

IPO Underpricing: What about the Shipping Sector?

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Abstract

This paper looks at IPO underpricing in a shipping sector. This sector presents interest as it has unique characteristics, among them pro-cyclicality, long history and ownership concentration. Moreover, an average level of underpricing in shipping is reported to be substantially lower than an overall level. The effects of shipping-specific factors on underpricing are exhaustively studied in this paper for the first time. In connection with shipping characteristics, we hypothesize several theories of underpricing to be relevant explanations of underpricing in a shipping sector. More specifically, we investigate an investor sentiment theory as shipping is highly exposed to business cycles, an information asymmetry argument as there seems to be low information asymmetry in shipping, and two ownership and control theories by Brennan and Franks and Stoughton and Zechner due to highly-concentrated ownership in a shipping sector. In addition, we consider a partial adjustment theory that has gained substantial empirical support in the literature. In order to test aforementioned theories and shipping-specific factors, we perform a cross-sectional regression analysis using a sample of 60 shipping IPOs from four different stock exchanges. The partial adjustment theory and the Stoughton and Zechner agency cost theory are supported by the results, while the investor sentiment theory, information asymmetry argument and the Brennan and Franks managerial control theory are rejected. Importantly, the Stoughton and Zechner theory and downward price revisions prevalent among shipping firms are able to partially explain low underpricing “puzzle” in shipping.

1 Introduction

This paper investigates initial public offerings (IPOs) in shipping firms. We choose to focus on this particular sector because of its unique characteristics. More specifically, shipping firms tend to have a highly-concentrated ownership structure. Shipping is also a sector that is more exposed to business cycles. Both these characteristics have been hypothesized to be important for firms' IPO decisions. We therefore advocate the sector-level approach for explaining IPO performance as it may give us further insights into a well-known "puzzle" of IPO underpricing.

The existing IPO literature concentrates on an overall IPO market and does not fully control for firm-specific characteristics. As firm characteristics may differ across industries, studies at a sector level should be encouraged. While shipping IPOs have been investigated before (Grammenos and Marcoulis (1996), Merikas, Gounopoulos, and Nounis (2009)), this paper considers additional shipping-specific factors and underpricing theories. We suggest to look at characteristics that make a shipping sector distinct from other sectors, such as, pro-cyclicality, highly-concentrated ownership, high tangibility, and long history. Typically, shipping firms are family-owned or have a highly-concentrated ownership structure that may positively impact underpricing according to the managerial control theory (Brennan and Franks, 1997). On the contrary, the agency cost theory by Stoughton and Zechner (1998) suggests a negative relationship between family ownership and underpricing as family firms are less exposed to agency problems. Neither of these control theories has gained sufficient empirical support, hence, it is difficult to claim that one theory is superior to another one and further testing is required. Merikas et al. (2009) argue that the shipping sector should exhibit lower information asymmetry, due to high tangibility and long history. Another distinct feature of the shipping industry is its exposure to business cycles. As reported by Ritter (1984), IPO underpricing is higher during the "hot" periods and respectively lower during the "cold" periods in the market. Such herding behavior of investors in the "hot" markets, which results in first-day positive abnormal returns, is consistent with an investor sentiment theory of underpricing. Furthermore, pro-cyclicality might be able to resolve the long-term IPO underperformance "puzzle". As investors are overly optimistic about "hot" IPOs, the presumed underpricing could simply arise from bubble-pricing, while long-term underperformance can be regarded as mean reversion of a price to the fundamental value. Thus, the effect of business cycles on IPO performance in the

shipping sector is likely to be significant. This paper, therefore, hypothesizes that the aforementioned unique characteristics related to shipping may shed light on the sources of IPO underpricing. In addition to the investor sentiment theory and two ownership and control theories, we also test a partial adjustment theory by Benveniste and Spindt (1989). This theory has gained considerable empirical support in the literature and seems to be an adequate explanation of underpricing from a theoretical viewpoint.

In this paper, we investigate different IPO underpricing explanations using a sample of 60 shipping IPOs from four different stock exchanges, associated with a developed shipping sector, namely, NYSE, NASDAQ, London Stock Exchange (LSE) and Oslo Stock Exchange (OSE). We find an average underpricing of 2.8% in our sample of shipping IPOs. Conforming to our expectations, the partial adjustment theory is able to explain most of the variation in shipping IPO underpricing. Additionally, our results reveal that the Stoughton and Zechner agency cost theory can partially explain underpricing. This result clearly undermines the Brennan and Franks managerial control theory. The sample in our analysis also renders the investor sentiment theory and information asymmetry argument insignificant. Among shipping-specific factors, we find post-IPO ownership concentration and pre-IPO family ownership to be significant.

The results of this paper can be useful for managers and investors in their decision-making. For instance, no evidence for the investor sentiment theory would eliminate any incentives to time the IPO (to go public during the “hot” periods or upturns rather than during the “cold” periods or downturns). While from investors’ perspective, short-term investing in non-family IPOs, and then realizing profits from underpricing is an optimal strategy. Hence, more empirical evidence on IPO performance driving forces will enable decision-makers to make more informed decisions.

The main contribution of this paper is empirical testing of sector-relevant IPO underpricing theories and factors, in contrast to other studies, that focus only on several leading theories. The findings of this paper can be also relevant outside shipping, for example, for other sectors that exhibit similar characteristics. The energy sector and industrial sector share several characteristics with a shipping sector, such as, sensitivity to business cycles, highly-concentrated ownership, high tangibility and low total asset turnover. Therefore, IPO underpricing in those sectors might be driven by the same factors and explained by the same theories as in shipping. While, in information technology sector and telecommunications sector, which exhibit opposite characteristics, we should

expect theories with mirrored predictions of effects on underpricing to be relevant, as well as high underpricing. Hence, the results of this paper have a potential to be applicable to other sectors and, therefore, are of essential interest to a broader audience.

2 Related literature

The initial public offering (IPO) is the public sale of firm's stock for the first time. There is a number of reasons why firms choose to go public, such as, capital needs, publicity, potential M&As, diversification. However, it is agreed in the literature, that the primary reason for going public is the need to raise capital for firm's investment or production activities. Therefore, it is natural to assume that an optimal pricing strategy for a firm would be to set the highest possible price based on the market valuation of stock. This is not what we observe, however, as IPO firms tend to underprice stock, i.e. the offer price is lower than the fair value of stock. The argument regarding firm's inability to incorporate public and private information into the offer price seems an unlikely explanation of underpricing since the bookbuilding method dominates in the majority of countries. Subsequently, investors' demand and valuation of stock is no longer a "black box" for issuers, which is suggestive of deliberate underpricing. This explanation is rather puzzling and raises even more questions. For instance, why do firms underprice even though they miss out on IPO proceeds? What are the issuer's motives for a seemingly suboptimal behavior?

2.1 Theories of underpricing

A vast amount of literature is dedicated to resolving the IPO underpricing "puzzle", and consequently, the comparative analysis of existing underpricing theories is quite challenging. Among numerous studies, we hold reviews of IPO underpricing theories by Jenkinson and Ljungqvist (2001), Ljungqvist (2005), and Ritter and Welch (2002) in high regard. Jenkinson and Ljungqvist (2001) suggest the following classification of IPO underpricing theories: asymmetric information, ownership and control, and institutional theories. Ljungqvist (2005) additionally points out behavioral theories of underpricing. Ritter and Welch (2002) divide existing underpricing theories into asymmetric information and symmetric information theories. We will refer to the classification by Ljungqvist (2005) as it is more specific and clarifying compared to others (see Table 1).

Table 1: **Classification of IPO underpricing theories**

This table provides the list of competing theories of IPO underpricing. These theories represent only a fraction of numerous explanations proposed in the literature. However, they are most well-grounded and backed up by empirical evidence. The classification of theories is analogous to that of Ljungqvist (2005). Additionally, proponents and opponents of theories are mentioned.

Theory	Proponents	Opponents
<u>Asymmetric information theories</u>		
Signaling theory	Allen and Faulhaber (1989), Welch (1989), Grinblatt and Hwang (1989)	Michaely and Shaw (1994), Jegadeesh, Weinstein, and Welch (1993) Ritter (2011)
Partial adjustment theory	Benveniste and Spindt (1989), Hanley (1993), Cornelli and Goldreich (2003)	Jenkinson and Jones (2004), Loughran and Ritter (2002b)
Principal-agent theory	Baron (1982), Loughran and Ritter (2003), Ljungqvist and Wilhelm (2003)	Muscarella and Vetsuypens (1989)
Winner's curse	Rock (1986), Koh and Walter (1989)	Chambers and Dimson (2009), Ritter (2011)
<u>Institutional theories</u>		
Lawsuit theory	Ibbotson (1975), Tinic (1988), Lowry and Shu (2002)	Drake and Vetsuypens (1993), Keloharju (1993), Ritter (2011)
Price support theory	Ruud (1993), Benveniste, Busaba, and Wilhelm (1996), Schultz and Zaman (1994), Hanley, Kumar, and Seguin (1993), Ellis, Michaely, and O'hara (2000)	Asquith, Jones, and Kieschnick (1998)
Tax	Rydqvist (1997), Taranto (2003)	
<u>Ownership and control theories</u>		
Managerial control theory	Brennan and Franks (1997), Boulton, Smart, and Zutter (2010b)	Stoughton and Zechner (1998)
Agency cost theory	Stoughton and Zechner (1998)	Brennan and Franks (1997)
<u>Behavioral theories</u>		
Informational cascade	Welch (1992), Amihud, Hauser, and Kirsh (2001)	
Investor sentiment	Ljungqvist, Nanda, and Singh (2006), Ritter (1991), Ofek and Richardson (2003)	Krigman, Shaw, and Womack (1999)
Prospect theory	Loughran and Ritter (2002b), Daniel (2002), Ljungqvist and Wilhelm (2005), Hanley (1993)	

The asymmetric information theories are the most mature among underpricing theories. The underlying assumption in these models is the information asymmetry between the parties in the IPO process. Consequently, the arising informational frictions lead to underpricing. The institutional theories relate underpricing to the institutional characteristics, such as, litigation risk, tax regime, etc. The ownership and control theories point out the potential agency problem and the control motivation for underpricing. At last, the behavioral theories state that underpricing may be the

result of the behavioral biases of the parties. This bunch of theories represents a real challenge for researchers, as they cannot be easily tested or verified. Among aforementioned theories of underpricing, the partial adjustment theory and the investor sentiment theory seem to have gained most support from both theoreticians and practitioners. Other theories, such as, ownership and control theories and behavioral theories are still at a development and testing stage. Importantly, according to Ritter (2011), there are no universal explanations of underpricing, but country- or market-relevant explanations:

The asymmetric information-based theories would be plausible if the average first-day return was in the vicinity of 2%, or maybe even 5%. In almost all countries, average underpricing is noticeably higher than this. In some cases, such as China, institutional constraints explain severe underpricing. In other cases, I think that agency problems between issuers and underwriters, combined with a willingness of at least some issuers to focus on factors other than maximizing the net proceeds raised in the IPO, are important.

Therefore, the specifics of a particular market should be taken into account and related to underpricing in that market.

2.2 Evidence on IPO underpricing

Despite a substantial body of literature dedicated to resolving the IPO underpricing puzzle, a consensus has not been reached. The stylized facts of IPO underpricing and long-term underperformance appear to be the only consistent finding across numerous studies in the multiple markets. Table 2 reports the average levels of underpricing and post-IPO performance across different countries, as well as globally. The average underpricing appears to vary substantially across countries and over time. Stoll and Curley (1970), Logue (1973), Reilly (1973), and Ibbotson (1975) first reported positive abnormal initial returns or underpricing of initial public offerings. Ritter and Welch (2002) document an average underpricing of 18.8% in US during 1980-2001. Loughran and Ritter (2003) also document the change in IPO underpricing over time, specifically, they show that it has increased dramatically since 1980s. Further, IPO firms with larger positive abnormal returns seem to underperform more in the long-term (see Table 2). Such significant underperformance in

three years after an IPO is consistent with the prediction of the investor sentiment theory. More specifically, the initial returns might be driven by overly-optimistic investors that would explain price reversion to the fundamental value in the long-run.

Table 2: **Global evidence on short- and long-term IPO performance**

This table presents empirical evidence on IPO initial returns and post-IPO three-year returns across different countries. The IPO performance at a global level is also documented (see World). The time range covered by the represented studies is 1960-2012.

Country	Researcher	Sample size	Time period	Average initial return	Average 3-year return
Australia	Lee, Taylor, and Walter (1996)	266	1976-1989	19.80%	-51.25%
China	Chan, Wang, and Wei (2004)	570	1993-1998	164.50%	75.07%
Denmark	Jakobsen and Sørensen (2001)	76	1984-1992	8.10%	-30.40%
Italy	Arosio, Giudici, and Paleari (2000)	108	1985-1997	18.20%	-11.53%
Finland	Keloharju (1993)	79	1984-1989	17.20%	-21.00%
France	Chahine (2008)	172	1996-1998	10.70%	-9.40%
Germany	Stehle, Ehrhardt, and Przyborowsky (2000)	187	1960-1992	26.90%	-6.00%
Greece	Thomadakis, Nounis, and Gounopoulos (2007)	254	1994-2002	38.94%	-15.35%
Sweden	Loughran, Ritter, and Rydqvist (2008)	162	1980-1990	27.30%	1.20%
Norway	Boulton, Smart, and Zutter (2011)	60	2000-2006	4.18%	
UK	Levis (1993)	483	1980-1988	16.80%	-8.31%
US	Aggarwal and Rivoli (1990)	1,598	1977-1987		-13.73%
	Ritter (1991)	1,526	1975-1994	18.00%	-34.47%
	Lowry, Officer, and Schwert (2010)	8,759	1965-2005	22.00%	
	Liu and Ritter (2011)	4,510	1993-2008	24.40%	
Europe	Gajewski and Gresse (2006)	1,846	1988-1998		-32.61%
	Akyol, Cooper, Meoli, and Vismara (2014)	3,677	1998-2012	16.50%	
World	Banerjee, Dai, and Shrestha (2011)	8,776	2000-2006	29.11%	
	Boulton et al. (2011)	7,306	2000-2006	27.53%	

Based on the evidence in Table 2, it is critical to have a country-specific and in some cases a sector-specific perspective when identifying possible relevant explanations of IPO underpricing. The observed cross-sectional variation in underpricing is likely to be related to idiosyncratic characteristics of particular countries or sectors.

2.3 Underpricing in a shipping sector

The shipping industry is interesting to look at as it exhibits a number of unique characteristics. Moreover, the global shipping sector carries around 90% of international trade, and therefore, is of great importance in the world's economy. The distinct characteristics of the shipping sector enable us to hypothesize which theories of underpricing are more probable. The IPO underpricing among shipping firms is also unusually low, which implies that firms' pricing incentives might be different from those in other sectors and need to be investigated. One prominent feature among shipping

firms is long histories, which is complemented with old traditions and strong networks. Furthermore, the shipping industry is mainly associated with tangible assets. Long history and high tangibility, consequently, imply lower information asymmetry experienced by shipping firms compared to other firms. Another feature is a more pronounced impact of business cycles on the performance in the shipping sector. Further, shipping firms are mostly family-owned or have a highly-concentrated ownership structure and, therefore, tend to experience less severe agency problem. In addition, the shipping industry is very volatile and highly-levered. The recent trend towards going public via an IPO can be explained by the high leverage of shipping firms as they need to finance large investments. Lastly, the growth in the shipping sector is quite rapid and mostly realized through M&A activity. The essential characteristics of the shipping sector, outlined in previous studies, are summarized in Table 3.

Table 3: Shipping sector characteristics

This table summarizes shipping-specific characteristics reported in the literature.

Characteristic	Researcher
Long history	Merikas et al. (2009)
Family ownership	Harlaftis and Theotokas (2004)
Pro-cyclicality	Stopford (1997)
High tangibility	Stopford (1997)
High volatility	Stopford (1997)
High leverage	Stopford (1997)
M&A activity	Alexandrou, Gounopoulos, and Thomas (2014)

The aforementioned shipping characteristics may have an impact on IPO underpricing in the shipping sector. Moreover, these unique features may indicate which underpricing theories are more plausible explanations of IPO underpricing in shipping. For instance, the low level of underpricing can be related to long history and high tangibility, based on the information asymmetry argument. While concentrated or family ownership may provide incentives for higher underpricing among shipping IPOs according to the Brennan and Franks managerial control theory. The opposite prediction is yielded by the Stoughton and Zechner agency cost theory. Pro-cyclicality of the shipping industry is supportive of the investor sentiment theory. Therefore, it seems reasonable to investigate the outlined theories as they are particularly relevant for the shipping sector.

The IPO underpricing in a shipping sector is relatively unresearched, and there are only a few shipping IPO studies to the author’s knowledge. It is also evident from Table 2 that IPO underpricing and long-term underperformance in the shipping sector is relatively small. The shipping IPO studies report average underpricing of 2-5%. Therefore, the shipping sector presents interest for researchers from two perspectives: (1) it has unique characteristics that can possibly explain lower underpricing in this sector, and (2) there is a room for research as only the mainstream theories of underpricing and a few shipping characteristics have been tested.

IPO performance in a global shipping sector was first investigated by Grammenos and Marcoulis (1996) with a small sample of 31 IPOs, and later by Merikas et al. (2009), with a larger sample of 143 IPOs over a longer time period. Grammenos and Marcoulis (1996) find an average underpricing of 5.32% in their sample. Their paper concentrates on testing the effects of gearing and age of fleet on IPO performance as shipping firms are mostly high-levered and have long histories. They find that long-term performance is positively related to the financial leverage and negatively related to the average age of fleet. Merikas et al. (2009) find considerably higher underpricing of 17.69%. Their paper captures the relation between the business cycles and IPO performance, in addition to testing the effects of the trivial firm- and deal-specific factors. Merikas et al. (2009) show that in the periods of economic expansion, IPOs tend to be more underpriced, and vice versa. With respect to the long-term performance, “hot” IPOs tend to underperform in the long-term, while “cold” IPOs outperform, which can be explained by the price reversion. These findings provide support for an investor sentiment theory of underpricing. Further, their study somewhat incorporates shipping specifics into the analysis, though, it still leaves out some important characteristics unique for shipping. In particular, they hypothesize the age of the firm to have a negative impact on IPO underpricing and a positive impact on the long-term performance. Both predictions are based on the information asymmetry argument and receive empirical support in their study. Other factors considered in their analysis are not shipping-related and, consequently, cannot account for the effects present exclusively in shipping. According to Merikas et al. (2009), this sector should exhibit lower information asymmetry² and underpricing respectively compared to other sectors. Their paper does not develop any further theoretical predictions in this regard and, hence, leaves more

²First, the market value is associated with the value of physical assets, i.e. shipping industry exhibits high tangibility. Second, extensive information flows reduce information asymmetry.

thorough investigation of shipping-specific factors to forthcoming research. The authors also find that both underpricing and long-term underperformance are lower in the shipping sector than the levels reported in the overall market. This empirical fact provides even stronger incentives to analyze the effects of shipping-related factors. There are no other empirical studies, at least to our knowledge, that consider shipping-specific characteristics in the IPO analysis at a cross-country level.

Further, there are two US studies, worth of our attention, as they examine IPO performance in the shipping sector and take into account shipping market conditions and maturity. Merikas, Gounopoulos, and Karli (2010) investigate a signaling explanation of the initial and long-term IPO returns. Their sample consists of 61 IPOs listed during 1987 - 2007. The authors report an average underpricing of only 4.44% and hypothesize that low underpricing is related to the maturity of the shipping sector. Grammenos and Papapostolou (2012) empirically test two leading asymmetric information theories of underpricing, namely, a partial adjustment theory and a winner's curse theory. The data set contains 51 shipping firms and covers the period of 1987 - 2008. They report an average underpricing of 2.69%. Their findings provide support for the partial adjustment theory, but inconsistent with the winner's curse theory. Furthermore, it is a first study in shipping that examines predictability of likelihood of underpricing. The authors find market conditions, price revision, operating efficiency, and gearing to be significant factors. In particular, the shipping market sentiment is positively related to the probability of underpricing. Overall, their results are indicative of no information asymmetry in the shipping IPO market since the probability of underpricing can be predicted based on the publicly available information.

This paper considers a broader set of shipping-specific characteristics compared to previous studies. These factors are also the means for testing several underpricing theories: the information asymmetry argument, the investor sentiment theory, and ownership and control theories.

3 Hypotheses

3.1 Development of hypotheses

This paper focuses on investigating several IPO underpricing theories and factors, considered to be the most relevant for a shipping sector. First, the investor sentiment theory by Ljungqvist

et al. (2006) may be a plausible explanation of underpricing in a shipping sector because this sector is more exposed to business cycles than others. The investor sentiment theory posits that underpricing is the result of irrational investors' behavior. More specifically, underpricing is claimed to be driven by overly-optimistic investors that push the price beyond the true value. The main prediction of this theory is price reversion to the fundamental value in the long-run. This theory has gained considerable empirical support in the literature. The inherent assumptions regarding investor sentiment and short-sale constraints also seem realistic. The former assumption is not surprising since IPO firms are typically young, informationally opaque companies, and therefore, hard to value. The latter assumption corresponds to IPO regulations in most countries. The investor sentiment theory is tested by including market-specific variables into the regression analysis, such as, stock market sentiment, shipping market sentiment, and IPO frequency³. These variables are used as proxies for investors' optimism and, consequently, are expected to be positively related to IPO underpricing. The positive relationship between these variables and underpricing is reported in earlier studies by Ritter (1984), Grammenos and Papapostolou (2012), and Merikas et al. (2009).

Hypothesis 1: The market-specific variables, such as, stock market sentiment, shipping market sentiment, IPO frequency, are positively related to IPO underpricing in a shipping sector.

Another probable explanation of underpricing in a shipping sector is control consideration of the owners. There are two diametrically opposing ownership and control theories of underpricing: a managerial control theory (Brennan and Franks, 1997) and an agency cost theory (Stoughton and Zechner, 1998). Both theories share an assumption of the potential agency problem in IPO firms, however, they provide completely different predictions and reasons for underpricing.

The managerial control theory by Brennan and Franks states that firms underprice in order to generate excess demand for shares, which results in a dispersed ownership structure. Unlike large investors, small investors have no incentives to monitor, which allows the manager to retain the private benefits of control. Hence, the relationship between the post-IPO ownership concentration and IPO underpricing should be negative. This prediction is supported with empirical evidence in Boulton, Smart, and Zutter (2010a). Moreover, the survey among CFOs of publicly listed firms by Brau and Fawcett (2006) reveals that in the majority of cases the motivation behind underpricing is a desire for dispersed ownership structure, which is consistent with a managerial control theory.

³High IPO frequency indicates the hot period in the IPO market, while low frequency - the cold period.

Though, underpricing is not the only way to protect manager's private benefits of control. The manager can alternatively use takeover defences or issue non-voting stock. Interestingly, firms that employ these types of protection are still underpriced (Field and Karpoff (2002), Aruaslan, Cook, and Kieschnick (2004)), which means that a managerial control theory is not a whole story.

In contrast to Brennan and Franks theory, the agency cost theory by Stoughton and Zechner assumes that monitoring, which is used to prevent the agency problem, is actually value-enhancing for the firm and for the manager as well. To encourage monitoring, managers can allocate large stakes to investors, and compensate their illiquidity through underpricing. This is feasible due to discretionary allocation of shares assumption in this theory (while pro-rata allocation is assumed in Brennan and Franks theory). Hence, the role of underpricing is to attract blockholders who engage in monitoring and, thereby, mitigate the agency problem.

This paper also hypothesizes that family-owned shipping firms have incentives to underprice more/less dependent on which theory is assumed to be valid. Given that Brennan and Franks theory is true, family firms are likely to underprice more in order to create dispersed ownership and retain private benefits of control (Chambers, 2012). The Stoughton and Zechner theory provides an opposite prediction, i.e. less underpricing in family firms where the agency problem is not a big concern⁴. The lower information asymmetry associated with family firms, should also lead to lower underpricing. Consistent with the prediction of the agency cost theory and the information asymmetry argument, Daugherty and Jithendranathan (2012) find that family firms experience less underpricing compared to non-family firms.

Hypothesis 2: Post-IPO ownership concentration and pre-IPO family ownership are related to IPO underpricing in a shipping sector.

This paper also investigates the relevance of the information asymmetry argument for underpricing by including the firm age, the current ratio, the measure of tangibility, the total asset turnover and the gearing ratio into the analysis. These factors impact the level of information asymmetry and can, therefore, be important determinants of IPO underpricing. Moreover, shipping firms typically have long histories, low liquidity, substantial tangibility, low total asset turnover and high leverage. As these factors seem to be essential for shipping, their effect on IPO underpricing in this sector

⁴Family firms typically do not experience agency conflicts as there is often no separation of ownership and management (Villalonga and Amit, 2006).

through the information asymmetry channel, can be significant. Ritter (1984) argues that there is a positive relationship between ex-ante uncertainty and IPO underpricing. As shipping firms have longer histories, more information is available to the public and they experience less uncertainty. Therefore, underpricing should be lower among shipping firms. The predicted negative relationship is confirmed by Su and Fleisher (1999), Loughran and Ritter (2002a), and Chahine (2008). High tangibility is another important feature of the shipping industry. As argued in Merikas et al. (2009), it results in lower information asymmetry, and less underpricing respectively. However, shipping firms also tend to be highly-levered, which implies larger uncertainty (Chen, Firth, and Kim, 2004) and, consequently, more underpricing. The current ratio, which is a proxy for liquidity, is hypothesized to be negatively related to underpricing, based on the previous evidence. The total asset turnover is a measure of operational efficiency of the firm, and was previously shown to be positively related to underpricing. Engelen (2003), Hauser, Yaari, Tanchuma, and Baker (2006), and Grammenos and Papapostolou (2012) provide supportive evidence for these predictions.

Hypothesis 3: Firm-specific factors, such as, firm age, current ratio and tangibility, are negatively related to underpricing in the shipping sector, while turnover and gearing are positively related.

The last theory to be tested is the partial adjustment theory of underpricing by Benveniste and Spindt, which is one of the leading theories in the field. The transition from the fixed-price offerings with a pro-rata allocation rule towards bookbuilding IPOs with a discriminatory allocation of shares gave rise to a so-called bookbuilding theory of underpricing. The information revelation or partial adjustment theory of underpricing (Benveniste and Spindt, 1989) is based on the assumption that the underwriter is less informed than investors in a bookbuilding IPO setting. Consequently, investors with positive information might understate their demand for the stock during the “road show” in attempt to deflate the IPO price. In response, the underwriter can use underpricing as an incentive device for investors so that they reveal their private information truthfully. Due to underpricing, the positive information received from investors is not fully, but partially, incorporated into the final offer price (Hanley, 1993). This theory suggests that underpricing is beneficial for all parties involved in the IPO. The underwriter and the issuer become informed about the market valuation of the issue and partially adjust the offer price, while investors earn positive abnormal initial returns. The price revision variable is commonly used to test the partial adjustment theory.

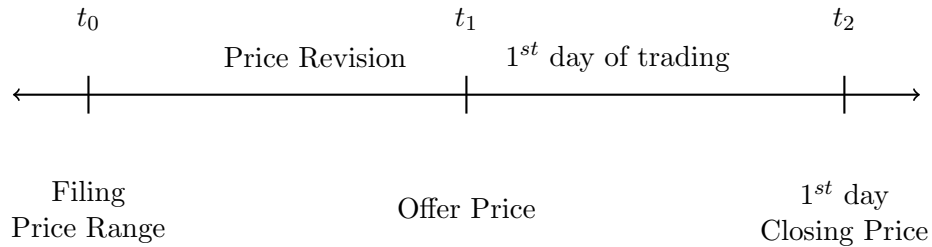
An upward revision in the final offer price from the midpoint of the initial price range is indicative of high investor demand for the stock. It follows from this theory that investors reveal positive information only if they are incentivized through underpricing, which is often accompanied by large share allocations. It is optimal for the issuer to rely more on the share allocation reward to investors rather than underpricing, since the latter is costly. Importantly, underpricing is still a necessary condition for truth-telling from investor side. Hence, a larger upward price revision implies higher underpricing. In other words, the more positive the information, the more underpricing is required. The price revision (PR) can be defined as the relative difference between the final offer price (P_{offer}) and the midpoint ($Midpoint$) of the initial filing price range:

$$PR_i = \frac{P_{i,offer}}{Midpoint_i} - 1 \quad (1)$$

The process of pricing the issue is illustrated on Figure 1, which is adopted from Grammenos and Papapostolou (2012).

Figure 1: **Initial Public Offering Timeline**

This figure illustrates the process of pricing an IPO. At t_0 , the issuer and the underwriter set a filing price range. Between t_0 and t_1 , the underwriter gathers information from investors during the road show. At t_1 , the final offer price is set. The first-day closing price is determined at t_2 .



Aggarwal, Krigman, and Womack (2002) find support for a positive relationship between underpricing, price revision and institutional allocations. Consistent with the partial adjustment theory by Benveniste and Spindt, the final hypothesis regarding the relationship between price revision and IPO underpricing is formulated.

Hypothesis 4: The price revision is positively related to IPO underpricing.

To summarize, shipping characteristics are considered in the analysis and essentially used for testing various underpricing theories (see Table 4). The partial adjustment theory is additionally tested as it has shown substantial explanatory power over IPO underpricing in previous studies.

Table 4: **The effect of shipping-specific factors on IPO underpricing**

This table links shipping-specific factors to the mainstream theories of underpricing. More specifically, the information asymmetry argument, the investor sentiment theory, and ownership and control theories can be tested by estimating the relationship between IPO underpricing and shipping-specific factors. The table also shows the predicted effects on underpricing for the respective factors.

Theory	Factor	Effect on underpricing
Information asymmetry	Firm age	↓
	Current ratio	↓
	Tangibility	↓
	Turnover	↑
	Gearing	↑
Investor sentiment theory	Pro-cyclicality	↑
Ownership and control theories	Pre-IPO family ownership	↑ / ↓
	Post-IPO ownership concentration	↑ / ↓

3.2 Potential determinants of IPO underpricing

For clarity, this paper classifies the potential determinants of IPO underpricing into three categories (see Table 5): (1) firm-specific factors, (2) deal-specific factors and (3) market-specific factors. The majority of factors represent shipping characteristics and underpricing theories of interest. The offer size and return on assets (ROA) are added as control variables. The offer size is predicted to be negatively related to underpricing, as larger offerings signal better prospects of the firm and reduce uncertainty associated with an IPO. ROA is a measure of profitability and is expected to be negatively related to underpricing. A detailed description of all factors is provided in Appendix A.

Table 5: **Potential determinants of IPO underpricing**

This table provides a list of potential determinants of IPO underpricing. They can be grouped in three categories: firm-specific, deal-specific, and market-specific factors. Additionally, the expected signs of relationship with underpricing are specified for all factors. The expected signs are determined based on the empirical findings from the previous research and theoretical reasoning.

Factor	Researcher	Expected sign
<u>Firm-specific factors</u>		
Firm age	Su and Fleisher (1999), Loughran and Ritter (2002a), Chahine (2008), Merikas et al. (2009)	-
Current ratio	Grammenos and Papapostolou (2012)	-
Gearing	Grammenos and Papapostolou (2012)	+
Turnover	Grammenos and Papapostolou (2012)	+
Tangibility	Merikas et al. (2009)	-
Return on assets	Grammenos and Papapostolou (2012)	-
Pre-IPO family ownership	Boulton et al. (2010a)	+/-
Post-IPO ownership concentration	Boulton et al. (2010a)	+/-
<u>Deal-specific factors</u>		
Price revision	Grammenos and Papapostolou (2012)	+
Offer size	Beatty and Ritter (1986), Smart and Zutter (2003)	-
<u>Market-specific factors</u>		
Market sentiment	Ritter (1984), Grammenos and Papapostolou (2012)	+
Shipping sentiment	Grammenos and Papapostolou (2012)	+
Frequency	Ritter (1984), Grammenos and Papapostolou (2012)	+

4 Data

4.1 Sample

The data set contains 60 IPOs in a shipping sector globally over a period 2004-2015. Specifically, shipping firms from four leading stock exchanges are considered: NYSE, NASDAQ, London Stock Exchange and Oslo Stock Exchange. The closing prices, market returns and post-IPO ownership data are collected from DataStream. The IPO deal-related data is extracted from SDC Platinum. Founding dates, pre-IPO family ownership and pre-IPO accounting data are gathered manually from firms' IPO prospectuses. The price revision variable is obtained only for 46 firms out of 60, i.e. bookbuilding IPOs, which reduces the sample for estimation involving this variable accordingly.

4.2 Descriptive statistics

The summary statistics for the variables is provided in Table 6. The initial return is 2.8% on average, which is consistent with the previous research findings. As expected, the initial return does not seem normally distributed, specifically, it exhibits negative skewness and positive excess kurtosis. It is also evident from Figure 2 that skewness occurs due to negative outliers. The variables for offer size and firm age are transformed into the logarithms to achieve normality. Other non-normally distributed variables, including initial return, cannot be log-transformed as they contain negative values.

Additionally, disaggregated summary statistics by year and stock exchange for initial return is presented in Table 8 and 9 respectively. The number of IPOs is quite volatile over the sample period. Furthermore, the average initial return appears to be higher in years with a larger number of offerings. This may indicate the hot and cold periods in the shipping IPO market. Similarly, there is some variation in initial returns across stock exchanges. As shown in Table 9, the LSE issues exhibit negative initial returns on average, while IPOs on three other stock exchanges are shown to be underpriced. The highest underpricing is detected on NASDAQ, then on OSE, and lastly on NYSE. However, even underpricing of 6.8% on Nasdaq is significantly lower than the general underpricing found in other studies.

Further, a more detailed summary statistics for explanatory variables is presented conditional

on the sign of initial return (see Table 7). For instance, it is evident that IPO underpricing appears when price revision is less negative. The fact that the price revision is negative on average even for the subsample of underpriced IPOs means that the price revision is not the only driver of underpricing. It also partially explains low underpricing among shipping firms where downward price revisions are prevalent.

Figure 2: **Distribution of initial return**

This figure illustrates the statistical distribution of initial return (approximated by the Epanechnikov kernel density function). The legend states the mean, the standard deviation, skewness, kurtosis, and the Jarque-Bera test statistic.

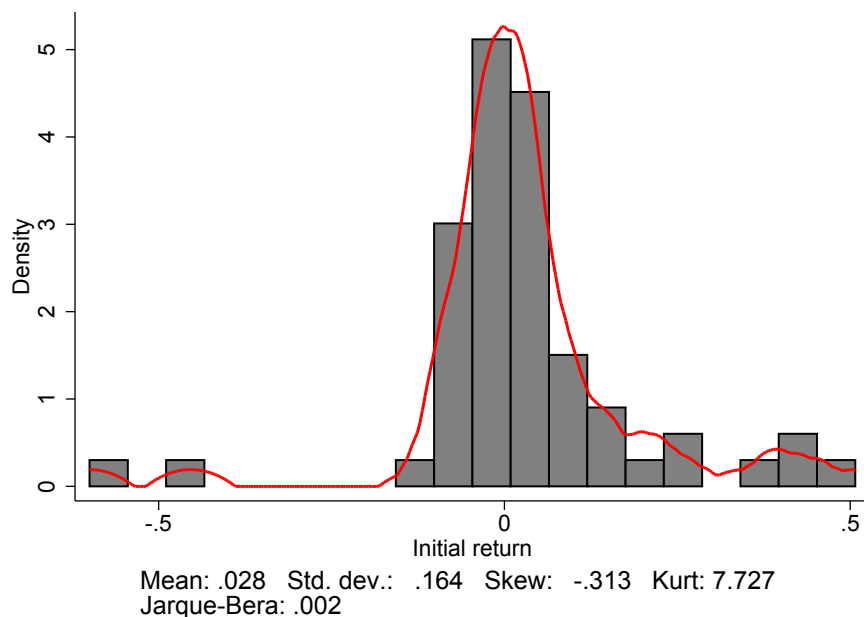


Table 6: **Summary statistics**

This table provides summary statistics for initial return and explanatory variables. Obs stands for the number of observations, Median, Min and Max - for median, minimum and maximum values respectively. Along with this statistics, the four statistical moments, such as, mean, standard deviation, skewness and kurtosis, are specified.

Variable	Obs	Mean	Std. Dev.	Median	Min	Max	Skewness	Kurtosis
IR	60	.028	.164	.007	-.6	.507	-.313	7.727
PR	46	-.072	.131	-.05	-.5	.143	-.842	4.007
Size	60	4.845	.879	4.993	1.982	7.129	-.884	4.816
Age	60	2.533	1.511	2.250	0	5.7	.335	2.076
CR	60	2.355	6.055	.932	.023	43.642	5.68	37.819
Tang	60	.734	.247	.811	.094	.991	-1.216	3.547
Gear	60	.622	.449	.641	0	3.179	2.892	18.590
Turn	60	.443	.802	.193	0	4.579	3.557	16.228
ROA	60	.059	.107	0.030	-.136	.519	2.311	9.819
OwnConc	60	.417	.497	0	0	1	.338	1.114
OutOwn	60	.322	.259	.35	0	.82	.160	1.756
Family	60	.367	.486	0	0	1	.553	1.306
Freq	60	7.433	2.807	8	1	11	-.539	2.325
MktSent	60	.039	.051	.035	-.059	.229	.678	4.715
ShipSent	60	.075	.101	.057	-.121	.334	.309	2.664

Table 7: **Summary statistics split by initial return**

This table provides summary statistics for explanatory variables conditional on the sign of initial return. The conditions $IR > 0$ and $IR < 0$ signify underpricing and overpricing accordingly. The number of observations (Obs), the mean and the standard deviation are included.

	$IR > 0$			$IR < 0$		
	Obs	Mean	Std. Dev.	Obs	Mean	Std.Dev.
PR	25	-.015	.106	21	-.139	.126
Size	34	4.954	.799	26	4.703	.971
Age	34	2.558	1.518	26	2.500	1.530
CR	34	3.114	7.664	26	1.361	2.680
Tang	34	.740	.216	26	.727	.286
Gear	34	.663	.536	26	.568	.304
Turn	34	.466	.711	26	.414	.921
ROA	34	.070	.127	26	.046	.073
OwnConc	34	.471	.507	26	.346	.485
OutOwn	34	.354	.254	26	.281	.264
Family	34	.265	.448	26	.500	.510
Freq	34	7.735	2.767	26	7.038	2.863
MktSent	34	.036	.060	26	.044	.039
ShipSent	34	.057	.095	26	.097	.106

Table 8: **Summary statistics for initial return by year**

This table provides summary statistics by year for initial return. N stands for the number of observations, Min and Max - for minimum and maximum values respectively. Along with this statistics, the four statistical moments, such as, mean, standard deviation, skewness, and kurtosis are specified.

Year	N	Mean	Std. Dev.	Min	Max	Skewness	Kurtosis
2004	4	-.076	.252	-.454	.072	-1.128	2.312
2005	11	.045	.117	-.075	.348	1.627	5.14
2006	9	.088	.183	-.089	.507	1.363	4.09
2007	9	.011	.272	-.6	.409	-.997	4.271
2008	4	-.035	.058	-.09	.028	.08	1.174
2010	5	-.036	.02	-.059	-.012	.031	1.425
2011	2	.022	.118	-.061	.106	0	1
2012	1	-.117	.	-.117	-.117	.	.
2013	8	.07	.146	-.017	.424	2.076	5.655
2014	6	.07	.108	-.005	.239	.812	1.819
2015	1	.009	.	.009	.009	.	.
Total	60	.028	.164	-.6	.507	-.313	7.727

Table 9: **Summary statistics for initial return by exchange**

This table provides summary statistics by stock exchange for initial return. N stands for the number of observations, Min and Max - for minimum and maximum values respectively. Along with this statistics, the four statistical moments, such as, mean, standard deviation, skewness, and kurtosis, are specified.

Exc	N	Mean	Std. Dev.	Min	Max	Skewness	Kurtosis
LSE	5	-.046	.314	-.6	.174	-1.408	3.142
NASDAQ	14	.068	.231	-.454	.424	-.232	3.224
NYSE	24	.015	.086	-.117	.239	.942	3.597
OSE	17	.034	.131	-.089	.507	2.933	11.403
Total	60	.028	.164	-.6	.507	-.313	7.727

A preliminary analysis of the association between variables is performed by examining cross-correlations (see Table 10). The initial return is positively moderately correlated with the price revision, and positively weakly correlated with the offer size, IPO frequency, post-IPO ownership concentration and outsider ownership. It is also shown to be negatively weakly correlated with the pre-IPO family ownership and the market sentiment. The correlation with other explanatory variables is close to zero, which is suggestive of no relationship. Although, the correlation does not imply causation, it is still indicative of the underlying relation between variables. Furthermore, since the explanatory variables are not strongly correlated with one another, there is less likelihood of multicollinearity problems.

There are several limitations to our data that need to be mentioned. First, the sample size is rather small, especially, relative to the number of predictors in the model. Hence, dropping some of the variables is necessary. Second, the dependent variable, initial return, is not normally distributed due to several negative outliers. Applying standard methods to deal with outliers would definitely improve the normality of the distribution, but it would also increase the risk of losing important observations. Since outliers in this case are considered to be legitimate, they are assigned the same weight as other observations. For obtaining valid inference in non-normality case, robust standard errors are used.

Table 10: Cross-correlation table

This table showcases the correlation coefficients between all variables. These cross-correlations are defined based on the casewise deletion method.

Variables	IR	PR	Size	Age	CR	Tang	Gear	Turn	ROA	OwnConc	OutOwn	Family	Freq	MktSent	ShipSent
IR	1.000														
PR	0.440	1.000													
Size	0.167	0.134	1.000												
Age	-0.029	-0.174	-0.251	1.000											
CR	0.023	0.108	-0.174	-0.061	1.000										
Tang	-0.013	0.260	0.361	-0.304	-0.010	1.000									
Gear	0.054	0.125	-0.189	0.214	-0.212	-0.084	1.000								
Turn	0.052	-0.127	-0.363	0.389	-0.108	-0.611	0.288	1.000							
ROA	-0.011	-0.090	-0.169	0.040	-0.083	-0.122	0.107	0.209	1.000						
OwnConc	0.270	0.240	0.043	-0.268	0.143	0.311	0.064	-0.111	-0.294	1.000					
OutOwn	0.227	0.304	0.031	-0.053	0.204	0.160	-0.111	-0.110	-0.137	0.263	1.000				
Family	-0.223	-0.274	-0.099	0.142	-0.170	0.091	-0.084	-0.100	0.268	-0.082	-0.044	1.000			
Freq	0.194	0.445	-0.104	-0.130	0.111	-0.027	0.034	0.039	0.102	0.075	0.022	-0.205	1.000		
MktSent	-0.176	0.010	0.134	0.214	-0.019	0.016	0.104	0.144	0.039	-0.137	-0.096	0.048	-0.240	1.000	
ShipSent	-0.021	0.007	0.090	0.080	-0.063	-0.017	0.164	0.068	-0.003	-0.023	-0.219	-0.125	-0.064	0.576	1.000

5 Results

5.1 Preliminary analysis

The univariate regression analysis is essential for testing hypotheses developed in this paper. The univariate results can be used to confirm the existence and strength of the relationship between the variables of interest. However, they should be taken cautiously due to the possibility of the omitted variable bias, which may result in biased coefficients. The univariate beta coefficients are derived from the correlations. However, the latter is purely a descriptive statistics of co-movement, while the former is a measure of observed causal relation - as such, both measures tend to exhibit the same sign but not the exact numerical values. The results from univariate regressions performed for all explanatory variables respectively are presented in Table 11.

Table 11: **Univariate estimation results**

This table shows univariate regression statistics, such as, beta coefficients (Coefficient), robust standard errors (Std.Err.), and explanatory power (R^2). The significance levels of beta coefficients are based on p-values and denoted with stars. The dependent variable is Initial Return. The explanatory variables are potential determinants of underpricing outlined earlier.

Variable	Coefficient	(Std. Err.)	R^2
Price Revision	0.533***	(0.159)	0.193
Offer Size	0.031	(0.020)	0.028
Firm Age	-0.003	(0.011)	0.001
Current Ratio	0.001	(0.002)	0.001
Tangibility	-0.009	(0.067)	0.000
Gearing	0.020	(0.016)	0.003
Turnover	0.011	(0.015)	0.003
Return on Assets	-0.016	(0.111)	0.000
Ownership Concentration	0.089**	(0.042)	0.073
Outsider Ownership	0.144	(0.095)	0.051
Family Ownership	-0.075*	(0.039)	0.050
Frequency	0.011*	(0.006)	0.038
Market Sentiment	-0.560	(0.424)	0.031
Shipping Sentiment	-0.035	(0.176)	0.000

Significance levels : * : 10% ** : 5% *** : 1%

The results suggest that initial return is significantly and positively related to price revision, IPO frequency and post-IPO ownership concentration. It is also marginally significantly and negatively related to pre-IPO family ownership. The relationship with other explanatory variables is found to be insignificant. The largest R^2 of 19.3% is achieved by the price revision, which is consistent with previous research and supportive of the partial adjustment theory. The other variables that yield noteworthy R^2 are post-IPO ownership concentration, post-IPO outsider ownership, pre-IPO family ownership, and lastly IPO frequency. These findings are consistent with the control motivation for underpricing. Specifically, it provides support for the prediction of the Stoughton and Zechner agency cost theory, as the sign of the relationship is positive with respect to post-IPO ownership concentration and negative with respect to pre-IPO family ownership. Furthermore, the marginal significance of IPO frequency is supportive of the investor sentiment theory. However, the multivariate regression analysis should be performed in order to obtain more accurate statistical inference. The multivariate analysis is preferred as it reduces likelihood of omitted variable bias.

5.2 Multivariate results

The multivariate regressions are estimated by the Ordinary Least Squares (OLS) using robust standard errors. Table 12 shows restricted sample regression results for a set of multivariate models specified to test four hypotheses, outlined in Hypotheses. The results for a full sample which contains 60 shipping firms are similar to those obtained for a restricted sample with 46 shipping firms (see Table 13). Initial Return is used as a dependent variable across all model specifications, while main independent variables are specified in accordance with hypotheses. The control variables for model specifications are selected based on the information criteria, such as, Akaike information criterion (AIC) and the Bayesian information criterion (BIC). The control variables selection for hypothesis testing is performed this way since it is not feasible to include all control variables into the model due to a small number of observations⁵. The robustness of selected models is tested by adding exchange dummies and a dummy for financial crisis 2007-2008 to each model specification.

The model specification for Hypothesis 1 includes primary variables of interest, such as, Frequency, Market Sentiment and Shipping Sentiment, and control variables, such as, Price Revision

⁵The rule of thumb says that there should be 10-15 observations per predictor in the model. Otherwise, inference from regression estimation is unreliable.

Table 12: **Multivariate results for a restricted sample**

This table shows OLS estimation results for a set of multivariate models that are specified to test hypothesis 1 (H1), hypothesis 2 (H2), hypothesis 3 (H3) and hypothesis 4 (H4). Each hypothesis is tested in two model specifications: (1) a plain specification with control variables selected based on the information criteria, (2) a specification with control variables, exchange dummies and a crisis period dummy. Beta coefficients are reported together with significance levels and robust standard errors in parentheses. The significance levels of the coefficients are determined based on p-values. The regression statistics, such as, a number of observations, adjusted R^2 , AIC and BIC are reported in the bottom panel.

	H1	H1 (with D)	H2	H2 (with D)	H3	H3 (with D)	H4	H4 (with D)
Frequency	0.002 (0.006)	-0.002 (0.009)						
Market Sentiment	-0.860 (0.710)	-0.728 (0.759)						
Shipping Sentiment	0.057 (0.239)	-0.011 (0.251)						
Price Revision	0.441*** (0.150)	0.491*** (0.152)	0.383*** (0.117)	0.407*** (0.127)	0.449*** (0.144)	0.469*** (0.157)	0.433*** (0.127)	0.455*** (0.137)
Family Ownership	-0.073* (0.037)	-0.079** (0.035)	-0.091*** (0.033)	-0.088** (0.035)	-0.105*** (0.038)	-0.098** (0.039)	-0.096*** (0.034)	-0.092** (0.036)
Dummy _{NASDAQ}		-0.131 (0.079)		-0.148** (0.070)		-0.126 (0.089)		-0.122* (0.066)
Dummy _{NYSE}		-0.186*** (0.048)		-0.208*** (0.036)		-0.196*** (0.052)		-0.186*** (0.032)
Dummy _{OSE}		-0.146** (0.062)		-0.148*** (0.047)		-0.137** (0.060)		-0.141*** (0.050)
Dummy _{Crisis}		0.008 (0.046)		0.008 (0.047)		0.023 (0.058)		0.020 (0.046)
Ownership Concentration			0.041 (0.040)	0.061 (0.047)				
Outsider Ownership			0.028 (0.088)	-0.003 (0.074)				
Firm Age					-0.002 (0.025)	-0.014 (0.032)		
Current Ratio					-0.002 (0.002)	-0.003 (0.002)		
Tangibility					0.015 (0.079)	0.005 (0.100)		
Gearing					-0.018 (0.059)	-0.034 (0.064)		
Turnover					0.049 (0.067)	0.030 (0.063)		
Constant	0.105 (0.068)	0.290*** (0.095)	0.075* (0.040)	0.242*** (0.040)	0.104 (0.067)	0.285** (0.134)	0.107*** (0.032)	0.251*** (0.040)
Observations	46	46	46	46	46	46	46	46
Adj. R^2	0.244	0.235	0.228	0.241	0.166	0.168	0.243	0.247
AIC	-46.387	-42.660	-46.301	-43.793	-40.220	-37.436	-49.007	-45.701
BIC	-35.415	-24.373	-37.158	-27.335	-25.591	-15.492	-43.521	-32.901

Table 13: **Multivariate results for a full sample**

This table shows OLS estimation results for a set of multivariate models that are specified to test hypothesis 1 (H1), hypothesis 2 (H2) and hypothesis 3 (H3). Each hypothesis is tested in two model specifications: (1) a plain specification with control variables selected based on the information criteria, (2) a specification with control variables, exchange dummies and a crisis period dummy. Beta coefficients are reported together with significance levels and robust standard errors in parentheses. The significance levels of the coefficients are determined based on p-values. The regression statistics, such as, a number of observations, adjusted R^2 , AIC and BIC are reported in the bottom panel.

	H1	H1 (with D)	H2	H2 (with D)	H3	H3 (with D)
Frequency	0.008 (0.007)	0.010 (0.009)				
Market Sentiment	-0.500 (0.560)	-0.524 (0.544)				
Shipping Sentiment	0.136 (0.255)	0.106 (0.230)				
Ownership Concentration	0.079* (0.040)	0.085* (0.043)	0.082* (0.042)	0.093* (0.050)	0.101* (0.052)	0.099* (0.055)
Dummy _{NASDAQ}		0.055 (0.133)		0.098 (0.137)		0.081 (0.166)
Dummy _{NYSE}		0.044 (0.121)		0.035 (0.121)		0.035 (0.147)
Dummy _{OSE}		0.092 (0.125)		0.079 (0.131)		0.073 (0.142)
Dummy _{Crisis}		-0.040 (0.055)		-0.048 (0.055)		-0.044 (0.068)
Outsider Ownership			0.108 (0.088)	0.078 (0.074)		
Family Ownership			-0.080** (0.038)	-0.087** (0.040)		
Return on Assets			0.228 (0.150)	0.351* (0.206)		
Firm Age					0.003 (0.022)	-0.004 (0.028)
Current Ratio					-0.000 (0.002)	-0.000 (0.002)
Tangibility					-0.060 (0.098)	-0.075 (0.105)
Gearing					0.006 (0.034)	0.014 (0.047)
Turnover					0.004 (0.022)	0.003 (0.025)
Constant	-0.058 (0.063)	-0.115 (0.148)	-0.026 (0.053)	-0.074 (0.135)	0.023 (0.070)	-0.009 (0.178)
Observations	60	60	60	60	60	60
Adj. R^2	0.054	0.024	0.096	0.080	-0.019	-0.054
AIC	-45.127	-39.783	-47.827	-43.303	-38.878	-33.538
BIC	-34.655	-20.934	-37.355	-24.454	-24.218	-10.500

and Family Ownership. Contrary to expectations and predictions of the investor sentiment theory, Frequency, Market Sentiment and Shipping Sentiment variables turn out to be insignificant. This finding implies no relationship between business cycles and IPO initial returns. The sentiment variables remain insignificant in a full sample estimation. Hence, the results provide no support for Hypothesis 1.

Hypothesis 2 is represented by a model that includes Ownership Concentration, Outsider Ownership, Family Ownership, which are the variables of interest, and a control variable, Price Revision. Family Ownership coefficient is found to be negative and highly significant, in line with our expectations. The coefficient ranges from -0.091 to -0.088 , which suggests that family-owned firms are underpriced less compared to non-family owned firms. This finding is consistent with the hypothesis that family firms have less incentives to underprice as the agency conflict is not severe. However, Ownership Concentration and Outsider Ownership are shown to be insignificant, contrary to our expectations. Therefore, the restricted sample results only partially support the Stoughton and Zechner theory. The full sample results confirm significance of Family Ownership. In addition, Ownership Concentration becomes marginally significant. The positive coefficient of Ownership Concentration indicates that firms with post-IPO concentrated ownership tend to underprice more. The revealed positive relationship between post-IPO ownership concentration and IPO underpricing is consistent with the Stoughton and Zechner theory. Hence, there seems to be sufficient support for Hypothesis 2 in our sample.

Hypothesis 3 is specified with a model that includes firm-specific variables of interest, such as, Firm Age, Current Ratio, Tangibility, Gearing and Turnover, and control variables, such as, Price Revision and Family Ownership. None of the firm-specific variables are found to be significant. This result is inconsistent with predictions of the information asymmetry theory and yields no support for Hypothesis 3. The results remain unchanged in a full sample estimation.

Hypothesis 4 is tested in a model that includes Price Revision as the main variable of interest and Family Ownership as a control variable. Price Revision coefficient is found to be positive and highly significant. More specifically, the coefficient is 0.455 , which suggests that the final offer price only partially adjusts to positive private information revealed by investors, which is consistent with the partial adjustment theory. Hence, there is strong evidence in favor of Hypothesis 4. This hypothesis cannot be tested for a full sample, since Price Revision can be obtained only for bookbuilding IPOs

(a restricted sample).

Overall, the results appear to be robust with respect to a sample size and model specifications. The partial adjustment theory is strongly supported in both restricted and full samples. Additionally, the Stoughton and Zechner agency cost theory seems to be relevant for pricing decisions in a shipping sector, as post-IPO ownership concentration is found to be positively related to IPO underpricing. The corroborating evidence also comes from the finding that family firms tend to be less underpriced than non-family firms. However, investor sentiment and information asymmetry do not seem to affect IPO underpricing in our sample.

5.3 Discussion

This paper examines a wider range of shipping-specific factors and underpricing theories compared to previous shipping IPO studies. In particular, we test the partial adjustment theory, the investor sentiment theory, and two conflicting ownership and control theories. The first two theories are considered as they have proved to be important in both shipping and general IPO literature. The ownership and control theories are additionally tested as they are regarded as plausible explanations of underpricing in the sector with concentrated or family ownership. Since these theories have not been extensively tested in the literature yet, and have not been considered as explanations of underpricing in a shipping sector, investigation of these theories is an important contribution of this paper. The managerial control theory by Brennan and Franks and the agency cost theory by Stoughton and Zechner provide opposite empirical predictions regarding the relationship between post-IPO ownership concentration and IPO underpricing. Hence, empirical testing is necessary in order to reveal the true underlying relationship between the two.

This paper provides supportive evidence for the agency cost theory by Stoughton and Zechner, since post-IPO ownership concentration is positively related to underpricing. Moreover, pre-IPO family ownership is found to be negatively related to underpricing, i.e. family firms tend to underprice less. This finding corroborates the agency story, as family firms do not often experience agency conflicts and, consequently, have less incentives to underprice. Hence, low underpricing in a shipping sector could be partially explained by family ownership or highly-concentrated ownership structure prevalent in shipping firms. The results are also supportive of the partial adjustment theory. Moreover, the price revision has the highest explanatory power over underpricing among

explanatory variables. Since price revision is shown to be mostly negative for our sample of shipping IPOs, there should be little to no underpricing according to the partial adjustment theory. Lastly, contrary to our expectations and previous research findings, investor sentiment variables and firm-specific variables, used to test information asymmetry argument, are found to be insignificant. Therefore, the results provide no support for the investor sentiment theory and information asymmetry argument.

The findings of this paper contribute to IPO literature in several ways. First, shipping characteristics, such as, post-IPO ownership concentration and pre-IPO family ownership are found to be significant. The coefficient signs are consistent with predictions of the Stoughton and Zechner theory, which in turn, renders null the Brennan and Franks theory. Moreover, low underpricing “puzzle” in a shipping sector can be partially explained by the Stoughton and Zechner theory. This finding accentuates the importance of accounting for sector-specific factors when explaining IPO underpricing. Second, price revision is found to be highly significant, consistent with the partial adjustment theory and previous literature. Finally, the investor sentiment theory and information asymmetry argument do not seem to be relevant for underpricing in shipping.

6 Conclusion

This paper provides additional insights into the IPO underpricing “puzzle” in a global shipping sector. The observed underpricing in shipping is rather low compared to the typical level, reported in previous studies. This paper suggests that shipping-relevant factors and underpricing theories can partially explain this empirical regularity. Among shipping-specific factors, post-IPO ownership concentration and pre-IPO family ownership turn out to be significant. However, other shipping firm-specific characteristics, such as, firm age, current ratio, tangibility, gearing and turnover are found to be insignificant. This paper also considers several underpricing theories that seem to be relevant to shipping specifics or have gained substantial empirical support in the previous literature. Specifically, we test the partial adjustment theory by Benveniste and Spindt, the investor sentiment theory, the information asymmetry argument, the agency cost theory by Stoughton and Zechner and the managerial control theory by Brennan and Franks. Consistent with previous research, the partial adjustment theory is able to explain a significant amount of underpricing in global ship-

ping. Moreover, downward price revisions prevalent among shipping firms are consistent with low underpricing in shipping. The investor sentiment theory and information asymmetry argument, contrary to expectations, are not supported by the results of this paper. Hence, low underpricing among shipping firms cannot be justified by business cycle fluctuations or low information asymmetry in this sector. Importantly, this paper provides strong evidence in favor of the Stoughton and Zechner agency cost theory, which claims that underpricing is a solution to the agency problem in the issuer's firm. The corroborating evidence also comes from the significant negative relationship between pre-IPO family ownership and IPO underpricing. Put differently, family firms typically do not experience severe agency problems, and therefore underprice less, which is fully consistent with the Stoughton and Zechner theory of underpricing. This result can partially explain lower underpricing observed in a shipping sector as most shipping firms are family-owned.

The findings of this paper can be useful for any parties involved in IPO decision-making in a shipping sector. For example, investors can exploit profitable short-selling opportunities due to larger underpricing expected from non-family shipping firms. Furthermore, this paper has significant importance for general IPO literature as it suggests potential relevance of sector-specific factors and theories to IPO underpricing by showing that shipping-specific factors do matter for underpricing in a shipping sector. An example of a shipping sector presents support for a notion that there could be sector-specific explanations of underpricing in other sectors as well. Moreover, the results for a shipping sector might be also relevant for sectors with similar characteristics. The investigation of idiosyncratic sector characteristics that could affect IPO underpricing in different sectors and testing their relevance is left to future research.

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A Explanatory variables

Table 14: List of explanatory variables

This table lists potential determinants of IPO underpricing or initial return that are used as explanatory variables. The short names, full names and descriptions of the variables are provided.

Variable name short	Variable name long	Description of variable
PR	Price Revision	A difference between the final offer price and the midpoint of the initial filing price range
Size	Offer Size	A logarithm of the offer size, defined as a number of offered shares times an offer price
Age	Firm Age	A logarithm of the firm age at IPO date (in years)
CR	Current Ratio	A ratio of current assets to current liabilities (a measure of liquidity)
Tang	Tangibility	A ratio of fixed assets to total assets of a firm
Gear	Gearing	A proxy for indebtedness of a firm, measured by a ratio of long-term debt to total capital of a firm
Turn	Turnover	A ratio of freight revenue to total assets of a firm
ROA	Return on Assets	A ratio of net income to total assets of a firm
Family	Family Ownership	A dummy variable which is equal to 1 for family-owned firms
OwnConc	Ownership Concentration	A dummy variable which is equal to 1 for firms with non-zero post-IPO ownership concentration, measured by a fraction of institutional holdings in a firm
OutOwn	Outsider Ownership	Post-IPO outsiders' holdings in a firm
Freq	Frequency	A total number of shipping IPOs in a year of an IPO
MktSent	Market Sentiment	A cumulative local market return over the last three months before an IPO
ShipSent	Shipping Sentiment	A cumulative local shipping market return over the last three months before an IPO