and Shleifer and Vishny, 1997).

In the following model, it is assumed that an agent has CARA (constant absolute risk aversion) preferences and that in equilibrium the price of asset *i* is given by equation 5.

$$P_i = \mu_i - \gamma \sum_{j=1}^{n} Q_j \sigma_{ij}, \quad (5)$$

where μ_i is the expected dividend of the asset (Grossman and Stiglitz, 1980). The slope of the demand curve is given by $\partial P_i / \partial Q_i = -\gamma \sigma_i^2$. The change in price as a result of an IPO is given by:

$$\Delta P_i = -\gamma Q_{ipo} \sigma_{ipo} \quad (6)$$

The implications of Equation 6 and Equation 3 are similar where the price of a stock that has a positive covariance with the IPO falls, and this effect is amplified by risk aversion and the weight of the IPO. Both the downward-sloping model and CAPM provide a similar intuition for the repricing of stocks as they are models of relative pricing i.e the pricing of any stock is relative to the rest of the stocks in the market. When a new stock is introduced to the market through an IPO, the portfolio of references changes and the covariance with the IPO measures the effect on a certain asset.

There are also behavioral considerations where literature suggests that investors categorize their assets and wealth by styles e.g investors may categorize assets by certain market-to-book ratios. When an IPO occurs, investors rebalance their portfolios to maintain their portfolio composition of different styles. Due to this, stocks with similar styles are sold as the new IPO is a direct substitute. Following this, downward sloping demand may occur from the interaction between rational arbitrageurs and biased investors where the IPO crowds out and lowers the price of the substitutable stocks (Barberis and Shleifer, 2003). Frictions such as uncertainty prevent the correction of mispricing that takes place due to style investing (De Long et al., 1990; Shleifer and Vishny, 1997).

In models with frictionless arbitrage, there is likely no immediate change in asset price on the date of issuance if agents have correctly predicted the IPO. However, in scenarios where there are constraints on arbitrage this is not the case. When an IPO is first announced, there is a lack of certainty, but the certainty increases during the IPO window and peaks on the listing date. This growth of certainty implies that there is a risk to an arbitrage strategy of short selling stocks with high IPO covariance and buying those with low IPO covariance until the listing date. This uncertainty may deter arbitrageurs from pursuing their strategy and affecting prices until the date of issuance (De Long et al., 1990; Shleifer and Vishny, 1997).

Empirical evidence is in favor of a downward-sloping demand model as it suggests that the market reaction to equity issuances is mostly negative (Baker and Wurgler, 2000). If empirical evidence was to support the CAPM model, we would instead see an ambiguous market reaction.

3.3. Price pressure

In 3.2, we focused on the portfolio rebalancing as done in Braun and Larrain's paper (2009). On the other hand, Shi et.al (2018) rather focus on the impact of size of IPOs on market prices as they hypothesize that a large supply shock may crowd out demand for existing stocks in the market. They argue the transitory price pressure hypothesis as described by Harris and Gurel (1986) that when an IPO is sizable enough and there is great speculation surrounding it, investors may also sell stocks which do not covary highly with the IPO which will affect the entire market rather than an industry. If price decline only occurs due to portfolio rebalancing, then we should expect to see a permanent price decline. However, liquidity or behavioral effects can result in a transitory price pressure. Price pressure consists of two concepts, first, before subscribing to an IPO, investors collect funds through selling other stocks and second, market makers only take these stocks at a discount. This discount may be correlated with IPO covariance if investors sell similar stocks to finance their new asset. However, investors are likely to repurchase their previously owned shares once they build up liquidity again and the share price will rebound. As a result, if the initial price depression is due to a liquidity shortage, a large price increase in stocks with high covariance with the IPO should be observed in the period following the IPO as this effect is reversed. This should also be reflected in an abnormal volume caused by the IPO event.

4. Background on IPOs

In Sweden, a typical IPO and stock exchange listing spans between four to six months (Pousette and Tipner, 2023). The process begins with the issuer assembling a team of financial, legal and public relations advisors. The preparatory phase involves thorough due diligence, prospectus drafting and engagement with the targeted stock exchange for a listing review, which may also include a pre-audit by a separate auditor. A prospectus draft is a legal document required by regulatory authorities in the process of an IPO. It includes detailed information about the company, its financial performance, operations, risks and the securities themselves which are being offered for sale. The prospectus is used by potential investors as an information source. The possibility to place orders for private individuals and institutions opens once this prospectus is published. Order books are typically kept open for 1-2 weeks but at times the subscription period can also close prior to the decided date. The price per share is set as either an interval or fixed price before the listing which is then decided based on demand once the company is listed. The listing company decides the composition between institutions and private individuals and at times, if many people are interested in subscribing, the listing can be oversubscribed meaning an investor receives fewer shares than they applied for as there are more people involved. Once you have subscribed you are required to have the required funds as outlined by the bank on a specific date otherwise you will not be able to partake in the IPO. However, these funds are not frozen or locked between the subscription and listing date (Avanza customer service, personal communication, April 10, 2024). On the day of the listing, those who signed up and had the required funds will receive their shares (*How do I invest in a company about to list on the stock market?* 2022).

The main costs associated with an IPO comprise of the stock exchange listing fee which consists of a fixed fee at application, variable fees based on market capitalization and in certain cases, cancellation fees. Additional fees include annual exchange fees, listing auditor fees and

the SFSA's review of prospectus fees. Once the IPO has taken place, financial advisors receive a fixed fee which is often a percentage of total shares offered (Pousette and Tipner, 2023).

Pousette and Tipner (2023) report that IPOs need to meet the corporate governance requirements outlined by the Swedish Companies Act and the Corporate Governance Code. These requirements include regulations related to board compositions, nomination committees, remuneration committees and audit committees.

5. Data and Methodology

In this paper, we investigate the effect of IPOs on the market return and the effect of IPOs on industry return. For simplicity, we have separated each following section of this paper into the market and industry.

We conduct event studies surrounding the offering and listing events of an IPO in Sweden. The event window is defined in Table 1.

Table 1: Descriptions of Event Window variables

Table 1 presents descriptions of the definition for each event window variable. The event window variable definitions are borrowed from the methodology in Shi et.al (2018).

Period Variable	Description
PREO	Pre-offering period, defined as 1 and 2 business days before the offering date
OD	Offering date
POSTO	Post-offering period, defined as 1 and 2 business days after the offering period
PREL	Pre-listing period, defined as 1 and 2 days before the listing date
LD	Listing date
POSTL	Post-listing date, defined as 1 and 2 business days after the listing period
ordinary1	Ordinary trading day estimated using all data points
ordinary2	Ordinary trading day estimated using all data points excluding event window dates

To look at the IPO effect on other assets we focus on the subscription day (OD), when investors first subscribe, and the listing day (LD) when investors can trade the shares on the stock exchange. As Shi et.al. (2018) points out, the IPO impact on the market price is likely to occur during the days surrounding these two events. Therefore, we look at the market two days before the subscription date (OD -1 and OD -2) as well as two days after (OD +1 and OD + 2). We apply the same window for the listing day event (LD-1, LD-2 and LD+1, LD+2). In contrast from Shi et.al. we do not have a frozen period to investigate in the event window.

5.1. IPO sample

To investigate the impact of IPOs on the Swedish market, we collect IPO data including offering date, listing date, issuing size and offering price from Refinitiv Eikon. As Braun and Larrain (2009) hypothesize, an IPO must be sizable to influence the market price. As such we

only include IPOs with an issuing proceed/value of at least 1% of the average monthly market trading value the month before its listing-date. Shi et.al. (2018) uses an arbitrarily chosen threshold for 2% but we find that using a larger threshold significantly decreases our original sample size from 346 to 103. However, we believe this should not matter as Shi.et.al. found the same results with both arbitrary thresholds. As such, by using the 1% threshold we can have a satisfactory number of observations when compared to previous studies. As another example, Braun and Larrain (2009) also use an arbitrary threshold of 20 million USD which they argue is sufficiently sizable emerging markets.

Table 2: Summary Statistics for IPOs

Table 2 reports the summary statistics the IPOs within our data for both the full sample (columns 2-5) and sizeable IPOs defined as IPOs with an issuing proceed/value of at least 1% of the average monthly market trading value the month before its listing-date (columns 7-11). (datasources: FinBas, Refinitiv Eikon)

	IPOs Full Sample					IPOs Sizable				
Year	N	Mean IPO Value	First-day return (%)	Total Trading Value	(%) Market trading value	N	Mean IPO Value	First-day return (%)	Total Trading Value	(%) Market trading value
2005	5	916	0.765	10537087997	0.068	3	1238	-2.248	9979238072	0.064
2006	12	532	-0.506	1399716901	0.007	4	1320	1.951	1296089509	0.006
2007	14	655	-0.571	2115542109	0.011	3	2147	-0.33	1600679620	0.009
2010	21	120	-1.623	348220517	0.004	3	767	-1.623	348220517	0.004
2011	12	162	-4.608	363597932	0.005	3	577	-3.778	356287164	0.004
2013	2	293	-3.460	54682246	0.001	1	583	-3.460	54682246	0.001
2014	14	1864	0.109	11521144144	0.185	12	2154	0.287	11450868839	0.184
2015	34	1458	-0.777	14657236048	0.179	21	2292	0.564	14285113299	0.175
2016	28	742	4.096	6854221752	0.103	16	1220	1.231	6756603637	0.101
2017	48	449	-0.673	4051205947	0.064	18	1102	0.948	3952876953	0.062
2018	23	252	-1.002	1490010663	0.022	9	586	-1.002	1490010663	0.022
2019	12	1578	5.829	5401965328	0.087	6	3086	6.375	5382873446	0.087
2020	19	1053	1.308	2345094513	0.027	10	1945	1.308	2345094513	0.027
2021	102	1065	3.04	12151601659	0.167	40	2615	3.04	12151601659	0.167
Total /Average	346	796	0.138	5235094840	0.066	149	1545	0.233	5103588581	0.065

Observing Table 2, the average first day returns of IPOs in our full sample as well as in our sample of sizable IPOs exhibits indications of very low levels of systemic underpricing compared to China who has one of the highest IPO underpricing rates in the world with an average of 113.5% between 1990-2014 (Shi.et.al., 2018). This serves as anecdotal evidence of low levels of speculation in Sweden. 2021 was a record year for the number of IPOs done in Sweden, the total surpassing France, Germany and Spain combined (Svensk Värdepappersmarknad). Globally, 2021 was a strong year for IPOs as markets were significantly less volatile after the Covid-19 pandemic and investors were eager to deploy the capital that had accumulated during the pandemic (*Global IPO Watch 2021*, 2021). The number

of IPOs was very low in 2008 as a response to the financial crisis and worldwide loss of confidence in capital markets and this followed into 2009 with a lack of IPOs (*European IPO markets suffer a dismal fourth quarter marking a five year low in activity,* 2009). The trading value decreased significantly after 2008 which could indicate a further negative impact of the financial crisis with less trading and greater mistrust in markets. The IPO data on Refinitiv Eikon does not include any IPOs listed for 2012 and 2009 and are thus, absent from our sample. Furthermore, observing the total trading value of IPOs for the sample period, it averages 0.66% of the market trading value indicating that sizable IPOs in Sweden serve a large share of the trading activity in the market.

5.2. IPO Effect on the Market

We study the impact of IPOs on the market through looking at the impact on market return and market turnover ratio. To study this, we collect open and close prices, trading value, market capitalization, bid-ask spread and number of shares for each stock listed on the Stockholm Stock Exchange for our sample period 2005-2022 from Finbas.

We use raw data for the Stockholm Stock Exchange to make our own market index as opposed to already existing indices (such as OMXSPI or Six Return) as it allows us to isolate the market price in exclusion of the IPOs in our sample. Our index is made by value weighting each stock on the Stockholm Stock Exchange by their market capitalization. To ensure that our market index is a valid proxy, we run a robustness check with the OMXSPI index and find a correlation of 0.94 when using open-close[2] returns and 0.98 when using close-close[3] returns. As such, we use close-close returns. The methodology and regression analysis are based on Shi et.al.'s (2018) paper with adaptations to fit the Swedish market dynamics.

5.2.1. Regression Analysis of IPO effect on Market return

We use a Garch-in-mean model to test how a sizable IPO would impact market return during the event window defined in Table 1. This model is common in econometrics to use to model the volatility of asset returns including market returns (Engle, 2001). The Garch-in-mean model is used to estimate the volatility of the market and included in the regression since it captures the following three things; 1) volatility clustering: market returns often exhibit periods of high volatility followed by periods of low volatility, 2) time-varying volatility: market volatility changes over time, 3) conditional heteroskedasticity: market returns can exhibit heteroskedasticity i.e. the variance of returns is not constant over time.

$$MR_t = \alpha_0 + \alpha_1 MR_{t-1} + \alpha_2 PREO + \alpha_3 OD + \alpha_4 POSTO + +\alpha_5 PREL + \alpha_6 LD + \alpha_7 POSTL + \alpha_8 h_t + \alpha_9 YEAR + \varepsilon_t \quad (7)$$

$$h_t = \beta_0 + \beta_1 h_{t-1} + \beta_2 \varepsilon_{t-1}^2$$

[2] Open-close returns are defined as closing price of stock less opening price of stock divided by the opening price of stocks.

[3] Close-close returns are defined as closing price of stock day t less closing price of stock day t-1 divided by closing price day t-1.

where MR_t is the market return on event window date t and h_t is the variance of the error term ε_t based on the information set by φ at time t − 1 and is modeled following ARMA (1,1) process which is a proxy for time-varying market risk. A lag return term MR_{t-1} is added to the mean equation control for first-order serial correlation amongst the following dummy variables: $PREO$ (pre-offering period), OD (offering day), $POSTO$ (post-listing offering date), $PREL$ (pre-listing period), LD (listing day), and $POSTL$ (post-listing period); and ε_t is the residual. Additionally, we include a year dummy, $YEAR$ to control for any time varying factors. In the case of the IPO depressing market returns, α_2 and/or α_3 should be negative as investors are selling existing holdings to collect liquidity. If the listing only depresses the market temporarily, then α_5 and/or α_6 should be negative while α_7 should be positive as the market price rebounds once liquidity is restored (Shi.et.al., 2018).

5.2.2 Regression Analysis of IPO effect on Market Turnover Ratio

Shi et.al (2018) explain that during the frozen period in China, the market exhibits low liquidity which is reflected in a low turnover. Once the frozen period ceases, liquidity increases as investors start to buy back shares they previously sold to fund their IPO subscription. In this case, both turnover and market return should reverse. In Sweden, there is no frozen period; rather an investor needs to have the required funds in their account by a certain date to be able to subscribe to the IPO (Avanza customer service, personal communication, April 10, 2024). As such, there is no significant liquidity constraint the promotes this pattern of investor behavior. We can expect to see an increase turnover before the subscription as investors sell their existing assets, a decrease when funds have been collected and an increase right after once investors can reallocate their portfolio and repurchase shares.

We use the following ordinary least squares (OLS) regression:

$$TURNOVER_t = \alpha_0 + \alpha_1 TURNOVER_{t-1} + \alpha_2 PREO + \alpha_3 OD + \alpha_4 POSTO + \alpha_5 PREL + \alpha_6 LD + \alpha_7 POSTL + YEAR + \varepsilon_t \quad (8)$$

where $TURNOVER_t$ is market turnover ratio on event window date t. A year dummy is created for each calendar year 2005-2022 to control for time specific effects. Remaining variables are as described in Equation 7. If investors sell their existing shares to raise funds to subscribe to IPOs, the coefficient should be positive due to increased trading activity. Investors will most likely do this during the pre-offering period α_2 and the pre-listing period α_3.

5.3 IPO Size Effect on the Market

The price pressure theory hypothesizes that a large enough IPO will result in a depression of market prices due to the sale of all stocks, not only those that covary with the IPO (Harris and Gurel, 1986). Thus, we further examine if there is a causal relationship between the size of an IPO and both the market return and the market turnover.

Table 3: Summary Statistics of Size Measures

Table 3 reports summary statistics for two different measures of IPO size relative to the market. 1) Issuing ratio and 2) Trading value ratio. The issuing ratio is defined as the IPO proceeds divided by the IPO market trading value on the listing day (excluding IPO trading value). The IPO trading ratio is the total trading value of the IPO on the listing day divided by the market trading value on the listing day, excluding the IPO shares. Both these measures are percentages. An IPO trading ratio of 1.42 indicates that the trading value of the IPO shares of the listing day is 1.42% of the market trading value. (datasource: FinBas and Refinitiv Eikon)

Variable	Average	Median	Min	Max	N
IPO Trading Value Ratio	1.4177	0.5463	0.0001	16.4794	163
IPO Issuing Ratio	5.7030	2.7242	0.0178	73.2444	163

Observing the summary statistics for our size measures IPO trading value ratio defined as the IPO trading value divided by the market trading value on the listing day as well as the IPO issuing value, defined as the IPO issuing proceeds divided by the market trading value on the listing day. The average IPO trading value ratio is approximately 1/4 of the size of the IPO issuing ratio while median IPO trading value ratio is approximately 1/5 of the size of the IPO issuing ratio. This indicates that for our sample, the pre-listing total valuation of the IPO far exceed the trading value of the IPO on the listing day.

We use IPO issuing ratio as our main measure for market return since it provides more indication of the individual IPO size in comparison to the overall trading activity in the market. This fits with our goal of understanding how the size of an IPO may impact the broader market dynamics like liquidity and trading patterns. We run both measures of IPO size as additional robustness.

5.3.1 Regression Analysis IPO Size Effects on the Market Return

To further examine whether the size of the IPO serves as an explanatory variable we run the following OLS regressions across the sizeable IPO sample during our sample period.

$$MR_t = \alpha_0 + \alpha_1 SIZE_{IPO} + YEAR + \varepsilon_t \quad (9)$$

where MR_t are the market return on day t within the event window defined in Table 3. We use run two separate regressions using, one using IPO trading value ratio as our $SIZE_{IPO}$ and a second regression using IPO issuing ratio. Furthermore, we run separate regressions for each event t. Year dummies are included for each calendar year to control for time-specific effects. We should expect to see that an increase in size results in a depression of market prices.

5.3.2 Regression Analysis IPO Size Effects on the Market Turnover ratio

The IPO size effects are further examined by also running the following OLS regression on market turnover ratio:

$$TURNOVER_t = \alpha_0 + \alpha_1 SIZE_{IPO} + YEAR + \varepsilon_t \quad (10)$$

where $TURNOVER_t$ is the market turnover ratio for each event t within the event window. The following variables and procedure are defined in the same way as Equation 9 Furthermore, we expect to see that an increase in size results in a decrease of the market turnover ratio.

5.4 IPO Covariance effects on the Market

We subsection the Swedish market into industries as a next step. To study the impact of IPOs industry returns, we create 11 value-weighted industry portfolios. Industry definitions are collected for companies listed in Sweden, we use TRBC Economic Sector Codes[4] for our industry categorization. Table 4 presents the composition of our observation across the industry categories.

Table 4: Industry Compositions

Table 4 reports the number of companies in each industry portfolio in column 2. The industry portfolios are created from companies listed on the Stockholm Stock Exchange excluding the IPOs in our sample. The industry categorization is based on TRBC Economic Sector definitions or TRBC codes. In total there are 13 TRBC industry definitions, in our sample there are 11 defined industries. In column 3, the number of IPOs in our full sample belonging in each Industry category is shown and in column 4 the number of Sizable IPOs belonging to each industry category is shown. Sizable IPOs are defined as IPOs with the issuing proceeds on the listing day larger than 1% of the average daily market trading value in the month before the listing date of the IPO. (datasource: FinBas and Refinitiv Eikon)

Industry	Nr of Companies in Industry Portfolio	Nr of IPOs	Nr of Sizable IPOs
Academic & Educational Services	2	5	3
Basic Materials	14	11	7
Consumer Cyclicals	43	52	30
Consumer Non-Cyclicals	10	9	5
Financials	39	29	14
Healthcare	52	64	22
Industrials	72	59	27
Real Estate	31	16	13
Technology	54	93	27
Utilities	2	7	1

Observing Table 4 it can be seen that the industry portfolio with most companies is Industrials. For the full sample of IPOs the industry with most IPOs is healthcare and for the sizable IPOs the largest industry is Consumer Cyclicals.

[4] There are 13 total industries according to Eikon definitions but we have 11 in our sample

5.4.1. Regression on effect of IPOs on Industry Abnormal Return

To study if covariance between an industry and the IPO industry has an effect on the industry portfolio returns we use the following regression:

$$R_{i,t} = a + \sigma_{i,IPO} + \varepsilon_{i,t} \quad (11)$$

where the dependent variable $R_{i,t}$ is the abnormal return of industry portfolio *i* during the day *t* as defined in Table 1. We use 2 different metrics to measure abnormal return: excess return, defined as the industry portfolio return less the risk-free rate and market-adjusted return, defined as industry portfolio return less the market return. Our main explanatory variable $\sigma_{i,IPO}$ is the covariance between the IPO industry and industry portfolio *i*.

We calculate 11 return observations for each IPO referring to 11 industry portfolios. We control for time and industry through interacting year and industry dummy variables as fixed effects represented as *a* in our equation. We use year as opposed to month due to sample size restraints. This is contrasting with Braun and Larrain (2009) who use a vector containing a set of IPO fixed effects. We use industry year fixed effects represented by a as opposed to IPO fixed effects since industry-year fixed effects allow us to capture the specific dynamics and trends within each industry over time rather than controlling for the IPO itself, in this way we isolate the effect of the introduction of the IPO from any industry-specific dynamics that may affect industry return. We run a separate regression for each defined event date *t*.

The main obstacle with running Equation 11 is that the covariance between an IPO and each industry is not observable before it is listed therefore, a proxy is needed. Braun and Larrain (2009) use the covariance between the industry of the IPO and a set of industry portfolios as a proxy. They however argue for using a US based proxy as they highlight that an in-sample covariance faces noisy samples and endogeneity problems. The out-of-sample proxies provided advantages tailored to emerging markets. For example, firms are often organized as diversified conglomerates due to poor development of financial intermediaries which can be reflected in high covariance between firms and industries. They also argue that by using US covariances they can have a forward-looking benchmark as the US is a diversified and internationally integrated market. Sweden has both of those characteristics making it a good benchmark without the need for using the US (Agari, 2024). While in-sample covariances can present endogeneity issues, IPOs are endogenous in and of themselves as they are planned based on market conditions and coordinated with financial institutions which makes it difficult to control. Therefore, it is more interesting to focus on other confounding variables such as industry and year fixed effects.

Another argument given by Braun and Larrain (2009) for using out of sample covariances is that an IPO dramatically changes the market structure which would have implications of the inter industry covariances. Based on this, they claim that in-sample covariances are not a good forward-looking covariance benchmark. We ran a robustness check on the market structure and inter-industry covariances by comparing the average ranking the industries have amongst each other in terms of correlation in our sample period (2005-2022) and in a 5- year historical period (2000-2005). When comparing the means for both correlation rankings, the general market structure of the industries stays constant over time, so we find it reasonable to use in-sample covariances (see Table A1 and Table A2 in the Appendix).

5.4.2 Regression on effect of IPOs on Industry turnover ratio

As aforementioned, turnover ratio has indications for the liquidity of the market and thus, also spillover effects as to returns of assets. As such we also aim to study the effect of IPO covariance with assets and the subsequent turnover ratio of the industry portfolio.

We run the following OLS regression:

$$TURNOVER_{i,t} = a + \sigma_{i,IPO} + \varepsilon_{i,t} \quad (12)$$

Equation 12 follows the same methodology and structure as equation 11. $TURNOVER_{i,t}$ is the dependent variable representing the turnover ratio for industry i for the event window day t. The main explanatory variable and fixed effects are the same as for Equation 12. We should expect to see an increase in turnover when investors are selling their assets to rebalance their portfolios (Braun and Larrain, 2009).

5.5 IPO Size Effect on Industry

According to the CAPM model presented by Merton (1980), the weight of an IPO scales the impact of covariance on the return of a stock. Larger stocks will result in a great price depression as there will be a large change to the portfolio reference. The downward-sloping demand of stocks also show that this effect is amplified by size (Grossman and Stiglitz, 1980).

To investigate the effect of the Size of IPOs on industry returns, we sort the IPOs into 3 groups, small, medium and large based on the two size measures 1) Issuing ratio and 2) Trading value ratio (see table 4 for definition). Since IPO covariance with industries is proxied through IPO industry covariance with the industry portfolio return, we use the size grouping to investigate the combined effect of covariance and size.

As previously defined, we use IPO trading value ratio as the primary measure for industry effects since it illustrates how trading activity within specific industries is affected by the size of an IPO specifically during the listing event. This makes sense for our focus on how IPO size influences industry-level dynamics and market interactions.

5.5.1 Regression Analysis IPO Size Effects on the Industry Return

We run the following OLS regression to investigate the interaction effect of IPO covariance with a given industry and the industry abnormal return:

$$R_{i,t} = \alpha + \alpha_1\sigma_{i,IPO} + \alpha_2 Large + \alpha_3 Medium + \alpha_6 Large \cdot \sigma_{i,IPO} + Medium \cdot \sigma_{i,IPO} + \varepsilon \quad (13)$$

The main dependent variable in equation is $R_{i,t}$, the abnormal return in industry i during the specified event window t, as aforementioned, we use two different measures for abnormal return, excess return and market-adjusted return. The main dependent variables are: the covariance between the IPO industry i, $\sigma_{i,IPO}$. The size groups $Large$ and $Medium$ are dummy variables, and we benchmark using the small group. The size group dummy variables are interacted with the covariance term $\sigma_{i,IPO}$, represented by $Large \cdot \sigma_{i,IPO}$ and $Medium \cdot \sigma_{i,IPO}$ to study the combined effect on industry return. Note that we benchmark against the group small. α represents year-industry fixed effects to control for any industry specific market dynamics. We should see an increased impact of size on turnover as the trading value increases.

5.5.2 Regression Analysis IPO Size Effects on the Industry Turnover ratio

To investigate if the IPO size interaction with the covariance between the IPO and the industry portfolio has any additional effects we use the following regression:

$$TURNOVER_{i,t} = \alpha + \alpha_1 \sigma_{i,IPO} + \alpha_2 Large + \alpha_3 Medium + \alpha_6 Large \cdot \sigma_{i,IPO} + Medium \cdot \sigma_{i,IPO} + \varepsilon \quad (14)$$

The main dependent variable in equation is $TURNOVER_{i,t}$, the turnover ratio in industry i during the specified event window t, The main dependent variables are: the covariance between the IPO industry i, $\sigma_{i,IPO}$. The size groups $Large$ and $Medium$ are dummy variables, and we benchmark using the small group. The size group dummy variables are interacted with the covariance term $\sigma_{i,IPO}$, represented by $Large \cdot \sigma_{i,IPO}$ and $Medium \cdot \sigma_{i,IPO}$ to study the combined effect on industry return. According to the theory we should expect to see an increased impact on return by size. α represents year-industry fixed effects to control for any industry specific market dynamics.

6 Empirical results

6.1 Summary statistics Market Turnover and Market Return

Table 5: Summary Statistics for Market Return and Turnover Ratio for Event Window

Table 5 presents the summary statistics for the da§ily market return and market turnover ratio of our value-weighted portfolio of companies listed on the Stockholm Stock Exchange during our sample period 2005-2022 over the event window. Event window variables are defined as: PREO (pre-offering period, one and two business days before the subscription to the IPO commends), OD (offering date, defined as the date subscriptions are available for investors), POSTO (post-offering date, two and one business days after the date in which subscription to the IPO is made available for investors) PREL (pre-listing period defined as two and one business days before the IPO company gets listed on the stock exchange), LD (listing date, the date in which the IPO company lists on the stock exchange) and POSTL (post-listing date defined as one and two business days after the IPO company gets listed on the stock exchange). Market turnover ratio is the market trading value divided by the total market capitalization (tradable shares). Market turnover ratio is winsorized at the 1% and 99% levels. IPO firms are excluded in the calculator of these measures. The market turnover ratio values are percentages. Market return is calculated based on closing value less previous trading day closing value. (datasource: FinBas)

	Market Return					Market Turnover Ratio				
Variable	Average Market Return	Median Market Return	Min	Max	N	Average Turnover	Median Turnover	Min	Max	N
PREO	0.0538	0.1119	-2.4707	2.8178	258	0.0047	0.0038	0.0015	0.0242	258
OD	0.0360	0.1331	-2.7259	2.0353	138	0.0048	0.0039	0.0018	0.0220	138
POSTO	-0.0107	0.0096	-2.7705	2.5242	252	0.0049	0.0038	0.0012	0.0237	252
PREL	-0.0339	0.0058	-2.7259	2.0353	257	0.0047	0.0038	0.0017	0.0229	257
LD	0.0367	0.0401	-2.6507	1.7290	139	0.0047	0.0038	0.0018	0.0220	139
POSTL	-0.0463	-0.0095	-3.0891	2.5242	250	0.0048	0.0039	0.0012	0.0237	250
ordinary1	0.0869	0.1282	-10.9205	9.4587	4,052	0.0077	0.0054	0.0001	0.0509	4,052
ordinary2	0.0936	0.1309	-10.9205	9.4587	3,668	0.0080	0.0057	0.0001	0.0509	3,668

The summary statistics in Table 5 show that on average the market turnover ratio does not change indicating no significant effect of IPOs on the liquidity levels. However, it can be observed that on average, the market return is negative during the post-offering period, pre-listing period and post-listing period and is on average positive for the pre-offering period, offering day and listing day it should also be noted that the relative size is smaller than during the ordinary days (indicated by ordinary and ordinary2) (see Table 1 for definitions). While the average effects do not infer any causality, it shows anecdotal evidence that the market is affected by the event of an IPO.

6.2 Effect of IPOs on Market Return

Table 6: IPO Effect on the Market Return

Table 6 reports the following GARCH-in-mean regression:

$$MR_t = \alpha_0 + \alpha_1 MR_{t-1} + \alpha_2\, PREO + \alpha_3 OD + \alpha_4 POSTO + +\alpha_5 PREL + \alpha_6 LD + \alpha_7 POSTL + \alpha_8 h_t + \alpha_9 YEAR + \varepsilon_t \quad (7)$$
$$h_t = \beta_0 + \beta_1 h_{t-1} + \beta_2 \varepsilon_{t-1}^2$$

where MR_t is the market return on day *t* and h_t is the variance of the error term ε_t based on the information set φ at time t − 1 and is modeled following ARMA (1,1) process which is a proxy for time-varying market risk. A lag return term MR_{t-1} is added to the mean equation to take away any first-order serial correlation amongst the following dummy variable: . Event window variables are defined as: PREO (pre-offering period, one and two business days before the subscription to the IPO commends), OD (offering date, defined as the date subscriptions are available for investors), POSTO (post-offering date, two and one business days after the date in which subscription to the IPO is made available for investors) PREL (pre-listing period defined as two and one business days before the IPO company gets listed on the stock exchange), LD (listing date, the date in which the IPO company lists on the stock exchange) and POSTL (post-listing date defined as one and two business days after the IPO company gets listed on the stock exchange) and ε_t is the residual. Additionally,

we include a year dummy, $YEAR$ to control for any time varying factors across our sample. Coefficients represents percentage point change in the dependent variable and standard errors are reported in brackets. (datasources: Finbas and Refinitiv Eikon)

	Dependent variable:
	Market Return
MRt_1	-0.014
	(0.015)
PREO	0.120
	(0.114)
OD	0.137
	(0.148)
POSTO	0.036
	(0.131)
PREL	-0.247
	(0.133)
LD	-0.072
	(0.144)
POSTL	-0.157
	(0.113)
ht	0.036**
	(0.011)
Year Fixed Effects	Yes
Observations	4,271
R^2	0.008
Adjusted R^2	0.002
Note:	(*)p < 0.05 (**)p < 0.01 (***)p < 0.001

We do not find a statistically significant effect that an IPO impacts market returns as seen in Table 6. Neither α_2 (pre-offering period) or α_3 (offering day) have a negative coefficient which would imply that there is no depression of market returns but we cannot be certain as there is no statistical significance. The coefficients for α_5 (pre-listing period) and α_6 (listing day) are both negative but the coefficient for post-listing date is not positive. This would imply that we do see prices depress at listing, supporting that investors sell their holdings to collect funds to subscribe to an IPO but do not re-purchase the previously sold shares after the IPO is listed which would contradict the transitory price pressure hypothesis (Harris and Gurel, 1986). These results also contradict, Shi et.al's (2018) findings where they observe that IPOs have a significant depressive effect on market return on both the pre-listing period and listing day. They show that this effect is transitory as the market return rebounds on the post-listing day providing support for a transitory effect and the price pressure theory.

Table 7: IPO Size Effect on Market Return

Table 7 reports the following OLS regression:

$$MR_t = \alpha_0 + \alpha_1 SIZE_{IPO} + YEAR + \varepsilon_t \quad (9)$$

Where the main dependent variable is MR_t, the market return on event window date t, $SIZE_{IPO}$ is one of the two size measures: 1) IPO Issuing Ratio defined as IPO proceeds divided by the market trading value on the IPO listing date and 2) IPO Trading Value ratio defined as the IPO trading value on listing day divided by the market trading value on the listing day. Additionally, we control for time-varying effects through a year dummy $YEAR$. We run separate regressions for each event window variable t. Coefficients represent percentage point change and the standard errors are reported in brackets. (datasources: Finbas and Refinitiv Eikon)

	Dependent variable:											
	Market Return											
	PREO	OD	POSTO	PREL	LD	POSTL	PREO	OD	POSTO	PREL	LD	POSTL
IPO Issuing Ratio	-0.013*	-0.006	-0.002	-0.009	-0.005	0.002						

	(0.006)	(0.008)	(0.006)	(0.005)	(0.008)	(0.006)						
IPO Trading Value Ratio							-0.015	-0.021	-0.027	-0.026	-0.005	-0.016
							(0.023)	(0.030)	(0.023)	(0.020)	(0.031)	(0.024)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	262	131	256	262	131	249	262	131	256	262	131	249
R^2	0.069	0.135	0.100	0.136	0.029	0.109	0.051	0.135	0.105	0.131	0.025	0.110
Adjusted R^2	0.016	0.031	0.048	0.087	-0.089	0.056	-0.003	0.030	0.053	0.082	-0.092	0.057
Note:												$^{(*)}p < 0.05$ $^{(**)}p < 0.01$ $^{(***)}p < 0.001$

Table 7 shows that the IPO issuing ratio as a size measure has a significant depressive effect of 0.013 on the market return on the pre-offering period. IPOs in themselves did not yield an effect on market return as shown in Table 6 which implies that an IPO must be even larger than the defined threshold to be able to impact returns. It is also worth noting that while not statistically significant, the return remains negative until the post-listing date when it turns positive. This indicates that there may be support for the price pressure hypothesis somewhere in the market (Harris and Gurel, 1986). More realistically, this is currently pointing towards a portfolio rebalancing hypothesis as we see a significant permanent return. Furthermore, because there is a significant depressive effect on the pre-offering period as opposed to pre-listing period, it indicates that investors sell their assets before it is offered to likely subscribe before the IPO is listed.

6.3 Effect of IPOs on Market Turnover Ratio

Table 8: IPO Effect on Market Turnover Ratio

Table 8 reports the following OLS regression:

$$TURNOVER_t = \alpha_0 + \alpha_1 TURNOVER_{t-1} + \alpha_2 PREO + \alpha_3 OD + \alpha_4 POSTO + \alpha_5 PREL + \alpha_6 LD + \alpha_7 POSTL + YEAR + \varepsilon_t \quad (8)$$

Where $TURNOVER_t$ is the main dependent variable representing the market turnover ratio defined as market trading value divided by market capitalization for each event window variable t. Event window variables are defined as: PREO (pre-offering period, one and two business days before the subscription to the IPO commends), OD (offering date, defined as the date subscriptions are available for investors), POSTO (post-offering date, two and one business days after the date in which subscription to the IPO is made available for investors) PREL (pre-listing period defined as two and one business days before the IPO company gets listed on the stock exchange), LD (listing date, the date in which the IPO company lists on the stock exchange) and POSTL (post-listing date defined as one and two business days after the IPO company gets listed on the stock exchange). $TURNOVER_{t-1}$ represents a lagged variable for market turnover. Additionally, we control for time-varying effects year-fixed effects represented by $YEAR$. Market turnover ratio is winzorised at the 1% and 99% level. Coefficients represent percentage point change and standard errors are reported in brackets. (datasources: FinBas, Refinitiv Eikon)

	Dependent variable:
	Turnover Ratio
TURNOVERt_1	0.599^{***}
	(0.012)
PREO	-0.017
	(0.020)
OD	0.028
	(0.026)
POSTO	0.012
	(0.023)
PREL	-0.004
	(0.024)
LD	-0.017
	(0.026)

POSTL	-0.009
	(0.020)
Year Fixed Effects	Yes
Observations	4,271
R^2	0.853
Adjusted R^2	0.853
Note:	$^{(*)}p < 0.05$ $^{(**)}p < 0.01$ $^{(***)}p < 0.001$

We find no significant results that IPO impacts turnover during the event window as seen in Table 8. If we look at the signs of the coefficients, we can see that turnover is negative on pre-offering and then positive on the offering day. This means that investors are selling their assets on the day of the offering and then continuing to do so during the post-offering period (Shi.et.al., 2018). After that, the coefficient stays negative meaning that trading activity does not increase during the listing period. While this is not significant, it would indicate that most subscription is happening during the offering day rather than listing.

Table 9: IPO Size Effect on Market Turnover Ratio

Table 9 reports the following OLS regression:

$$TURNOVER_t = \alpha_0 + \alpha_1 SIZE_{IPO} + YEAR + \varepsilon_t \quad (10)$$

Where $TURNOVER_t$ is the main dependent variable representing the market turnover ratio defined as market trading value divided by market capitalization for each event window variable t. Event window variables are defined as: PREO (pre-offering period, one and two business days before the subscription to the IPO commends), OD (offering date, defined as the date subscriptions are available for investors), POSTO (post-offering date, two and one business days after the date in which subscription to the IPO is made available for investors) PREL (pre-listing period defined as two and one business days before the IPO company gets listed on the stock exchange), LD (listing date, the date in which the IPO company lists on the stock exchange) and POSTL (post-listing date defined as one and two business days after the IPO company gets listed on the stock exchange). The main dependent variable is $SIZE_{IPO}$ representing two different measures of IPO size, IPO Issuing Ratio defined as IPO proceeds divided by the market trading value on the IPO listing date for the n number of IPOs in our sample and IPO Trading Value ratio defined as the IPO trading value on listing day divided by the market trading value on the listing day for the n number of IPOs in our sample. Additionally, we control for time-varying effects through a year dummy $YEAR$. We run separate regressions for each event window variable t. Coefficients represent percentage point change and standard errors are reported in brackets. (Datasources: Finbas, Refinitiv Eikon)

	Dependent variable:											
	Turnover Ratio											
	PREO	OD	POSTO	PREL	LD	POSTL	PREO	OD	POSTO	PREL	LD	POSTL
IPO issuing ratio	-0.001	-0.0005	-0.002	-0.001	-0.0005	-0.002						
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)						
IPO trading value							0.001	0.005	-0.002	0.001	0.005	-0.002
							(0.004)	(0.006)	(0.004)	(0.004)	(0.006)	(0.004)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	262	131	256	262	131	256	262	131	256	262	131	256
R^2	0.843	0.859	0.893	0.843	0.859	0.893	0.843	0.860	0.892	0.843	0.860	0.892
Adjusted R^2	0.834	0.842	0.887	0.834	0.842	0.887	0.834	0.844	0.886	0.834	0.844	0.886
Note:												$^{(*)}p < 0.05$ $^{(**)}p < 0.01$ $^{(***)}p < 0.001$

The issuing ratio in Table 9 shows that size of an IPO has no significant effect on market turnover during the entire even window. However, when looking at the trading ratio we can see that while it is not significant, the turnover increase on the pre-offering and offering date and well as the pre-listing and listing date. This indicates that investors are selling existing assets and subscribing to the IPO both when the IPO is first offered and then when it is traded.

6.4 Effect of IPO Covariance and Industry Returns

Table 10: IPO Covariance Effect on Industry Abnormal Return

Table 10 reports the regression results of the following OLS regression:

$$R_{i,t} = \alpha + \sigma_{i,IPO} + \varepsilon_{i,t} \quad (11)$$

Where $R_{i,t}$ is the abnormal return in industry i during the event t. The events are defined as PREO (pre-offering period, one and two business days before the subscription of the IPO commends, OD (offering date, the date in which subscription to the IPO commends), POSTO (post-offering period, one and two business days after the subscription period commends), PREL (pre-listing period, one and two business days before the initial listing of the IPO on the stock exchange), LD (listing date in which the IPO gets listed on the stock exchange) and POSTO (post-listing period, one and two business days after the initial listing of the IPO on the stock exchange). We use two different measures of abnormal return, Excess return defined as industry return less the risk-free rate (proxied by the one-month Swedish T-bill) and Market-adjusted return defined as the industry return less the market return. We run separate regressions for each t for both measures of abnormal return. The main independent variable is $\sigma_{i,IPO}$, representing the covariance between the IPO industry and the industry portfolio i. Industry portfolios are value-weighted portfolios of companies listed on the Stockholm Stock Exchange sorted based on TRBC Economic Sector codes. Coefficients represent percentage point change and standard errors are reported in brackets. (datasources: FinBas, Refinitiv Eikon and Riksbanken Arkiv)

	Dependent variable $R_{i,t}$:											
	Excess return						Market-adjusted return					
	PREO	OD	POSTO	PREL	LD	POSTL	PREO	OD	POSTO	PREL	LD	POSTL
Covariance	0.052	0.069	-0.088	0.098	-0.332***	0.113	0.051	0.169	-0.145	0.125	-0.538***	0.171
	(0.047)	(0.097)	(0.070)	(0.064)	(0.089)	(0.078)	(0.062)	(0.123)	(0.091)	(0.083)	(0.118)	(0.101)
Industry-Year Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,080	1,540	2,981	3,080	1,529	2,926	3,080	1,540	2,981	3,080	1,529	2,926
R^2	0.0004	0.166	0.098	0.093	0.158	0.118	0.0002	0.147	0.063	0.078	0.091	0.082
Adjusted R^2	0.0001	0.073	0.049	0.045	0.064	0.069	-0.0001	0.052	0.012	0.030	-0.010	0.031

Note: $^{(*)}p < 0.05$ $^{(**)}p < 0.01$ $^{(***)}p < 0.001$

We observe that IPOs have a significant effect on industry returns on the listing day. During 2005-2022, we find that an IPO reduces excess return by 0.33 percentage points and market adjusted return by 0.54 percentage points on average at the 1% significance level. This means that a one- standard-deviation increase in the IPO covariance makes market adjusted return fall by 0.54 percentage points. The impact of IPOs on industry return exhibits a relatively higher level of statistical significance, suggesting a stronger association with the IPO compared to the market return. While the return on the post-listing period is positive, it is not significant. As such, a depression of return on the listing day without a rebound supports a portfolio rebalancing story where investors sell substitutable holding to subscribe to the IPO (Shi.et.al., 2018).

Braun and Larrain (2009) find that one standard deviation increase in IPO covariance results in a 0.40% fall in market adjusted returns in their sample of 254 IPOs in 22 different emerging markets during 1989-2002. We find a bigger effect size at 0.54 percentage points due to various reasons. Firstly, our study is done using data from a different period, 2005-2022 and stock market participation in Sweden has increased over those years which means more investors can implement an arbitrage strategy which in turn has a bigger impact on returns. Furthermore, as Sweden has previously experienced great IPO activity and is one of the most developed markets in Europe, investors are likely more sophisticated than emerging markets and therefore can extract more value from their arbitrage trades resulting in greater market effect. From a more practical standpoint, there are also differences in methodology, specifically industry definitions. We use Eikon definitions for defining the industry whereas Braun and Larrain use Fama French definitions and this can impact industry composition and response to IPOs. Braun

and Larrain also find that moving one place closer to the IPO in ranking makes prices fall by 5.9 percentage points.

Table 11: IPO Size Effect Industry Abnormal Return Based on Trading Value Ratio

Table 11 reports the following OLS regression:

$$R_{i,t} = \alpha + \alpha_1\sigma_{i,IPO} + \alpha_2 Large + \alpha_3 Medium + \alpha_6 Large \cdot \sigma_{i,IPO} + Medium \cdot \sigma_{i,IPO} + \varepsilon \ (13)$$

Where $R_{i,t}$ is the abnormal return in industry i during the event t. The events are defined as PREO (pre-offering period, one and two business days before the subscription of the IPO commends, OD (offering date, the date in which subscription to the IPO commends), POSTO (post-offering period, one and two business days after the subscription period commends), PREL (pre-listing period, one and two business days before the initial listing of the IPO on the stock exchange), LD (listing date in which the IPO gets listed on the stock exchange) and POSTO (post-listing period, one and two business days after the initial listing of the IPO on the stock exchange). We use two different measures of abnormal return, Excess return defined as industry return less the risk-free rate (proxied by the one-month Swedish T-bill) and Market-adjusted return defined as the industry return less the market return. We run separate regressions for each t for both measures of abnormal return. The main independent variable is $\sigma_{i,IPO}$, representing the covariance between the IPO industry and the industry portfolio i. Industry portfolios are value-weighted portfolios of companies listed on the Stockholm Stock Exchange sorted based on TRBC Economic Sector codes. $Large$ and $Medium$ represent dummy variables where IPOs are sorted into 3 groups: small, medium and large based on the trading value ratio (defined as trading value of IPO on LD divided by the trading value of the market on LD). The interaction effect of covariance between the IPO and the industry and the size of the IPO is represented by the interaction terms $Large \cdot \sigma_{i,IPO}$ and $Medium \cdot \sigma_{i,IPO}$. Coefficients are percentage point changes and standard errors are reported in brackets. (datasources: FinBas, Refinitiv Eikon, Riksbanken)

	Dependent variable:											
	Excess return						Market-adjusted return					
	PREO	OD	POSTO	PREL	LD	POSTL	PREO	OD	POSTO	PREL	LD	POSTL
Covariance	-0.005	0.290*	-0.075	0.051	-0.255*	0.148	-0.059	0.491**	-0.060	0.091	-0.433*	0.276
	(0.094)	(0.144)	(0.101)	(0.093)	(0.129)	(0.112)	(0.125)	(0.184)	(0.127)	(0.119)	(0.169)	(0.141)
Covariance-Medium	-0.213	-0.146	-0.029	-0.005	-0.098	-0.037	-0.297*	-0.318	-0.072	-0.054	-0.210	-0.100
	(0.113)	(0.174)	(0.121)	(0.112)	(0.156)	(0.135)	(0.151)	(0.223)	(0.153)	(0.144)	(0.203)	(0.170)
Covariance-Large	-0.354**	-0.426*	-0.033	-0.261*	-0.042	-0.087	-0.675***	-0.471	-0.224	-0.414*	-0.160	-0.239
	(0.129)	(0.199)	(0.140)	(0.128)	(0.178)	(0.158)	(0.172)	(0.254)	(0.177)	(0.164)	(0.232)	(0.198)
Industry-Year Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,706	1,353	2,618	2,706	1,342	2,552	2,706	1,353	2,618	2,706	1,342	2,552
R^2	0.099	0.206	0.137	0.126	0.207	0.151	0.074	0.174	0.096	0.117	0.117	0.114
Adjusted R^2	0.043	0.101	0.082	0.072	0.102	0.095	0.016	0.065	0.038	0.062	-0.001	0.055

Note: $^{(*)}p < 0.05$ $^{(**)}p < 0.01$ $^{(***)}p < 0.001$

Table 12: IPO Size Effect Industry Abnormal Return Based on Issuing Ratio

Table 12 reports the following OLS regression:

$$R_{i,t} = \alpha + \alpha_1\sigma_{i,IPO} + \alpha_2 Large + \alpha_3 Medium + \alpha_6 Large \cdot \sigma_{i,IPO} + Medium \cdot \sigma_{i,IPO} + \varepsilon \ (13)$$

Where $R_{i,t}$ is the abnormal return in industry i during the event t. The events are defined as PREO (pre-offering period, one and two business days before the subscription of the IPO commends, OD (offering date, the date in which subscription to the IPO commends), POSTO (post-offering period, one and two business days after the subscription period commends), PREL (pre-listing period, one and two business days before the initial listing of the IPO on the stock exchange), LD (listing date in which the IPO gets listed on the stock exchange) and POSTO (post-listing period, one and two business days after the initial listing of the IPO on the stock exchange). We use two different measures of abnormal return, Excess return defined as industry return less the risk-free rate (proxied by the one-month Swedish T-bill) and Market-adjusted return defined as the industry return less the market return. We run separate regressions for each t for both measures of abnormal return. The main independent variable is $\sigma_{i,IPO}$, representing the covariance between the IPO industry and the industry portfolio i. Industry portfolios are value-weighted portfolios of companies listed on the Stockholm Stock Exchange sorted based on TRBC Economic Sector codes. $Large$ and $Medium$ represent dummy variables where IPOs are sorted into 3 groups: small, medium and large based on the issuing ratio (defined as issuing proceeds of IPOs divided by the market trading value during listing date of the IPO). The interaction effect of IPO covariance with the industry I and IPO size is represented by the interaction terms $Large \cdot \sigma_{i,IPO}$ and $Medium \cdot \sigma_{i,IPO}$. Coefficients are percentage point changes and standard errors are reported in brackets. (datasources: FinBas, Refinitiv Eikon, Riksbanken)

	Dependent variable:											
	Excess return						Market-adjusted return					
	PREO	OD	POSTO	PREL	LD	POSTL	PREO	OD	POSTO	PREL	LD	POSTL
Covariance	-0.159	0.157	-0.122	-0.003	-0.324*	0.117	-0.226	0.314	-0.217	0.062	-0.509*	0.064
	(0.115)	(0.177)	(0.123)	(0.114)	(0.158)	(0.137)	(0.153)	(0.226)	(0.156)	(0.146)	(0.207)	(0.173)
Covariance-Medium	0.108	-0.043	0.139	0.087	0.184	0.021	0.090	-0.177	0.252	0.026	0.147	0.209
	(0.128)	(0.197)	(0.137)	(0.127)	(0.176)	(0.152)	(0.170)	(0.252)	(0.173)	(0.163)	(0.229)	(0.192)
Covariance-Large	-0.117	-0.086	-0.105	-0.133	-0.165	-0.060	-0.347	-0.057	-0.145	-0.304	-0.327	0.043
	(0.138)	(0.214)	(0.149)	(0.138)	(0.191)	(0.168)	(0.185)	(0.273)	(0.189)	(0.177)	(0.249)	(0.212)
Industry-Year Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,706	1,353	2,618	2,706	1,342	2,552	2,706	1,353	2,618	2,706	1,342	2,552
R^2	0.102	0.206	0.138	0.127	0.211	0.150	0.081	0.175	0.095	0.119	0.121	0.111
Adjusted R^2	0.047	0.101	0.083	0.072	0.105	0.094	0.024	0.066	0.037	0.064	0.003	0.052
Note:												$^{(*)}p < 0.05$ $^{(**)}p < 0.01$ $^{(***)}p < 0.001$

Table 11 shows that when covariance is isolated there is a positive effect on the offering day and a negative effect on the listing day on both the excess return and the market-adjusted return. For excess return, there is a positive effect of 0.29 percentage points on the offering day and a depressive effect of 0.26 percentage points of the listing day. The absolute effect on the market-adjusted return is larger with a positive effect of 0.49 percentage points on the offering day and a depressive effect of 0.43 percentage points on the listing day. An industry appreciation on the offering day of the IPO could be a signal of positive market sentiment. If investors perceive the industry associated with the IPO favorably, they may demonstrate enthusiasm and optimism by bidding up the prices of stocks within that industry on the offering day. A depression of prices on the listing day is the same effect we see in Table 10 and follows the portfolio rebalancing hypothesis. The interaction term between covariance and IPO size captures the combined effect of both variables on return. It represents how the relationship between covariance and the return changes as IPO size varies. Also, it is important to note that the size is relative to small, meaning it represents the additional effect of covariance on the industry return for large companies compared to small companies. Medium IPOs when interacted with covariance have a significant depressive average return of 0.3 percentage points on the pre-offering period of market-adjusted returns. A depressive effect on the pre-offering period indicates that investors sell their assets to raise funds to subscribe to the IPO before it is listed. When interacting the large IPO with covariance we can see that there are significant effects on multiple periods when compared to small companies. There is a significant depressive effect on pre-offering, offering, and listing period for both excess return and on pre-offering and pre-listing for market-adjusted return. The largest depressive effect occurs on the pre-listing period for the market-adjusted return at0.68 percentage points. This effect is much larger than other effects in absolute terms which indicates that a larger proportion of existing assets are sold before the IPO is offered compared to before it is going to trade on the market. The size interacted with the covariance of the IPO does not influence the listing day which implies that all IPOs regardless of size depress returns.

The results of the issuing ratio in Table 12 provide additional evidence that IPOs have a depressive effect on industry return on the listing day for both excess return and market-adjusted return for the listing day. For excess return there is a depressive effect of 0.32 percentage points and for market-adjusted return a depressive effect of 0.51 percentage points.

6.5 Effect of IPOs on Industry Turnover

Table 13: IPO Covariance Effect on Industry Turnover Ratio

Table 13 reports the following OLS regression:

$$TURNOVER_{i,t} = a + \sigma_{i,IPO} + \varepsilon_{i,t} \quad (12)$$

Where $TURNOVER_{i,t}$ is the market turnover ratio defined as market trading value divided by market capitalization in industry i during the event t. The events are defined as PREO (pre-offering period, one and two business days before the subscription of the IPO commends, OD (offering date, the date in which subscription to the IPO commends), POSTO (post-offering period, one and two business days after the subscription period commends), PREL (pre-listing period, one and two business days before the initial listing of the IPO on the stock exchange), LD (listing date in which the IPO gets listed on the stock exchange) and POSTO (post-listing period, one and two business days after the initial listing of the IPO on the stock exchange). We run separate regressions for each t for both measures of abnormal return. The main independent variable is $\sigma_{i,IPO}$, representing the covariance between the IPO industry and the industry portfolio i. Industry portfolios are value-weighted portfolios of companies listed on the Stockholm Stock Exchange sorted based on TRBC Economic Sector codes. Coefficients represent percentage point change and standard errors are reported in brackets. (datasources: FinBas, Refinitiv Eikon and Riksbanken Arkiv)

	Dependent variable:					
	Turnover ratio					
	PREO	OD	POSTO	PREL	LD	POSTL
Covariance	-0.035	-0.067	-0.103	-0.062	-0.072	-0.147
	(0.096)	(0.133)	(0.121)	(0.123)	(0.163)	(0.172)
Industry-Year Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,069	1,535	2,973	3,070	1,523	2,921
R^2	0.529	0.515	0.488	0.457	0.591	0.392
Adjusted R^2	0.504	0.460	0.460	0.428	0.545	0.358

Note: $^{(*)}p < 0.05$ $^{(**)}p < 0.01$ $^{(***)}p < 0.001$

While the turnover is not statistically significant, it is negative for the entire IPO period as seen in Table 13 which means that it does not increase during portfolio rebalancing. This means that while IPOs do affect industry returns, it does not translate into an effect on the turnover. The same pattern is visible in Table 14 when using trading value ratio as a size proxy. When looking at the supplementary size measure of issuing ratio in Table 15, we can see that the sign for offering date and listing date are both positive. This is in line with theory as investors are either selling existing assets to collect funds to subscribe on the offering date or collect funds to buy shares on the listing date (Braun and Larrain, 2018).

Table 14: IPO Size Effect on Industry Turnover Ratio Based on Trading Value Ratio

Table 14 reports the results from the following OLS regression:

$$TURNOVER_{i,t} = \alpha + \alpha_1\sigma_{i,IPO} + \alpha_2 Large + \alpha_3 Medium + \alpha_6 Large \cdot \sigma_{i,IPO} + Medium \cdot \sigma_{i,IPO} + \varepsilon \quad (14)$$

Where $TURNOVER_{i,t}$ is the turnover ratio of industry portfolio i during the event t. The events are defined as PREO (pre-offering period, one and two business days before the subscription of the IPO commends, OD (offering date, the date in which subscription to the IPO commends), POSTO (post-offering period, one and two business days after the subscription period commends), PREL (pre-listing period, one and two business days before the initial listing of the IPO on the stock exchange), LD (listing date in which the IPO gets listed on the stock exchange) and POSTO (post-listing period, one and two business days after the initial listing of the IPO on the stock exchange). The main independent variable is $\sigma_{i,IPO}$, representing the covariance between the IPO industry and the industry portfolio i. Industry portfolios are value-weighted portfolios of companies listed on the Stockholm Stock Exchange sorted based on TRBC Economic Sector codes. $Large$ and $Medium$ represent dummy variables where IPOs are sorted into 3 groups: small, medium and large based on the trading value ratio (defined as trading value of the IPO during the LD divided by the market trading value during LD). The interaction effect of IPO covariance with the industry I and IPO size is represented by the interaction terms $Large \cdot \sigma_{i,IPO}$ and $Medium \cdot \sigma_{i,IPO}$. Coefficients are percentage point changes and standard errors are reported in brackets. (datasources: FinBas, Refinitiv Eikon, Riksbanken)

	Dependent variable:
	Turnover ratio

	PREO	OD	POSTO	PREL	LD	POSTL
Covariance	-0.001	-0.135	-0.067	-0.009	-0.069	-0.178
	(0.163)	(0.212)	(0.204)	(0.173)	(0.258)	(0.176)
Medium TV	0.164	-0.015	0.387	0.113	0.559	-0.118
	(0.322)	(0.418)	(0.402)	(0.341)	(0.510)	(0.347)
Large TV	0.168	-0.073	-0.541	0.327	-0.699	-0.645
	(0.366)	(0.477)	(0.467)	(0.388)	(0.585)	(0.404)
Covariance-Medium TV	-0.104	0.016	-0.276	-0.066	-0.312	-0.050
	(0.197)	(0.256)	(0.246)	(0.209)	(0.311)	(0.213)
Covariance-Large TV	-0.086	0.062	0.183	-0.163	0.372	0.218
	(0.225)	(0.293)	(0.285)	(0.238)	(0.357)	(0.248)
Industry-Year Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,692	1,347	2,608	2,694	1,334	2,546
R^2	0.489	0.557	0.492	0.448	0.643	0.453
Adjusted R^2	0.457	0.498	0.459	0.414	0.595	0.417
Note:						$^{(*)}p < 0.05$ $^{(**)}p < 0.01$ $^{(***)}p < 0.001$

Table 15: IPO Size Effect on Industry Turnover Ratio Based on Issuing Ratio

Table 15 reports the results from the following OLS regression:

$$TURNOVER_{i,t} = \alpha + \alpha_1\sigma_{i,IPO} + \alpha_2 Large + \alpha_3 Medium + \alpha_6 Large \cdot \sigma_{i,IPO} + Medium \cdot \sigma_{i,IPO} + \varepsilon \quad (14)$$

Where $TURNOVER_{i,t}$ is the turnover ratio of industry portfolio i during the event t. The events are defined as PREO (pre-offering period, one and two business days before the subscription of the IPO commends, OD (offering date, the date in which subscription to the IPO commends), POSTO (post-offering period, one and two business days after the subscription period commends), PREL (pre-listing period, one and two business days before the initial listing of the IPO on the stock exchange), LD (listing date in which the IPO gets listed on the stock exchange) and POSTO (post-listing period, one and two business days after the initial listing of the IPO on the stock exchange). The main independent variable is $\sigma_{i,IPO}$, representing the covariance between the IPO industry and the industry portfolio i. Industry portfolios are value-weighted portfolios of companies listed on the Stockholm Stock Exchange sorted based on TRBC Economic Sector codes. $Large$ and $Medium$ represent dummy variables where IPOs are sorted into 3 groups: small, medium and large based on the issuing ratio (defined as the total IPO proceeds of an IPO divided by the market trading value during LD). The interaction effect of IPO covariance with the industry I and IPO size is represented by the interaction terms $Large \cdot \sigma_{i,IPO}$ and $Medium \cdot \sigma_{i,IPO}$. Coefficients are percentage point changes and standard errors are reported in brackets. (datasources: FinBas, Refinitiv Eikon, Riksbanken)

	Dependent variable:					
	Turnover ratio					
	PREO	OD	POSTO	PREL	LD	POSTL
Covariance	-0.161	0.087	-0.002	-0.105	0.263	-0.305
	(0.200)	(0.260)	(0.251)	(0.212)	(0.317)	(0.215)
Medium IR	-0.650	0.102	-0.123	-0.580	0.667	-0.825*
	(0.348)	(0.453)	(0.437)	(0.369)	(0.554)	(0.374)
Large IR	-0.283	0.479	0.299	0.140	1.167	-0.856*
	(0.375)	(0.487)	(0.476)	(0.397)	(0.597)	(0.411)
Covariance-Medium IR	0.253	-0.171	-0.035	0.232	-0.380	0.266
	(0.223)	(0.290)	(0.279)	(0.236)	(0.353)	(0.239)
Covariance-Large IR	0.079	-0.330	-0.245	-0.090	-0.566	0.274
	(0.242)	(0.314)	(0.304)	(0.256)	(0.383)	(0.263)
Industry-Year Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,692	1,347	2,608	2,694	1,334	2,546
R^2	0.490	0.558	0.491	0.450	0.643	0.455
Adjusted R^2	0.458	0.499	0.458	0.415	0.595	0.419
Note:						$^{(*)}p < 0.05$ $^{(**)}p < 0.01$ $^{(***)}p < 0.001$

7. Discussion

We do not find a causal relationship between IPOs and the market return during the defined event window which contradicts previous literature as Shi.et.al's (2018) finds as a negative causal relationship between IPOs and market return which is further amplified by size on both the offering day and the listing day. A key reason as to why we do not find support for the direct effect is that the presence of zealous speculation in China. This speculation is characterized by oversubscribing to the IPO and is also a driver behind selling stocks which do not covary with the IPO to collect necessary funds. This speculation is also the primary justification that Shi et al. (2018) give behind the effect they find. Furthermore, Wilhelm and Ljungqvist (2003) find that the lock-up period in China is a key driver of market speculation, a concept which is not present in Sweden and therefore points to less speculation than China. Furthermore, the strong investment culture of Sweden (Agari, 2024) coupled with significantly higher financial literacy, supports the notion of Sweden having less speculation (Klapper et.al., 2014). Furthermore, as Sweden is one of the deepest capital markets in Europe (Agari, 2024), consisting of a wide range of assets, the impact of an IPO is reduced. Merton (1980) explains that the introduction of a new stock into the market impacts the market composition and in turn influences risk premiums. As Sweden has a deep capital market, the influence of IPOs on risk premiums reduces resulting in a smaller impact on market prices. Despite not finding a direct causal relationship, we do find a significant effect of -0.013 percentage points on the market return on the pre-offering period when observing the impact of IPO size on market prices. This supports Shi.et.al's hypothesis that a large IPO does result in a depression of market prices through investors getting ready to subscribe to an IPO by selling existing holdings that do not only covary with the IPO on the pre-offering period. This emphasizes the importance of IPO size. It is also important to note that there was no effect on listing day. This could be related to the IPO issuing ratio is significantly greater than the IPO trading value ratio. As such, most investors likely sell their assets to subscribe to an IPO on the offering date.

Naturally, we did not find a reversal effect of market prices like Shi.et.al. (2018). Harris and Gurel (1986) point out that the transitory effect on market prices is attributable to liquidity and/or behavioral effects. We have already established that China may face more behavioral constraints which are evident through the presence of over speculation in the IPO market. China has a unique institutional set up such that funds committed to an IPO are frozen up until near the listing of the IPO. This creates a serious liquidity constraint as investors first need to sell their assets to collect funds and then lock them up. As Avanza clarified, Sweden does not have the same level of market controlling regulations and does not require funds to be committed. Investors only need to have the required funds by a certain date in their bank account to be able to partake in the IPO. As such, we do not find any support for the price pressure hypothesis. There is a possibility that we find a more prevalent effect of IPOs on the market if we use a larger sample size. In this case, our sample size was limited due to data availability and quality issues. As we see an impact of size, it is possible that a sample which consists of a greater number of large IPOs will have a more pronounced effect.

We find robust evidence that the covariance of IPOs has a causal effect on industry returns on the listing date. During our sample period of 2005-2022, we find that an IPO reduces market adjusted return by 0.54 percentage points on average at the 1% significance level. We observe additional support for these findings when studying the relationship between size and IPO. These findings suggest that industries that covary highly with the IPO experience depressed returns due to the increased selling pressure that comes with investors trying to rebalance their portfolios. Barberis and Shleifer (2003) provide a behavioral explanation behind this as they

suggest that investors rebalance their portfolios when new assets enter the market to maintain their exposure to certain styles of assets such as industry in this case. When there is a new IPO, investors sell their existing holdings in that industry to be able to buy the new asset. This results in a portfolio rebalancing effect and the returns of the assets which are sold are depressed. The CAPM model also provides additional insights; as an IPO is introduced into the market, the way assets correlate with each other changes which has an influence on both covariance and expected returns. If the asset covaries highly with the IPO, it will have a higher expected return because of a higher risk premium. As higher covariance results in a higher risk premium, it also results in a decrease in price for that asset. This explains why we see that on the listing date there is an average decrease in industry returns (Merton, 1980).

We do not find a significant effect for any other events in the defined IPO window when studying the direct relationship between covariance and returns likely due to the downward-sloping demand of stocks. Portfolio rebalancing results in a depression of market prices and cannot be corrected due to uncertainty which is a key constraint to arbitrage. This uncertainty is highest at the announcement date and reaches a low on the listing date as investors can be sure of their arbitrage strategy involving short selling stocks with high IPO covariance and buying those with low IPO covariance. As such, investors are likely to delay their strategy up until the listing date and likely why significant effect of covariance on industry return is only present on the listing date. We therefore for constraints on arbitrage. (De Long et al., 1990; Shleifer and Vishny, 1997).

Furthermore, when observing the effect of size interacted with covariance on industry returns, we find that for large IPOs depresses market returns during the pre-offering, offering, pre-listing, and listing period. The most notable effect is that a when a large IPO covaries with an industry on the pre-listing day it depresses industry returns by average of 0.68 percentage points which is much larger than any other effect on industry return. This implies that more investors subscribe to the IPO during the offering period rather than when it is listed. This is also in line with our results on the market effect which show significant during the pre-offering period. The results of size of IPOs expand on what we observe in Table 12 where there is only an effect on the listing day. We believe has to do with the increased information and transparency that follows an IPO of a larger company. Larger IPOs may have more extensive information dissemination and market coverage leading up to the listing day. This could reduce the uncertainty surrounding the IPO which deters investors from implementing their arbitrage strategy and influencing market prices until the listing day (De Long et al., 1990; Shleifer and Vishny, 1997). This increased information could influence trading activity of selling stock that have a high covariance with the IPO on both the day before offering and listing. Furthermore, a larger IPO is likely to be backed by large institutional investors due to their high prevalence in Sweden which further increases comfort of investors (Agari, 2024). Overall, our findings that IPOs result in a permanent depression of industry returns are in line with those of Braun and Larrain (2009).

We do not find an impact of IPOs on turnover which is not in line with either of the papers. An IPO might depress market prices due to increased selling pressure as investors reallocate their portfolios to participate in the IPO. This selling pressure can lead to a temporary imbalance between supply and demand, causing prices to decrease. However, it may not significantly affect turnover because turnover represents the volume of shares traded within a given period, which can remain unaffected by short-term price movements caused by IPOs. Investors may still engage in trading activities for other reasons unrelated to the IPO, maintaining turnover levels despite price fluctuations. Furthermore, the frozen period in China gives a very clear

picture of turnover. The turnover is high before subscribing to the IPO due to high rates of oversubscription but then becomes negative during the frozen period when the funds are locked. Once this period ends, the liquidity constraint alleviates, and investors can buy back their old holdings which again drives up the turnover. Sweden does not have a frozen period and has less speculation which explains the results found on turnover ratio Shi et.al. (2018).

This paper provides support for the downward-sloping demand of stocks and the portfolio rebalancing hypothesis. Our findings suggest that investors rebalance their portfolios when a new asset is introduced into the industry causing a permanent depression of prices which cannot be corrected due to market frictions such as uncertainty. This permanent price effect is seen both on a industry level but also a market level which has not been found before. We do not find evidence supporting the price pressure hypothesis as the industry return does not rebound likely due to a highly financially literate population with high stock market involvement and a lack of a frozen period imposed by the government.

8. Conclusion

This paper studies asset supply shocks in the form of 149 IPOs on the Stockholm Stock Exchange for the years 2005-2022. Previous papers done on this topic by Shi.et.al (2018) and Braun and Larrain (2009) have looked at China and emerging markets respectively. Sweden is a dramatically different geography when it comes to stock market participation (Kaustia et.al., 2023), financial literacy (Klapper et.al., 2014), financial infrastructure and investment culture (Agari, 2024). Through doing this geographical expansion we can study if IPOs can have effects in a relatively developed and internationally well-established market (Svensk Värdepappersmarknad, n.d.). We find that IPOs depress market prices during the pre-offering period and do not experience a rebound once the asset is listed. This is inconsistent with previous literature. Shi.et.al find a price pressure transitory effect where market prices are first depressed during the offering and listing but then rebound once liquidity is restored. A key reason why our results differ is due to the regulatory differences between Sweden and China. Since Sweden does not have a lockup period, there is likely less liquidity constraint in the market. Furthermore, Sweden does not experience the same level of speculation surrounding IPOs as China which impacts subscription. As such, we do not find support for a price pressure story in our findings. We do however note that a larger sample size could yield different results, and this serves as a possible extension for future work within this topic.

As we find a permanent price depression amongst market prices, we subset the market into industries as a next step to explore the portfolio rebalancing hypothesis. To understand the impact of IPOs on industry returns, we focus on IPO industry covariances. We find that an asset supply shock has an inverse relationship with covariance on returns i.e. a positive covariance between an IPO and industry will result in a negative return and the greater the covariance the greater the impact. The industry return is depressed by an average of 0.54 percentage points on the listing day due to increased selling pressure as investors are trying to rebalance their portfolios. We also look at the effect of the size of the IPO on industry returns and find that large IPOs impact depress returns of multiple periods in the IPO window due to the decreased uncertainty. Decreased uncertainty is the alleviation of a friction which allows investors to perform their arbitrage trades earlier and therefore impact a wider range of industry returns. As we find a permanent depression of returns for both the market and the industry and observe frictions to arbitrage which also impact returns, we find support for the downward-sloping demand curve of stocks and the portfolio rebalancing hypothesis.

These findings show that there is a portfolio rebalancing effect in well-established markets (Agari, 2024) with low government interference (Pousette and Tipner, 2023) like Sweden. Markets that exhibit similar characters are likely to find a permanent depressive effective amongst both market prices and industry prices. This is due to the demand of investors being constant and following a downward-sloping demand curve which results in subscribing to an IPO at the expense of existing holdings (Braun and Larrain, 2009).

A possible extension in the empirical analysis of supply shocks on other asset prices would be to isolate IPO waves to observe the effects on return during a single large supply shock. This analysis would offer a deeper understanding of the dynamics driving asset price movements during periods of high IPO activity.

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Appendix

Table A1: Summary Statistics for Correlation Ranking of Different industries (in-sample period)

Table A1 shows the mean, median, max and distribution of the ranking of correlations between industries for the main sample period years 2005-2022. The industry definitions are following TRBC industry sector codes. Correlations are calculated based on the daily excess return in each industry portfolio. Excess return is defined as the daily return in each industry less the risk-free rate (1-month Swedish T-bills). A mean value of 3.14 for Academic and Educational Services means that this industry on average has this ranking amongst the other industries. Correlation ranking is done by normalizing the correlation from 1 to 11 (see appendix for correlation matrix, Table A3). (datasources: FinBas, Refinitiv Eikon, Riksbanken Arkivet)

Measure	Academic & Educational Services	Basic Materials	Consumer Cyclicals	Consumer Non-Cyclicals	Energy	Financials	Healthcare	Industrials	Real Estate	Technology	Utilities
Min	1.04	2.18	2.20	1.00	1.00	2.13	1.81	2.24	1.61	1.93	2.04
Q1	2.25	4.97	4.27	3.25	1.71	4.81	4.28	5.08	4.43	4.22	3.73
Median	2.63	6.45	6.27	3.83	2.13	6.77	6.25	6.97	5.94	6.32	4.79
Mean	3.14	6.23	5.95	3.99	2.67	6.28	5.64	6.56	5.68	5.77	5.01
Q3	2.72	7.42	7.10	3.99	2.19	7.47	6.36	8.11	6.61	6.84	5.86
Max	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00

Table A2: Summary Statistics Ranked Correlations for Correlation Ranking of Different industries (out-of-sample period)

Table A2 shows the mean, media, max and distribution of the ranking of correlations for the main sample period years 2000-2005. The industry definitions are following TRBC industry sector codes . Correlations are calculated based on the daily excess return in each industry portfolio. Excess return is defined as the daily return in each industry less the risk-free rate (1-month Swedish T-bills). A mean value of 2.24 for Academic and Educational Services means that this industry on average has this ranking amongst the other industries. Correlation ranking is done by normalizing the correlation from 1 to 11 (see appendix for correlation matrix, Table A3). (datasources: FinBas, Refinitiv Eikon, Riksbanken Arkivet)

Measure	Academic & Educational Services	Basic Materials	Consumer Cyclicals	Consumer Non-Cyclicals	Energy	Financials	Healthcare	Industrials	Real Estate	Technology	Utilities
Min	1.00	1.30	1.33	1.31	1.27	1.38	1.09	1.58	1.27	1.37	1.00
Q1	1.30	3.19	2.59	2.09	1.34	3.05	2.49	3.23	2.44	2.77	2.10
Median	1.37	4.93	4.92	2.82	1.47	5.12	4.33	5.50	3.19	4.33	2.60
Mean	2.24	5.17	4.78	3.30	2.44	5.36	4.34	5.46	3.65	4.94	3.16
Q3	1.54	6.87	6.33	3.23	1.91	7.40	5.03	7.46	3.90	6.64	3.01
Max	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00

Table A3: Correlation Matrix Between Industries for the Sample Period

Table A3 present the correlation matrix between the industry portfolios created based on the Stockholm Stock Exchange, categorized based on TRBC Economic sector codes. Correlation is calculated based on industry excess return where excess return is defined as the industry return less the risk-free rate (proxied by the Swedish 1-month T-bill.

Industry	Academic & Educational Services	Basic Materials	Consumer Cyclicals	Consumer Non-Cyclicals	Energy	Financials	Healthcare	Industrials	Real Estate	Technology	Utilities
Academic & Educational Services	1.000	0.218	0.222	0.151	0.070	0.207	0.227	0.226	0.234	0.202	0.163
Basic Materials	0.218	1.000	0.632	0.347	0.176	0.700	0.571	0.760	0.575	0.592	0.527
Consumer Cyclicals	0.222	0.632	1.000	0.311	0.178	0.640	0.556	0.700	0.558	0.582	0.432
Consumer Non-Cyclicals	0.151	0.347	0.311	1.000	0.066	0.330	0.344	0.333	0.358	0.314	0.241
Energy	0.070	0.176	0.178	0.066	1.000	0.172	0.142	0.182	0.123	0.153	0.176
Financials	0.207	0.700	0.640	0.330	0.172	1.000	0.560	0.791	0.605	0.631	0.513
Healthcare	0.227	0.571	0.556	0.344	0.142	0.560	1.000	0.607	0.527	0.563	0.401
Industrials	0.226	0.760	0.700	0.333	0.182	0.791	0.607	1.000	0.624	0.658	0.561
Real Estate	0.234	0.575	0.558	0.358	0.123	0.605	0.527	0.624	1.000	0.514	0.414
Technology	0.202	0.592	0.582	0.314	0.153	0.631	0.563	0.658	0.514	1.000	0.420
Utilities	0.163	0.527	0.432	0.241	0.176	0.513	0.401	0.561	0.414	0.420	1.000

Table A4: Covariance Matrix Between Industries for the Sample Period

Table A4 present the covariance matrix between the industry portfolios created based on the Stockholm Stock Exchange, categorized based on TRBC Economic sector codes. Covariance is calculated based on industry excess return where excess return is defined as the industry return less the risk-free rate (proxied by the Swedish 1-month T-bill.

Industry	Academic & Educational Services	Basic Materials	Consumer Cyclicals	Consumer Non-Cyclicals	Energy	Financials	Healthcare	Industrials	Real Estate	Technology	Utilities
Academic & Educational Services	4.20	0.73	0.67	0.48	0.75	0.77	0.65	0.81	0.67	0.62	0.89
Basic Materials	0.73	2.64	1.51	0.88	1.50	2.07	1.30	2.14	1.31	1.43	2.29
Consumer Cyclicals	0.67	1.51	2.17	0.71	1.37	1.71	1.15	1.79	1.15	1.27	1.70
Consumer Non-Cyclicals	0.48	0.88	0.71	2.41	0.54	0.93	0.75	0.90	0.78	0.73	1.00
Energy	0.75	1.50	1.37	0.54	27.30	1.63	1.04	1.65	0.90	1.19	2.45
Financials	0.77	2.07	1.71	0.93	1.63	3.30	1.43	2.49	1.54	1.71	2.49
Healthcare	0.65	1.30	1.15	0.75	1.04	1.43	1.98	1.48	1.04	1.18	1.51
Industrials	0.81	2.14	1.79	0.90	1.65	2.49	1.48	3.01	1.52	1.70	2.60
Real Estate	0.67	1.31	1.15	0.78	0.90	1.54	1.04	1.52	1.97	1.07	1.55
Technology	0.62	1.43	1.27	0.73	1.19	1.71	1.18	1.70	1.07	2.21	1.67
Utilities	0.89	2.29	1.70	1.00	2.45	2.49	1.51	2.60	1.55	1.67	7.14