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Long-run performance of Initial Public Offerings and its determinants: Evidence from France

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Abstract

Using a sample of 290 firms that undertook their IPOs in France between 1999 and 2019, this paper attempts to substantiate the long-term underperformance anomaly and make up for the scarcity, unsteadiness and outdated nature of previous French studies. We examine abnormal returns throughout the 5-year window and try to explain why certain companies are more likely to perform badly on the aftermarket. Our results suggest that underperformance exists and can be observed from one year following the IPO. For most relevant methodologies, we find BHARs amounting to -12% and -30.5% for the 5-year horizon. As for aftermarket determinants, figures support the idea that young small companies that went public during periods of high investor sentiment have poorer performance on the long-run. We also discern cyclicality and bring to light a negative correlation between underpricing and the long-term performance. Our evidence is consistent with the postulates of “hot market” and fads prevalence.

I Introduction

Anomalies associated with Initial Public Offerings have been a recurring topic in the academic literature. Major findings revolve around 3 phenomena: the underpricing on the short-term (Ibbotson, 1975), the overpricing on the long-term (Ritter, 1991) and the cyclicality pattern of issuances (Ibbotson and Jaffe, 1975). The value of conducting such studies lies in the ability to test market efficiency but above all in the capacity to predict IPO performance. Understanding these mechanisms would then allow issuers to adjust the structure and timing of their offering so as to maximize their proceeds. Conversely, it would potentially help knowledgeable investors to select more advantageous opportunities.

Although a common consent has emerged around underpricing and cyclical effects, the poor abnormal performance on the long-run is still being questioned (Gompers and Lerner, 2001). Detecting return irregularities is indeed highly problematic since the intent comes down to determining what should have happened if the company had not recently gone public. In other words, we try to compare a performance to another that does not actually exist and can only be conceptualized.

Accordingly, previous studies have engendered highly divergent observations. This is particularly striking in France where some authors failed to unveil any anomaly (Degeorge and Derrien, 2001) and others even came up with overperformance (Sentis, 2001). Additionally, while many studies have been conducted in the United States and in Europe as a whole, relatively little work has been done to comprehensively and exclusively investigate the case of France.

Thereby, the purpose of this paper is to substantiate the underperformance debate and make up for the scarcity, unsteadiness and outdated nature of previous studies conducted in France. The contribution relies mainly on the use of a longer data series, the inclusion of recent listings on Euronext Paris and the assessment of abnormal returns using several benchmarks and measures. As a matter of fact, the data sample is comprised of 290 companies that conducted their IPOs in France between 1999 and 2019, that is to say listings over the past 20 years either on the former Paris New Market or on Euronext Paris.

The analysis is structured in two parts. To begin with, we test the prevalence of the long-term abnormal performance. To this end, we compute both Cumulative Average Abnormal Returns (CAARs) and Buy-and-Hold Abnormal Returns (BHARs) across the 5-year window following the IPO. For each measure, we use 4 different benchmarks in order to control for the returns sensitivity to the employed methodology. Two are based on indices (CAC All-tradable and CAC Mid & Small) and two are derived from the control firm approach. For the latter, we find a matching company for each IPO firm either

using a single criteria – size – or considering both size and book-to-market ratio. In the second instance, we try to specify factors that can explain the propensity to be subject to such anomaly. There, we conduct cross-sectional analysis and Ordinary Least Squares regressions to explore macro and micro variables affecting the long-term returns of IPOs. We put particular emphasis on the relationship between initial returns and underperformance.

Throughout the analysis, we have observed widely varying results depending on the prevailing methodology. Hence, we acknowledge the crucial importance of the benchmark. In particular, we have noticed significant discrepancies from abnormal returns computed using the CAC All-tradable index. There is a clear explanation: index constituents include large companies that substantially drive the index performance as they are heavily weighted. The thing is, almost 75% of our sample firms are companies with a size below €500 million. Using this index thus does not seem appropriate. Moreover, we also find some conflicting results using the double-matching methodology. This is due to a lower number of observation involved by matching failures and missing data. As a consequence, most of our conclusions are primarily derived from abnormal returns adjusted for the CAC Mid & Small index or a size-matched control firm.

The main finding of this paper is the recognition of an underperformance pattern on the long term. Looking at CAARs, results reveal a reversal of performance leading to negative cumulative abnormal returns from the 12th month following the issuance, the end of the "honey-moon". BHARs, that tend to provide us with a more realistic appraisal, also confirm the tendency of IPO firms to poorly perform on the aftermarket. For most relevant methodologies, we find an abnormal performance amounting to -4.7% and -10% for the 3-year horizon and to -12% and -30.5% looking at the 5-year window. Therefore, our findings support the idea that the price at issuance is driven up by most optimistic investors (Miller, 1977) and that subsequent corrections happen as uncertainty and information asymmetries decrease. Yet, those conclusions must be considered with cautious as most of our measures demonstrate a very low level of statistical significance.

The second valuable output of this study is to highlight the typical characteristics of companies that are more severely affected by the underperformance phenomenon. We notice that small young companies that came public during periods of high investor sentiment have poorer performance on the long-run. Running business in the New Economy sectors and beneficiating from Venture-Capitalist support seem to adversely affect the aftermarket as well. These relationships can be basically understood referring to two theoretical particularities. First, issuers try to time their offerings to maximize their proceeds and benefit from market momentum. Second, companies at an early stage of business development and/or with high growth potential usually present greater information

asymmetries and are therefore more prone to fads and over-enthusiasm at issuance. Interestingly, we discern cyclicality and bring to light a negative correlation between underpricing and the long-term performance. Indeed, for all our OLS models, we find negative coefficient indicating that high initial return is associated with poor long-term performance. This is consistent with the postulate of “hot market” and the impresario hypothesis (Shiller, 1988).

II Literature review

II.1 Previous findings on long-term performance and overpricing concept

The underperformance anomaly is a recurring but controversial topic in the IPO literature. In this subsection we present the conflicting outcomes of major previous studies. We consider international results and pay particular attention to what have been previously highlighted in France. Next, we summarize the various theories that contribute to rationalize the prevalence of poor abnormal performance on the long-term.

II.1.1 Empirical evidence of long-term performance

Numerous empirical studies have been investigating patterns of companies that have gone public. Among other trends, the long-term performance of IPOs has been broadly documented, especially in the United States of America (US). In his prominent paper, Ritter (1991) analyzed the 3-year performance of 1,526 IPOs that went public in the US between 1975 and 1984. He found out that if investors buy stocks at the end of the first day of trading and hold them for 3 years, they would be left with only 83 cents compared to each dollar invested in a group of matching firms.

International findings on long-term performance

Country	Authors	Sample size	Issuing period	Measure	Methodology	Statistical significance	Abnormal performance
Brazil	Aggarwal et al. (1993)	62	1980-1990	3-year AAR	Market index (BOVESPA)	Yes	-47.0%
Canada	Kooli & Suret (2002)	445	1991-1998	5-year VW CAAR	Size-matched firm	Yes	-11.02%
				5-year VW BHAR		No	-20.61%
				5-year VW CTAR		No	-11.02%
Chile	Aggarwal et al. (1993)	36	1982-1990	3-year AAR	Market index (IGPA)	No	-23.7%
China	Chang et al. (2010)	1194	1993-2004	3-year BHAR	Size-matched firm	No	-6.2%
					BTM-matched firm	No	-2.7%
					Size and BTM-matched firm	Yes	-7.8%
Germany	Schuster (2003)	155	1988-1998	3-year CAAR	Market index (FAZ)	No	-11.66%
				3-year BHR		No	98.50%
Italy	Schuster (2003)	58	1988-1998	3-year CAAR	Market index (MIB)	Yes	-41.85%
				3-year BHR		Yes	-49.24%
Spain	Schuster (2003)	53	1988-1998	3-year CAAR	Market index (IGBM)	Yes	-30.21%
				3-year BHR		No	7.27%
Sweden	Schuster (2003)	99	1988-1998	3-year CAAR	Market index (AFG)	No	-12.70%
				3-year BHR		No	-7.25%

UK	Levis (1993)	712	1980-1988	3-year CAAR	Market index (HGSC)	Yes	-8.31%
				3-year BHAR	Market index (HGSC)	n.a.	-13.65%
US	Loughran & Ritter (1995)	4,753	1970-1990	3-year EW BHR	Size-matched firm	Yes	-26.9%
				5-year EW BHR		Yes	-50.7%

Tab.1. International evidence on long-term IPO performance. "AAR" stands for average abnormal return, "CAAR" stands for cumulative average abnormal return, "BHAR" stands for buy-and-hold abnormal return, "CTAR" stands for calendar-time abnormal return. "VW" and "EW" refer to value-weighted and equally-weighted respectively. When available, we disclose returns computed from first-day rather than from the offering price. We consider statistical significance as relevant from at least 10% level.

This scrutiny hasn't been an American specificity and various studies have been conducted across markets such as Continental Europe (Schuster, 2003), the United Kingdom (UK) (Levis, 1993), Latin America (Aggarwal et al., 1993), Canada (Kooli & Suret, 2002) and China (Chang et al., 2010), etc. Table 1 sums up the contrasted previous results on IPO long-term performance.

Previous findings on the French market

Authors	Sample size	Issuing period	Measure	Methodology	Statistical significance	Abnormal performance
Derrien & Womack (2003)	264	1992-1998	2-year CAAR	Size and BTM-matched portfolio	No	-6.27%
Mansali & Labegorre (2010)	379	1990-2003	5-year CAAR	Industry and size-matched firm	Yes	-18.61%
			5-year BHAR		Yes	-48.54%
Schuster (2003)	213	1988-1998	3-year CAAR	Market index (SBF250)	Yes	-19.01%
			3-year BHR		No	-20.74%
Sentis (2001)	61	1991-1995	3-year BHAR	Market index (SBF250)	No	10.86%
			3-year BHAR	Industry and size-matched firm	No	29.88%

Tab. 2. French evidence on long-term IPO performance. "CAAR" stands for cumulative average abnormal return and "BHAR" for buy-and-hold abnormal return. When available, we disclose returns computed from first-day rather than from the offering price. We consider statistical significance as relevant from at least 10% level.

Studies conducted in France have led to very divergent conclusions as exemplified in Table 2. As a case in point, Degeorge and Derrien (2001) claimed that no underperformance over the 3-year period was noticeable for French IPOs that took place between 1991 and 1998. Sentis (2001) even found significantly positive abnormal returns for the first-year horizon (21.87% average return with 2.07 t-statistics). Conversely, Mansali & Labegorre (2010) reported significant long-term underperformance.

Still, when compared to other geographical region, the literature related to the IPO aftermarket in France remains very sparse. Indeed, most authors have integrated French data for the purpose of aggregating European data (Schuster, 2003) but France was rarely the core focus of the study. Additionally, all references mentioned above deal with sample of firms that listed on the former French

"Second Marché" and "Nouveau Marché". Those two compartments disappeared in 2005 following the creation of a single regulated market, Eurolist. The intended contribution of this paper is therefore to provide a comprehensive and updated analysis that integrates the Euronext Paris framework.

II.1.2 The overpricing theories

In this context, the long-term analysis of IPOs is commonly associated with the idea of overpricing and poor performance. In other words, taking a long-term picture, IPO firms tend to be overvalued at issuance. This notion has been summarized by Ritter (1991) as the fact that after going public "firms significantly underperformed a set of comparable firms matched by size and industry".

This anomaly has been early conceptualized and predicted by Miller in his theory of heterogeneity of investor beliefs. Indeed, Miller (1977) pointed out that due to uncertainty, investors have different estimates of return. In a world without short-selling, the price is determined by most optimistic investors who will bid the stock up to a value that is above the mean evaluation of potential investors. As a result, the greater the divergence, the higher the price. In the case of a firm going public, the divergence will be at its height when the stock is issued and will then decreased over time jointly with uncertainty and information availability. This can provide an explanation of the poor performance phenomenon.

Another logic to this underperformance can be found in the windows of opportunity and timing theories. IPO market is indeed characterized by periods of high-volume issuances where issuers tend to take advantage of high investor sentiment in order to maximize their proceeds. Those so-called "hot-periods" are generally associated with high initial returns (Ibbotson and Jaffe, 1975) and may induce subsequent adjustments on the long-run. We will revert and provide more substance to this rationale in upcoming sections.

A third explanation is the existence of fads in the IPO market. The excess demand can be rationalized using the overreaction (De Bondt and Thaler, 1985) and impresario (Shiller, 1988) hypotheses. According to the first one, investors tend to excessively react to noticeable news events thereby breaching the Bayes rule. Besides, the impresario theory claims that underwriters deliberately underprice offerings to artificially kindle investors' interest.

Yet, the concept of overpricing is not universally accepted and has been continuously questioned for both theory and methodology – as we will develop further in section III.2. – purposes.

II.2 Analysis of previous research on factors influencing the aftermarket performance

Here, we report and examine factors that have been previously documented due to their presupposed effect on IPO long-term performance. First, we differentiate micro and macro variables and try to set up a comprehensive overview of main interesting findings. Then, we place special emphasis on the relationship between initial returns and long-term abnormal returns. Those latter are the two main anomalies in the IPO market and many authors have tried to apprehend the relationship between them.

II.2.1 Micro and macro indicators

Indicators likely to explain IPO performance on the long run	
Micro factors	**Macro factors**
Industry sector	Economy cycle (growth)
Age and firm size	Volatility and uncertainty
Offer size and structure	Market liquidity
Ownership structure	Investor sentiment
VC and PE backing	IPO market condition (volume)
Governance and board size	Interest rates
Prospectus disclosure	Listing rules and regulation
Profitability	Place of quotation
Spending on R&D	Government intervention
Tangibility of assets	
Financial position and leverage	
ESG integration	
Initial return	
Underwriter reputation and fees	

Tab. 3. Summary of main factors affecting the long-term return of IPO firms.

All information available prior and after the issuance can potentially impact the IPO pricing and its subsequent performance depending on how it affects investor's belief and return estimation. The information can either be specific to the firm and the offering; in such case it can be gauged through micro variables. Or, it can rely on the overall environment and external factors; in this case macro indicators provide a useful tool to assess the effect on the long-run.

In Table 3, we intend to draw an overview of factors that have been previously investigated to explain IPO performance. The significance of impact highly differs depending on the variable and most of them are still highly questioned among academics.

Micro variables are the most obvious parameters to integrate when it comes to understand investors' perception and evaluation of a firm that is going public. Every company is unique: in terms of business

of course – the industry – but also in terms of management, organization, maturity, financial structure, culture etc – in short, the way they operate the business.

Since Ritter (1991), three main micro factors have been broadly recognized as determinants of long-term performance: industry, size and age. Then, authors such as Brav and Gompers (1997) integrated the book-to-market ratio in their studies. Profitability (prior and forecasted) thereby became another screening item. They also introduced a distinction between venture and non-venture capital-backed company. We will expand on those "most renowned" factors in our OLS models and cross-sectional analysis.

Broadly speaking, all items linked to the financial and operating characteristics of a company can possibly influence returns forecast and performance. Based on prospectus data, Bhabra and Pettway (2003) analyzed the relationship between long-term performance and more precise factors such as tangibility of assets, leverage and spending on R&D. They also looked at data specific to prospectus drafting including the number of disclosed risk factors. However, if their results reveal some kind of relationship up to one year, the explanation power of prospectus data decreases substantially overtime.

Ownership structure and governance have also been regarded. Looking at variables such as board size and independence, share of insider ownership and CEO/Chairman duality, Howton et al. (2001) managed to highlight a relationship between board structure and IPO anomalies on the short and long-run. They showed that long-term performance is correlated to the share ownership by insiders: having insiders as shareholders favors alignment of interest and limits IPO underperformance.

Some determinants may also come from the offering structure itself: offer size, type of offering (book-building, auction), underwriters reputation, amount of fees, dilution and primary shares issuance, lock-up periods etc[1]. The literature has most extensively documented the relationship between those items and short-term returns. Yet, as they have an impact on the pricing and the perceived riskiness of the operation, their effect on the aftermarket is contemplated as well.

More recently, other considerations such as Corporate Social Responsibility (CSR) have been scrutinized. Chan and Walter (2014) found conclusive evidence that environmentally-friendly firms

[1] For more information, relevant literature includes:

- Carter, R.B., Manaster, S., 1990. Initial public offerings and underwriter reputation. Journal of Finance 65, 1045-1067.
- Goergen, M., Khurshed, A. and Mudambi, R. (2007), "The long-run performance of UK IPOs: can it be predicted", Managerial Finance, Vol. 33 No. 6, pp. 401-419.
- Sherman, Ann, 2002, Global trends in IPO methods: Book building vs. auctions, University of Notre Dame working paper.

outperform other firms looking at the one year window post issuance (12.4% vs. -7.1% one-year BHAR). This argument is consistent with the idea that firms incorporating environmental standards are likely to avoid additional costs induced by CSR crises and environmental disaster on the long-run.

Furthermore, IPO pricing and subsequent performance are dependent from the prevailing economic conditions and the overall market environment. Yet, the direct influence of macroeconomic factors on IPO timing and performance have been only investigated much more recently and is still triggering discordances.

One of the only macro effects to reach consensus is the influence of investor sentiment and IPO issuance volumes. Those relationships constitute the key pillars of the cyclical and windows of opportunity features. In line with the "hot market" theory developed by Ibbotson and Jaffe (1975), Lee, Shleifer, and Thaler (1991) substantiated that investor sentiment has a high role to play in the decision of going public. Indeed, using discounts on closed-end fund as a measure of investor optimism, they showed that more companies go public when discounts are low i.e. when investor sentiment is high (–19.3 coefficient with statistical significance at 1% level, 41% R-square). The correlation with high IPO volume thereby reflects the issuers' intent to benefit from this optimism and ensuing inflated valuations.

As for business cycle, GDP explanatory power is much more controversial. Using data across 15 countries, Loughran et al. (1994) failed to significantly identify relationship between IPO volume and investment opportunities assessed using 3-year GNP growth rate (t and t+2 horizons). Yet, they prove positive correlation with the inflation-adjusted level of the stock market. On the contrary, some authors brought to the fore differing tendency. The study of La Porta et al. (1997) using a data sample across 49 countries is a case in point. Their primary intent was to investigate the influence of economic conditions and more specifically legal systems on equity and debt markets. Highlighting differences between civil and common law countries, they concluded that weak investor protection – measured by the character of legal rules and the quality of law enforcement – leads to narrow capital markets. In this regard, please note that their thesis further manifest the influence of macro-environment. Incidentally, they also demonstrate that the GDP growth rate has a statistically significant effect on IPOs when controlling for legal origin: a 1% increase in GDP growth raises the number of IPOs by about 0.2. Other authors have exemplified similar effect such as Meluzín et al. (2014) in Poland.

II.2.2 Relationship between initial return and long-term performance

IPO initial returns and related underpricing have been among first IPO patterns to be unveiled in the literature. As early as 1929, *The Economist*[2] reported that shares were sold at a lower price than the one at which they began trading, thereby undermining issuer proceeds. Since then, the anomaly has been extensively discussed and numerous theories have been framed to explain its survival and variations among time, firms and market places.

While the existence of underpricing is widely accepted, its relationship and impact on the long-term performance is still a subject of controversy among academics. A greater number of authors have tip the balance in favor of a negative relationship between both horizons. A higher underpricing would induce poorer long-term returns: that is to say higher level of underperformance. This is aligned with Ritter (1991)'s findings and conclusion: "There is some tendency for firms with high adjusted initial returns to have the worst aftermarket performance." Yet, other studies belie this standpoint. For instance, Schuster (2003) analyzed 973 European IPOs during 1988 and 1998 and found out that companies having the highest initial returns also have the best aftermarket performance. Table 4 presents main theories that provide arguments substantiating each stance.

Theory	Author	Description
Hypothesis supporting a negative relationship between underpricing and the aftermarket		
The overreaction hypothesis	De Bondt and Thaler (1985)	Individuals tend to react excessively to unexpected and dramatic news events. This hypothesis predicts that as stocks experience more extreme returns the subsequent price reversals will be more pronounced. Similarly to the portfolio formation phenomenon studied by the authors, the IPO is a period of extreme returns – mostly characterised by extremely high initial performance – that will be notably rectified in the long-term.
The impresario hypothesis	Shiller (1988)	Underwriters deliberately underprice issuances in order to fuel positive impression among investors and create a favourable reputation with regard to their clients. This tendency can be compared to imresarios who provide ticket reductions for publicity purposes so as to enhance the reputation of the performer and increase prices for subsequent concerts. But as this inflated enthusiasm disappears overtime, this trend can contribute to poorer aftermarket performance.
Legal liability	Tiniç (1988)	Underpricing can be seen as a form of insurance against legal liability and potential reputational damages. As an illustration, in the US since the Securities Act of 1933, investment bankers can be sued if they do not conduct sufficient due-diligences and fail to prevent omissions,

[2] The Economist, 27 July 1929, p.175-6.

		false and/or misleading information. Large initial returns provide the advantages to reduce the probability of a lawsuit brought by an investor and to decrease the maximum dollar amount cost as the recoverable damage is limited to the offer price. If underwriters have specific concerns about the issuance, they will voluntarily leave behind some market optimism. If those fears crystallised afterwards, it may affect the long-term performance.
Hypothesis supporting a positive relationship between underpricing and the aftermarket		
Signalling	Allen and Faulhaber (1989)	Underpricing is a signal of high-quality firm. This theory is based on the assumption that managers and insiders are better informed about the firm prospects. As a result, managers of good firms use lower IPO price and quantity in order to signal their superiority. Indeed, only good firms can be expected to recoup this initial loss. This leads to investors' increased satisfaction and the issuer may be able to raise additional funds at an attractive price in the future. In this case, greater underpricing is consistent with better performance on the long-run.

Tab. 4. Summary of main theories providing explanations as regards to the relationship between initial return and long-term performance.

III Data and methodology

In the subsequent section, we provide a comprehensive description of the IPO sample construction and composition. We then investigate difficulties related to the methodology and detail measures and benchmarks that we have selected to assess abnormal returns.

III.1 Data sample

The IPO dataset is extracted from Bloomberg database and includes listings meeting the following criteria: (1) the company is listed in France (2) the pricing date is between 1999 and 2019 and (3) the company is not a closed-end fund, a REIT, a SPE nor a SPAC. This first extract was composed of 484 companies. Then, in order to get meaningful data, we further restricted this sample by adding two additional filters: (4) the offer size is above €10 million and (5) the offer price is not equal to 0. Also, we manually excluded 5 companies due to lack of data or no correspondence with the above set of criteria. Consequently, our final sample is comprised of 290 IPOs. Figure 1 shows the distribution of our sample compared to all French listings reported on Bloomberg for the corresponding period. We can thus notice its representativeness.

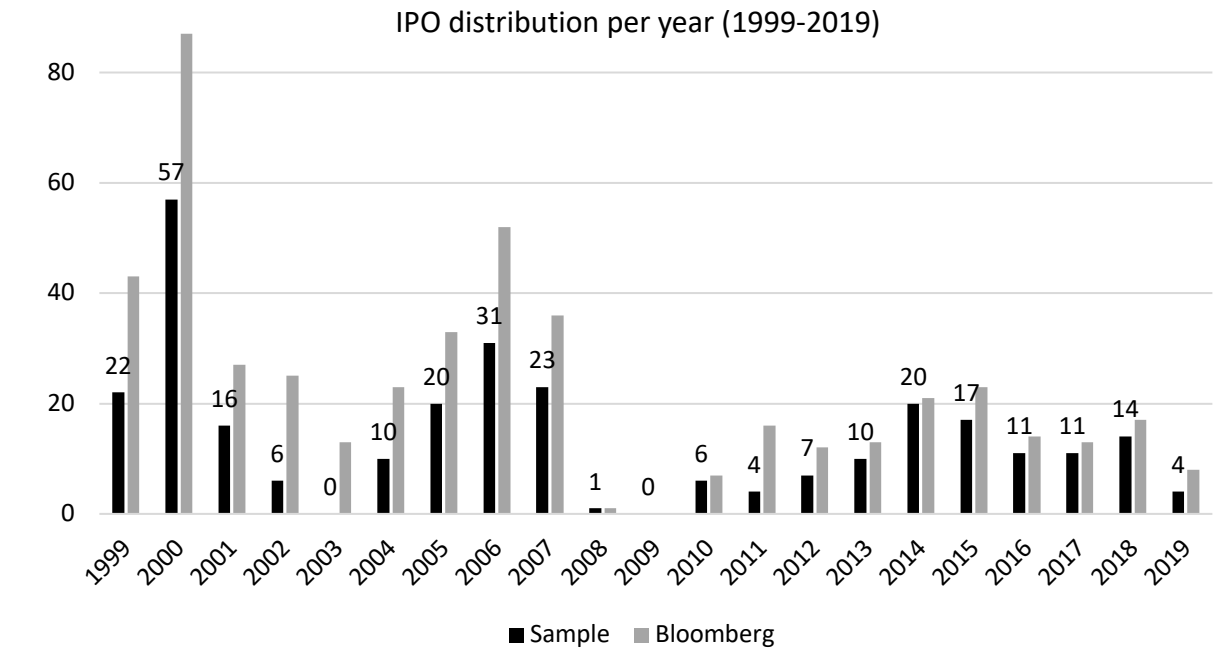

Fig. 1. Distribution of French listings by year of issuance in terms of the number of offers. The sample consists of 290 IPOs as per previous defined criteria and is compared to the preliminary Bloomberg extract.

The apparent distribution of French IPOs throughout the considered 20-year period seems consistent with the widely discussed phenomenon of IPO cyclical pattern. As previously stated, IPO activity is subject to anomalies involving high volume of issues during so called "hot issue" periods. Ibbotson and Jaffe (1975) were among the first to document the existence of such periods in the US and further identified a significant correlation between the IPO volume and the monthly average underpricing. Here, we can recognize 3 periods of "hot" markets: 1999-2000, 2006-2007 and 2014-2015. Almost 60% of offerings included in our sample (i.e. 170 IPOs) occurred during those 6 years. Conversely, if we consider the "cold" periods following the dot-com bubble (2002-2003) and the financial crisis (2008-2011), only 17 IPOs took place over the same number of years.

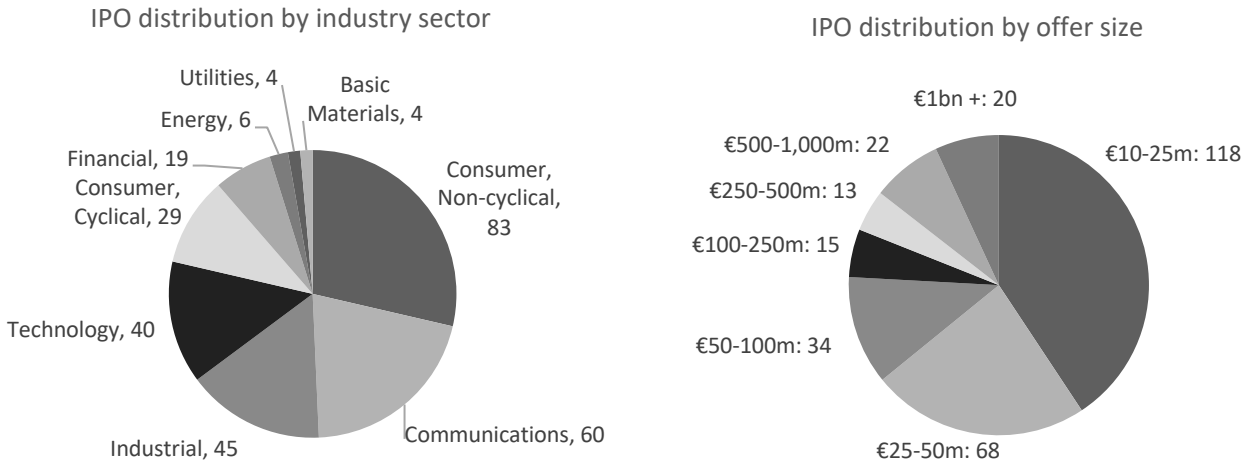

Fig. 2. Distribution of our sample IPOs by sector and offer size in terms of numbers of offers. The sample consists of 290 IPOs as per previous defined criteria, including offer size filter i.e. above €10 million.

	Number of IPOs	Proceeds (€m)
Size (market capitalization)		
< €50 million	52	853
€50 million < Size ≤ €100 million	58	1,169
€100 million < Size ≤ €500 million	100	4,970
€500 million < Size ≤ €1 billion	15	4,068
€1 billion < Size ≤ €5 billion	40	29,543
> €5 billion	13	36,734
Sample	**290**	**77,872**

Tab. 5. Distribution of our sample IPOs by market capitalization. The sample consists of 290 IPOs as per previous defined criteria. Market capitalization refers to the first market capitalization available on Bloomberg within the first year from issuance.

Table 5 and Figure 3 illustrate the typical size of firms included in our sample. Please note that the sum of IPO number and proceeds does not match the total as we are lacking 12 market capitalizations (no quotation was available on Bloomberg within the first 12 month following the issuance).

In line with common sense intuition, we can observe that most IPOs are relatively small companies. Indeed, more than 1/3rd of our firms have a market capitalization below €100 million and almost 75% of listings are companies with a size below €500 million. On the contrary, only 53 companies have an initial market capitalization above €1 billion (including 8 above €10 billion).

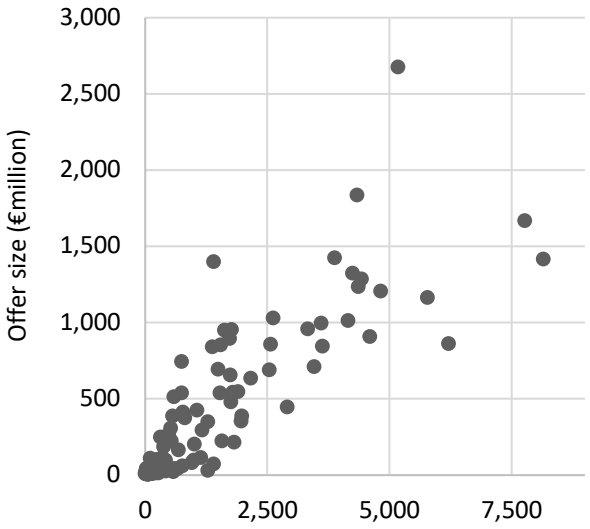

Fig. 3. Sample firms offer size displays in function of total market capitalization. The sample consists of 290 IPOs as per previous defined criteria. Market capitalization refers to the first market capitalization available on Bloomberg within the first year from issuance. For sake of visibility, the top 8 IPOs with market capitalization above €10 billion are not disclosed.

III.2 Empirical measures of long-term performance

Contrary to initial returns, measuring the long-run performance is not straightforward and has been questioned in several papers. Relevance of approaches and metrics is still debated.

In the first place, the long-run horizon is not homogeneously defined. Yet, it is commonly assessed for a minimum 1-year period and most studies are investigating the 3-year and 5-year windows.

Then, when it comes to post-IPO analysis, assessing long-term performance necessary relates to abnormal returns. In other words, are average returns trends specific to firms having experienced an IPO?

III.2.1 The joint-hypothesis problem and methodology issues

By nature, long-horizon tests are bound to suffer from the joint-hypothesis problem. Indeed, to test whether there is an "abnormal" return, once should first calculate the "normal" or expected rate of return. The problem is thus twofold: the approach must test whether the abnormal return is zero and whether the theoretical model predicting the expected return is correct.

As a consequence, the choice of methodology can lead to very different conclusions when it comes to appraising the existence of abnormal returns. This should not be underestimated. Fama (1998) even states that abnormal performances can be explained by wrong measurements and that anomalies tend to disappear when the right adjustments are made.

As an illustration, Brav and Gompers (1997) took up Loughran and Ritter (1995) work and adjusted their results for book-to-market effect. They found that IPO firms perform as well as the benchmark and that venture-backed IPOS even significantly outperform their relative portfolios. As a result, the poor performance initially documented by Loughran and Ritter (1995) can no longer be attributed to the IPO effect but rather to the fact that IPO firms are primarily small and low book-to-market firms.

Another finding of Brav and Gompers (1997) is that anomalies of 5-year buy-and-hold returns decline when IPOs and reference benchmarks returns are weighted by the first available market value instead of being weighted equally.

Still, we cannot radically ignore the idea of long-term underperformance as exemplified by continuous and more recent statistics. In the US, Ritter (2019) highlights an underperformance relative to other firms of the same size and book-to-market ratio of around 2.1% per year between 1980 and 2017.

III.2.2 Event studies vs calendar-time approach

Two main approaches have been developed in the literature: the event-study and the calendar-time portfolio methodologies.

- The aim of an event study is to gauge the effect of a specific event – corporate decision or economic event – on the stock price behavior of a sample of firms. In this study, firms are experiencing the same event i.e. going public at different points in calendar time. For each stock, the return is then assessed relatively to the event, not the calendar date. Event studies allow to measure the unanticipated impact of a corporate decision on the wealth of the claimholders. Additionally, it is used to test market efficiency. Indeed, in a context of perfect information efficiency, there should be an immediate reaction but no further reaction on the long-run i.e. abnormal performance should not persist over time.

- Calendar-time portfolio approach is also known as Jensen-alpha approach. In this method, a portfolio is constructed for each calendar month of the sample period. Assuming that our long-run horizon is 1 year, it will include all firms that have experienced the event within the previous year. The main difficulty with this method is that event firms' are not linearly distributed throughout the time period. This has been widely documented for newly listed firms: market timing is one of the most substantial IPO pattern under study since Ibbotson and Jaffe (1975). Consequently, the portfolio will be rebalanced each month as new firms will be added and others will exit. Eventually, portfolio excess returns are computed each month and a multifactor regression is run (e.g. CAPM, Fama-French three factors). The intercept resulting from this regression can then be analysed and interpreted as the post-event abnormal performance.

In the subsequent analysis, we will focus on the event-study approach. This preference can be justified by the following two rationales.

First, as mentioned by Loughran and Ritter (2000), the calendar-time portfolio approach can be biased toward underestimated abnormal returns. As stated above, this is due to the attempt of managers to take advantage of time-varying misvaluations or so called windows of opportunity. Accordingly, Loughran and Ritter (2000) state that "tests that weight firms equally should have more power than tests that weight each time period equally". In other words, using alternative approach such as buy-and-hold returns tend to capture more anomalies.

Secondly, another logical basis for using event-study analysis is that it can draw up a more realistic representation of investor behavior. Kothari and Warner (2007) explain that the BHAR method – that we will develop further – is actually closer to investors' investment experience than an approach involving monthly (or even daily) rebalancing.

However, cautiousness is still required as BHAR approach is not exempted of bias. Some may even argue in favor of calendar-time approach subject to standardization (Dutta, 2014). Eventually, the joint-hypothesis dilemma remains.

III.2.3 Returns computation

The initial return is computed on the first day of trading using the widespread method of raw initial return. For issuing firm *i*, it is defined as follows:

$$IR_i = \frac{P_{i,1}}{P_{i,0}} - 1$$

Where $P_{i,0}$ is the offer price of company *i* and $P_{i,1}$ is the first day closing price. Data used for closing price is the unadjusted price historically determined on the stock exchange and therefore does not take into account subsequent operations.

For all other metrics, monthly returns are calculated using Bloomberg closing prices that are adjusted for capital actions (stock splits, repurchases or dividends) and all of the prices are disclosed in euro.

For both CAARs and BHARs, we will exclude the initial return meaning that returns will be calculated from the first close price available. Each month period is defined as a consecutive 21-day trading interval.

Returns are through December 31 2019. As our sample include IPOs from 1999 to 2019, the 1-year returns are only for IPOs from 1999 to 2018, 3-year returns for IPOs from 1999 to 2016 and 5-year returns for IPOs from 1999 to 2014.

III.2.4 Cumulative abnormal returns

The cumulative average abnormal return (CAAR) is a widely used measure of abnormal return. It is the sum of each month's average abnormal performance of the whole firm sample. The abnormal performance is calculated for firm i as the difference between monthly IPO return and the corresponding matching firm return:

$$ar_{it} = r_{it} - r_{mt}$$

r_{it} is the return of firm *i* and r_{mt} the return of the matching firm or benchmark for month t. We then compute the average abnormal return in event month *t* (not calendar period) for the whole portfolio of IPO firms. We use the equally-weighted arithmetic mean:

$$ARR_t = \frac{1}{n}\sum_{i=1}^{n} ar_{it}$$

CAAR from month q to month s is then defined as:

$$CAAR_{qs} = \sum_{t=q}^{s} ARR_t$$

Because IPO firms can be delisted before the end of our period sample, CAARs indirectly incorporate monthly portfolio rebalancing. For ARR_t computation, n is thus the number of firm still listed in month t following the IPO.

For the purpose of this analysis, we will focus on 1-year, 3-year and 5-year abnormal returns following the IPO.

III.2.5 Buy-and-hold abnormal returns

As opposed to the CAAR method, the Buy-and-hold abnormal return (BHAR) method first compounds each firm's abnormal returns over a defined period and then uses the mean as the performance measure. This is considered to be more consistent with actual investor behavior as it essentially represents the abnormal return of a portfolio strategy consisting in buying stocks on their first trading day (precisely at closing) and passively holding them over *T* periods.

The BHAR for firm *i* is calculated for a *T*-month period as:

$$BHAR_{iT} = \prod_{t=1}^{T}(1 + r_{it}) - \prod_{t=1}^{T}(1 + r_{mt})$$

Then, using equally-weighted arithmetic mean:

$$BHAR_T = \frac{1}{n}\sum_{i=1}^{n} BHAR_i$$

Similarly to our CAAR measures, we will look in particular at the post-IPO BHARs over the 1-year, 3-year and 5-year periods. Note that returns will include only IPOs that survived for the considered period.

III.2.6 Wealth relatives

To interpret the BHAR performance, we also compute wealth relatives (WR) as a performance measure. The wealth relative is the ratio of the end-of-period wealth from holding a portfolio of IPO firms to the end-of-period wealth from holding a portfolio of matching firms. Wealth relatives can be assessed with or without compounding returns monthly. However, in this paper, we will use similar approaches to Ritter (1991) and Loughran and Ritter (1995) and use compounded returns. Consequently, we will use the subsequent formula:

$$WR_{iT} = \frac{\prod_{t=1}^{T}(1 + r_{it})}{\prod_{t=1}^{T}(1 + r_{mt})}$$

For the entire sample, we then have:

$$WR_T = \frac{1}{n}\sum_{i=1}^{n} WR_i$$

A wealth relative greater than 1.00 indicates outperformance while a ratio less than 1.00 indicates IPO underperformance.

III.2.7 Benchmark sensitivity and selection

As mentioned at the beginning of this section, abnormal returns are highly sensitive to the employed methodology and choosing a consistent matching firm is one of the hottest issue.

We use two different approaches: first, we adjust returns for reference portfolios using the CAC All-Tradable and CAC Mid & Small indices. However, the use of those CAC indices as benchmarks may induce biases as they are value-weighted while our IPO returns are equally-weighted. Additionally, firms included in those indices may present notable differences compared to our sample.

As an alternative, we secondly use the control firm approach. Sample firms are matched to a control firm depending on size and book-to-market characteristics. We run two matching procedures: the first one based on market capitalization only and the second one on both factors. The latest also allows us to control for effects evidenced by Brav and Gompers (1997) and explained above.

To find our control firm we first aggregate all firms listing on the former Paris New Market as well as on Euronext Paris at the end of each year of our prevailing period. Then, adopting a similar approach to Loughran and Ritter (1995), we take the market capitalizations on each last trading day of the year – being most of the time December 31 – provided that they have been public for at least 3 years.

For the matching procedure based on a single parameter i.e. size only, the matching firm is then defined as the firm with the closest market capitalization provided that the value is between 75% and 125% of the issuing firm capitalization.

For the second procedure, we first filter on market capitalization and then match book-to-market ratio as per Barber and Lyon (1997) methodology. Indeed, the authors show that test statistics following this methodology were well specified in all their sampling situations.

More precisely, we first identify all firms listed in the prevailing year (and for at least 3 years) with market value between 75% and 125% of the sample firm market capitalization. Then, we choose our matching firm among this set as the non-issuing firm with the closest book-to-market ratio. To do this, the book-to-market ratio for all of the companies available on Bloomberg, which were traded on the French market, are estimated at the end of December each year from 1999 to 2019. As per issuing firm, we take the first market capitalization and book-to-market ratio available on Bloomberg after the IPO as long as it is within one year from the offering date.

For both procedure, if a matching firm is delisted – or data is lacking – within 3 years, a second matching firm is introduced in place of the first one. This replacement firm is the non-issuing company with the second closest market capitalization in the simple matching procedure. In the double-criteria matching procedure, it is the one with the second closest book-to-market ratio among the size-based preselected firms.

As data – especially book-to-market – is not always available, we failed matching numerous IPO firms using these procedures: we couldn't find appropriate matching firms for 20 and 107 companies for procedures based on size only and on both factors respectively. As a result, the approach based only on market capitalization may appear as more representative.

Please note that we do not consider matching by industry as per Loughran and Ritter (1995) arguments: firms can time their offers to take advantage of sector misvaluations and public firms with same industry and size characteristics are scarce.

IV Empirical results and discussion

All figures and statistical findings are disclosed and discussed in this section. At first, we analyze whether our CAAR and BHAR results validate the underperformance anomaly. Afterwards, we investigate factors that affect the long-term performance using cross-sectional analysis and OLS regressions. There, we try to identify variables that increase the likelihood of companies to poorly perform on the aftermarket.

IV.1 Abnormal returns

IV.1.1 Cumulative average abnormal returns

Figure 4 depicts cumulative average abnormal returns during the 5-year period following the public offer. Abnormal returns computed using the control-firm approach and those adjusted for CAC Mid & Small index consistently illustrate the underperformance trend over the long-term. Visually, this pattern seems to materialize roughly 12 months after the issuance.

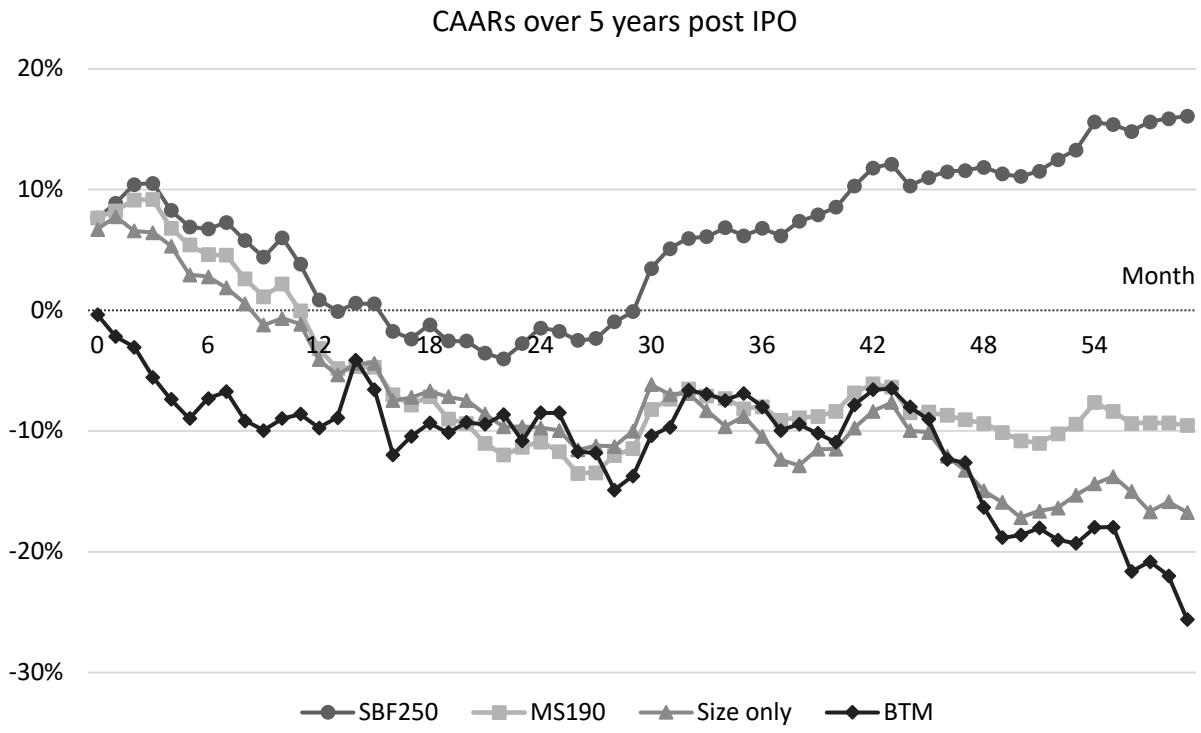

Fig. 4. Equally weighted cumulative abnormal returns measured from first closing market price. The figure compares the aftermarket performance over the 5-year period following the IPO using different various benchmarks; "SBF250" stands for CAC-All tradable index (i.e. all firms traded on Euronext Paris with a minimum 20% free float annual velocity), "MS190" stands for CAC Mid & Small index, "Size only" refers to abnormal returns calculated from matching firms based on market capitalization and "BTM" refers to abnormal returns calculated using control firms matched using size and book-to-market ratio.

Returns resulting from the CAC All-tradable adjustment appear totally in conflict with the long-term anomaly as CAARs become positive from the 31st month onwards. Yet, we should not make a case of such observation as this adjustment is not appropriate. As a matter of fact, we previously indicated that most of the sample IPO firms are small companies (most of them having a market capitalization far below €1 billion). However, the CAC All-Tradable index – as opposed to the CAC Mid & Small – includes the 60 companies with the highest ranking in terms of free float market capitalization and turnover. As a reference, if we look at such companies today, their market capitalizations are well above €1 billion and even predominantly go beyond €50 billion. Assessing abnormal returns using CAC All-tradable benchmark is comparing apples and oranges.

Additionally, indices are value-weighted meaning that those large companies have a magnified effect on index fluctuation. Figure 5 demonstrates this impact and the subsequent divergence: over the considered period CAC All-Tradable has largely underperformed indices with smaller components. This chart also provides justification regarding the suitability of CAC Mid & Small index with respect to CAC Small. The volatility difference between them tends to be negligible and using those two benchmarks would have been redundant.

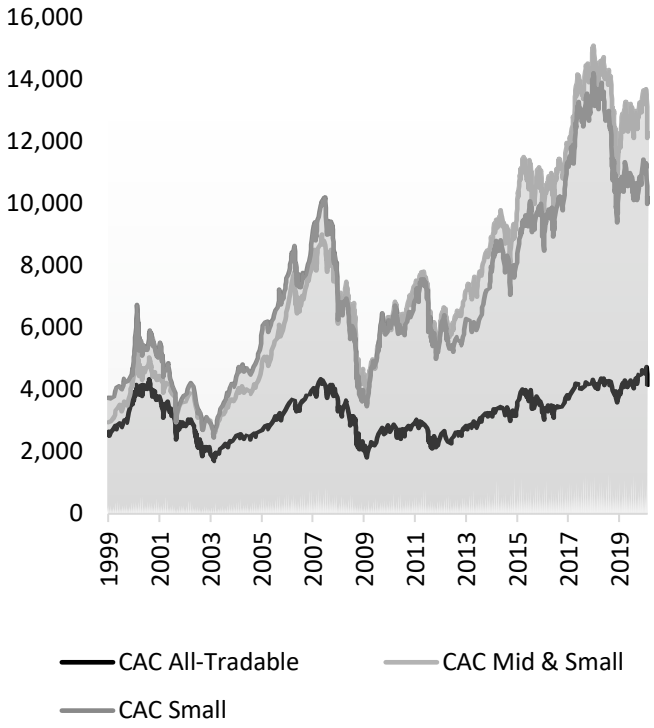

Fig. 5. Evolution of main French indices since 1999; Bloomberg data extracted using SBF250, MS190 and CS90 tickers.

Table 6 provide additional details on CAAR results. Excluding results based on SBF250 adjustments, CAARs become negative from the 12-month horizon, the end of the "honey-moon". From this point, the long-term underperformance effect strengthen and the statistical significance goes down. At 3 years, CAARs are ranging from -6.87% (t-statistic: -0.60) to -8.77% (t-statistic: -0.94) depending on the benchmark but they are not statistically significant. At 5 years, the cumulative abnormal return calculating using the 2-step matching approach is -25.59% and statistically significant at the 10% level.

	Portfolio adjusted - SBF250				Portfolio adjusted - MS190			
Month	**IPOs trading**	**AARs**	**CAARs**	**t-stat**	**IPOs trading**	**AARs**	**CAARs**	**t-stat**
1	282	7.63%	7.63%	4.93	282	7.67%	7.67%	4.96
2	282	1.26%	8.89%	4.06	282	0.58%	8.25%	3.77
3	282	1.54%	10.42%	3.88	282	0.90%	9.14%	3.42
6	277	-1.36%	6.92%	1.82	277	-1.41%	5.40%	1.43
12	274	-2.20%	3.82%	0.71	274	-2.21%	-0.04%	-0.01
24	250	1.25%	-2.77%	-0.36	250	0.67%	-11.33%	-1.50
36	230	-0.66%	6.19%	0.67	230	-0.83%	-8.13%	-0.88
48	211	0.12%	11.60%	1.08	211	-0.39%	-9.07%	-0.85
60	189	0.19%	16.08%	1.34	189	-0.17%	-9.51%	-0.79

	Control firm - Size only				Control firm - Size and BTM			
Month	**IPOs trading**	**AARs**	**CAARs**	**t-stat**	**IPOs trading**	**AARs**	**CAARs**	**t-stat**
1	267	6.70%	6.70%	4.30	180	-0.35%	-0.35%	-0.18
2	268	1.06%	7.76%	3.52	181	-1.82%	-2.16%	-0.80
3	267	-1.18%	6.58%	2.44	180	-0.88%	-3.04%	-0.91
6	262	-2.38%	2.95%	0.77	177	-1.59%	-8.97%	-1.91
12	258	-0.47%	-1.13%	-0.21	173	0.37%	-8.60%	-1.29
24	231	0.03%	-9.62%	-1.26	145	-2.20%	-10.81%	-1.15
36	211	0.87%	-8.77%	-0.94	128	0.57%	-6.87%	-0.60
48	180	-1.15%	-13.25%	-1.23	104	-0.30%	-12.62%	-0.95
60	152	-0.88%	-16.72%	-1.39	63	-3.60%	-25.59%	-1.72

Tab. 6. Equally-weighted cumulative average abnormal returns over the 5-year aftermarket period. Average abnormal returns (AARs) and cumulative average abnormal returns (CAARs) are computed as described in section III.2. Both CAAR and BHAR methods test the null hypothesis that mean abnormal performance is equal to zero. For the CAAR, a standard test statistic is the CAAR divided by an estimate of its standard deviation: $t = \frac{CAAR_{qs}}{\sqrt{{\sigma_{qs}}^2}}$

where ${\sigma_{qs}}^2 = (q - s)\,\sigma^2(AAR_t)$.

$\sigma^2(AAR_t)$ is the variance of the one-period mean abnormal return. This equation means that the CAAR has a higher variance the longer is the horizon length. We highlighted the 3-year and 5-year horizons that are key to our long-term analysis.

In a word, it seems that IPO firms come up with lower returns than other companies on the long-term aftermarket. However, we must notice that the degree of significance of these anomalies is very low and rejecting the null hypothesis is statistically questionable.

IV.1.2 Buy-and-hold abnormal returns

BHARs calculated for the sample IPO firms are reported in Figure 6. The overall trend seems aligned with the long-term underperformance pattern and relatively similar to our previous CAARs observations.

As we detailed above (see section IV. 1.), BHARs calculating using the SBF250 adjustment are not actually pertinent. CAC All-tradable index is indeed influenced by large companies that have relatively

poorly performed in recent years. Additionally, the number of observations for the BHARs based on both size and book-to-market criteria is significatively reduced due to matching failures. As we kept matching firms that have delisted or that were lacking data after 3 years, the 48-month and 60-month BHAR observations may also be sparse. Accordingly, the number of observations drops from 180 to 85 for the 1-month and 60-month BHARs respectively when using the two-step matching methodology. This leads to the average being highly affected by extreme values and provides a rationale for monitoring alternative indicators such as the median.

To test and control for the impact of the reduced number of observations, we computed BHARs adjusted for CAC Mid & Small using the same IPO sample as the one available for the Size and BTM approach. The results (disclosed in Appendix 3) confirm the existence of a bias linked to the scarcity of observations. Indeed, we obtained positive BHARs as well (2.38 and 5.61 for 4-year and 5-year horizons). The double-step methodology is undoubtedly relevant from a theoretical stance, yet in practice, it is more complicated to implement and results are drastically affected by the reduced number of observations.

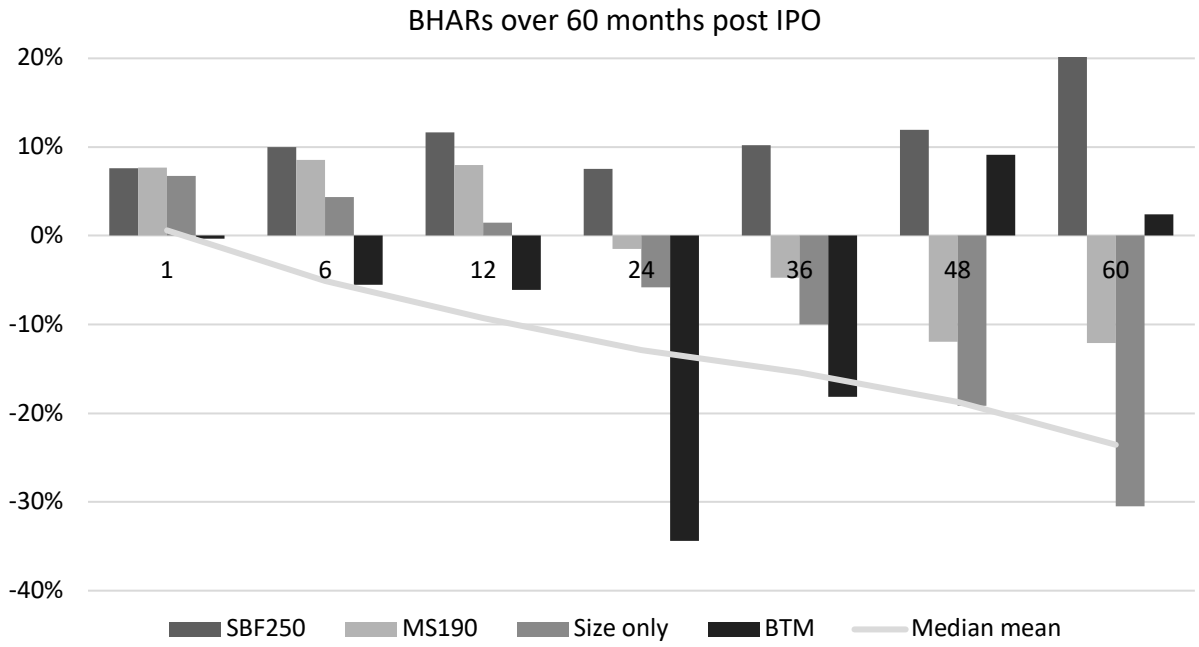

Fig. 6. Equally weighted Buy-and-hold abnormal returns measured from first closing market price. The figure compares the aftermarket performance over the 5-year period following the IPO using different various benchmarks; "SBF250" stands for CAC-All tradable index (i.e. all firms traded on Euronext Paris with a minimum 20% free float annual velocity), "MS190" stands for CAC Mid & Small index, "Size only" refers to abnormal returns calculated from matching firms based on market capitalization and "BTM" refers to abnormal returns calculated using control firms matched using size and book-to-market ratio. "Median mean" is the average of the different BHAR medians resulting from the various methodologies.

To make it clear, the positive abnormal returns observed for some “SBF250” and “BTM” adjusted figures are certainly not an evidence of any long-term overperformance but simply result from model misspecifications. Consequently, returns adjusted for CAC Mid & Small index and for size-based matching firms are worthy of greatest consideration.

Furthermore, assessing the statistical significance of BHARs is problematic. One main reason, documented by Barber and Lyon (1997) is that long-term returns tend to be right skewed even after being adjusted using matching firms. This tendency is not surprising as the lower bound for returns is -100% while they are not limited in the upside. Others argue that this arises from observations overlapping.

Figure 7 provides a comparison of the 3-year BHARs distribution depending on the methodology and the benchmark used. The positive skewness is verified for abnormal returns computed using indices. Skewness coefficients are equal to 3.07 and 3.12 when using the CAC All-tradable and the CAC Mid & Small respectively. Graphically, this is confirmed by the mean being higher than the median. To a lesser extent, this is also true for BHARs resulting from the matching approach based on size only (skewness = 0.21). Yet, this is not accurate when it comes to the distribution of returns corrected using the two-step matching procedure. This inconsistency can be explained by the lower number of observations involved by matching failures and greater extreme values.

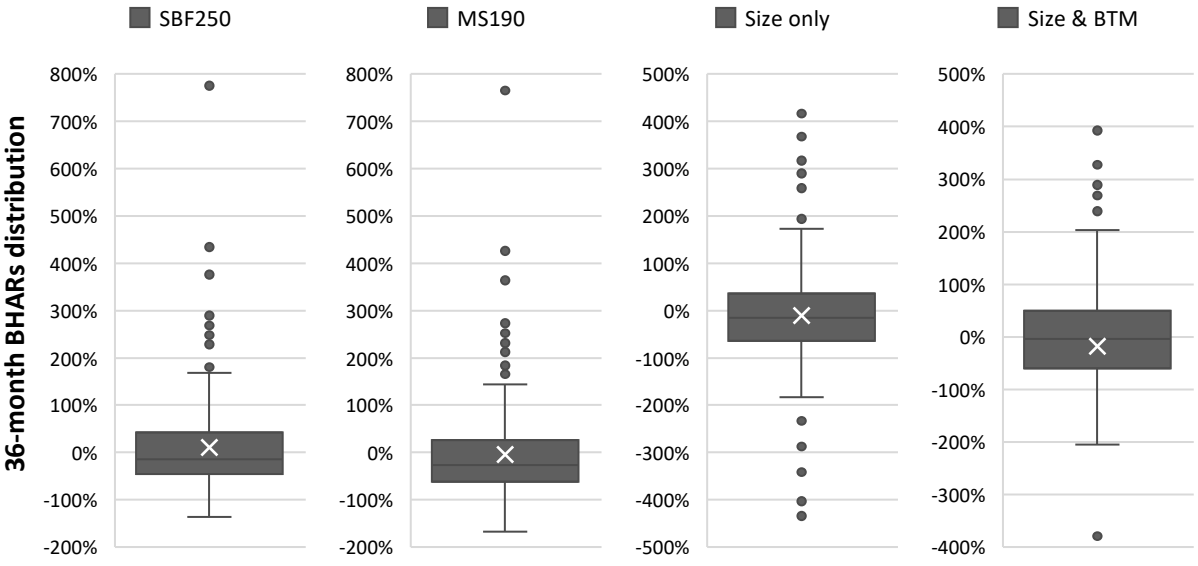

Fig. 7. Distribution of 36-month Buy-and-hold abnormal returns computed using the various methodologies defined in section III.2. Average is represented by the white cross marker. For returns based on the two-step procedure (i.e. Size & BTM) disclosed in the bottom right), two extremely low values do not appear to guarantee the visibility of the chart.

Portfolio adjusted - SBF250								
Month	**n**	**BHARs**	**Median**	**t-stat**	**skew**	**adj t-stat**	**Negative BHARs**	**WRs**
1	282	7.63%***	0.57%	3.48	8.30	5.57	47.16%	1.07
6	277	10.00%**	-2.90%	2.47	4.07	3.01	54.87%	1.08
12	274	11.62%*	-9.20%	1.89	4.17	2.23	58.39%	1.06
24	250	7.51%	-13.48%	1.16	4.39	1.33	60.00%	1.02
36	230	10.19%	-14.94%	1.55	3.07	1.74	59.13%	1.09
48	211	11.98%*	-15.14%	1.79	1.78	1.94	56.87%	1.13
60	189	20.79%***	-14.86%	2.27	2.30	2.59	58.20%	1.20

Portfolio adjusted - MS190								
Month	**n**	**BHARs**	**Median**	**t-stat**	**skew**	**adj t-stat**	**Negative BHARs**	**WRs**
1	282	7.67%***	0.88%	3.49	8.20	5.55	45.74%	1.08
6	277	8.54%**	-4.16%	2.09	4.04	2.49	56.32%	1.07
12	274	7.96%	-11.64%	1.29	4.17	1.47	62.77%	1.02
24	250	-1.50%	-22.51%	-0.23	4.44	-0.18	65.20%	0.93
36	230	-4.74%	-26.85%	-0.72	3.12	-0.65	65.22%	0.93
48	211	-11.96%*	-36.48%	-1.81	1.70	-1.66	65.40%	0.89
60	189	-12.06%	-43.06%	-1.34	2.23	-1.21	68.25%	0.88

Control firm - Size only								
Month	**n**	**BHARs**	**Median**	**t-stat**	**skew**	**adj t-stat**	**Negative BHARs**	**WRs**
1	266	6.76%***	1.08%	2.74	7.44	3.96	46.62%	1.08
6	258	4.39%	-5.35%	0.99	2.82	1.07	55.43%	1.09
12	255	1.50%	-7.48%	0.26	2.97	0.30	57.25%	1.11
24	225	-5.81%	-8.16%	-0.84	1.39	-0.80	54.67%	1.29
36	207	-9.99%	-15.87%	-1.32	0.21	-1.31	57.00%	1.55
48	178	-19.17%*	-19.42%	-1.87	-0.19	-1.89	57.87%	1.45
60	151	-30.49%**	-27.56%	-2.03	-0.15	-2.05	62.91%	1.69

Control firm - Size and BTM								
Month	**n**	**BHARs**	**Median**	**t-stat**	**skew**	**adj t-stat**	**Negative BHARs**	**WRs**
1	180	-0.35%	-0.10%	-0.21	0.73	-0.20	50.56%	1.01
6	174	-5.53%	-7.81%	-1.10	1.98	-1.02	61.49%	1.04
12	170	-6.13%	-8.83%	-0.70	-0.78	-0.72	55.88%	1.11
24	142	-34.35%	-7.26%	-1.48	-6.37	-1.96	55.63%	1.43
36	127	-18.15%	-3.94%	-0.95	-5.01	-1.15	51.18%	1.94
48	99	9.14%	-3.89%	0.76	0.15	0.76	52.53%	2.02
60	85	2.45%	-8.74%	0.14	-1.75	0.10	54.12%	2.22

Tab. 7. Equally weighted Buy-and-hold abnormal returns measured from first closing market price. Buy-and-hold abnormal returns (BHARs) and Wealth Relatives (WRs) are computed as described in section III.2. Both CAAR and BHAR methods test the null hypothesis that mean abnormal performance is equal to zero. For the BHAR, a conventional test statistic is $\sqrt{n}$S with $S = \frac{BHAR_T}{\sigma_T}$ and n being the number of IPO firm observations.

The skewness adjusted t-stat (disclosed under "adj t-stat" column) is $t = \sqrt{n}(S + \frac{1}{3}S^2\gamma + \frac{1}{6n}\gamma)$ with γ an estimate of the skewness coefficient. Negative BHARs represents the percentage of sample IPOs that have underperformed the benchmark. */**/*** denotes the significance at the 10%/5%/1% level based on conventional t-stat. Most relevant figures are highlighted in grey.

One implication of the positive skewness is negatively biased t-statistics. In such case, tests may lead to over-rejection of the null hypothesis in favor of an underperformance alternative. For all these reasons and even if the positive skewness is not verified in our entire dataset, we also report a skewness-adjusted t-statistic.

Table 7 summarizes the various indicators from the different methodologies used to compute the Buy-and-hold abnormal returns. As a reminder, to be in line with typical IPO patterns, we should have: (1) negative BHARs after a certain period (2) more than 50% IPOs that underperform the benchmark on the long-term (3) positive skewness and (4) wealth relatives below 1. The only methodology that actually leads to results ticking all these boxes is the CAC Mid & Small adjustment (MS190). Here, underperformance trend is strengthening from 24 months following the IPO. BHARs are equal to -4.74% (t-statistic: -0.72) for the 3-year period and 12.06% (t-statistic: -1.34) after 5 years. This is the only approach that demonstrates average wealth relatives below 1 from 24 months onwards. The use of matching firms based on size only also confirms most of our expectations. Indeed, even if the positive skewness and wealth relatives figures are inconsistent, 4 and 5-year BHARs amount to -19.17% and -30.49% respectively with statistical significance.

Looking at the broader picture, all benchmarks result in more than 50% IPOs having negative BHARs as early as from the 6th month following the issuance – subsequently median BHARs are also negative.

To sum-up, the results tend to reveal an underperformance pattern on the long-term, in particular looking at the 3-year and 5-year periods following the offering. Yet, the figures need to be considered cautiously as they are not always statistically robust. Having say that, we can at least consider our results to prove the difficulties to steadily assess abnormal returns because of their high benchmark sensitivity.

IV.2 Cross-sectional results

To get a better appreciation of the long-run anomaly, we have segmented BHARs depending on different firm characteristics. Results are displayed in Table 8 and enable us to originate four main trends.

The first one is the constant underperformance of small companies compared to firms with higher market capitalization. Here we can observe that for all methodologies and the three main horizon periods (1, 3 and 5 years), average abnormal returns are always lower for our sub-sample composed of firms with a size below €150 million. An analogous comment can be inferred from age segmentation results. Looking at most relevant methods (CAC Mid & Small adjustment and matching based on size

only) and horizons (3 and 5 years), BHARs appear to be consistently lower for young companies. Third, it seems that IPOs occurring during hot periods are more affected by the underperformance phenomenon. Indeed, except for BHARs derived from the double-step matching procedure, all average abnormal returns are higher when the listing occurred during what we call a "cold period". In Ritter's (1991) words, "the pattern that emerges is that the underperformance is concentrated among relatively young growth companies, especially those going public in the high-volume years". A last point deserve to be mentioned: average performance tends to vary across industries. In particular, for all 3-year and 5-year observations, the lowest abnormal return either comes from the "Technology" or the "Communications" sub-samples. Conversely, financial firms often demonstrate the best performance on the long run. This is also consistent with Ritter's (1991) findings.

		Portfolio adjusted SBF250			Portfolio adjusted MS190		
	n	**1-year**	**3-year**	**5-year**	**1-year**	**3-year**	**5-year**
Entire sample	290	11.62%	10.19%	20.79%	7.96%	-4.74%	-12.06%
Large IPO firms (> €150m)	122	19.02%	11.09%	33.82%	15.31%	-4.61%	1.51%
Small IPO firms (< €150m)	156	-4.45%	2.22%	12.09%	-8.06%	-12.16%	-20.97%
Hot periods	133	-0.01%	-3.59%	2.55%	-2.70%	-18.47%	-27.00%
Cold periods	157	21.82%	22.83%	38.46%	17.30%	7.84%	2.42%
Consumer, Non-cyclical	83	11.95%	5.62%	2.12%	8.26%	-9.00%	-25.45%
Consumer, Cyclical	29	9.96%	26.83%	79.35%	6.52%	14.18%	46.15%
Industrial	45	3.05%	8.82%	17.20%	-2.80%	-6.49%	-16.18%
Technology	40	12.16%	20.40%	16.29%	10.11%	1.51%	-25.68%
Utilities, Energy & Basic Materials	14	32.37%	-1.07%	5.59%	29.17%	-9.81%	32.37%
Communications	60	10.01%	-1.33%	-8.11%	7.32%	-16.12%	-41.90%
Financial	19	20.34%	30.92%	111.80%	14.87%	14.17%	73.11%
PE-backed	44	13.84%	2.32%	30.76%	11.77%	-8.04%	10.27%
Non PE-backed	246	11.21%	11.33%	19.87%	7.25%	-4.27%	-14.12%
Old companies (> 10 years)	125	7.52%	19.11%	39.48%	4.40%	3.93%	8.67%
Young companies (< 10 years)	163	14.92%	3.45%	6.16%	10.81%	-11.30%	-28.29%
Short-term underpriced	175	12.35%	6.69%	20.76%	8.77%	-7.81%	-11.14%
Short-term overpriced	86	1.62%	12.22%	18.75%	-2.25%	-3.47%	-17.12%

		Control firm Size only			Control firm Size and BTM		
	n	**1-year**	**3-year**	**5-year**	**1-year**	**3-year**	**5-year**
Entire sample	265	1.50%	-9.99%	-30.49%	-6.13%	-18.15%	2.45%
Large IPO firms (> €150m)	122	12.88%	-6.31%	-20.83%	7.87%	-4.39%	3.67%
Small IPO firms (< €150m)	156	-7.27%	-13.06%	-37.41%	-17.72%	-30.47%	1.45%

Hot periods	133	-7.28%	-14.06%	-30.86%	1.18%	-4.87%	6.61%
Cold periods	157	9.31%	-6.12%	-30.11%	-11.13%	-27.66%	-0.61%
Consumer, Non-cyclical	83	0.98%	-2.35%	-30.33%	-10.45%	-9.89%	-33.44%
Consumer, Cyclical	29	2.57%	10.52%	24.37%	-11.62%	3.06%	13.80%
Industrial	45	-6.05%	-7.49%	-21.77%	8.50%	21.76%	17.63%
Technology	40	-11.85%	-33.77%	-87.80%	-35.66%	-115.35%	98.52%
Utilities, Energy & Basic Materials	14	46.94%	-7.95%	-21.41%	-19.29%	-78.96%	-5.95%
Communications	60	-1.82%	-27.48%	-60.48%	15.34%	-11.59%	-50.89%
Financial	19	19.20%	14.88%	61.60%	0.23%	44.35%	139.14%
PE-backed	44	19.12%	-12.50%	47.00%	-6.73%	-68.02%	-80.92%
Non PE-backed	246	-1.97%	-9.60%	-37.79%	-5.96%	-7.12%	14.84%
Old companies (> 10 years)	125	8.23%	2.39%	2.30%	-13.29%	-48.01%	-7.57%
Young companies (< 10 years)	163	-3.93%	-18.79%	-54.61%	0.54%	7.76%	14.26%
Short-term underpriced	175	0.78%	-15.95%	-38.32%	-4.02%	-13.70%	12.84%
Short-term overpriced	86	-10.07%	-4.56%	-22.90%	-24.07%	-36.95%	-19.71%

Tab. 8. 12-month, 36-month and 60-month BHARs categorized by size, period momentum, industry, PE support, age and initial return. Equally weighted Buy-and-hold abnormal returns are measured from first closing market price as per methodology described in section III.2. n refers to the initial number of sample firms entering the various categories; this not corresponds to the number of observations for the different BHAR measures due to delisting, matching failure and lack of data. Large IPO firms are IPO with initial market capitalization strictly above €150 million; Hot periods are defined as periods with at least 8 issuances over a 3-month period centered on the IPO date (7 being the sample median); Industries are reported as per Bloomberg classification; Old companies are firms that have been incorporated for at least 10 years at IPO date; Short-term underpriced (resp. overpriced) refers to IPOs with strictly positive (resp. strictly negative) initial return. 3-year and 5-year BHARs computed using CAC Mid & Small and size matching are highlited in grey as they are under higher scrutiny in the context of our analysis.

In sum, we observe that the following features seem to increase the likelihood of being prone to underperformance:

- Being a small company
- Being a young company
- Having priced the offering during periods of high momentum
- Running business in the technology and communication sectors

Adopting a broader view, those patterns may evidence two related notions that can provide an explanation to underperformance, namely over-optimism and windows of opportunity.

Coming back to the theory developed by Miller (1977), underperformance among small and young companies is not surprising. For this type of growing companies, asymmetries of information and cash flows uncertainty are greater. Therefore, the divergence of opinion among investors is sharpened and the minority driving the price happens to be even more enthusiastic. R. Rajan and H. Servaes (1997)

also show that analysts forecasts tend to be even more inflated when it comes to long term prospects vs. short term ones, thereby influencing investors propensity to buy at higher price. But as uncertainty and analysts' predictions declines overtime, the long-term performance is negatively affected. All of this is also applicable for technology and communication companies as they are generally considered as innovative firms with high growth potential that is yet to materialize.

The thing is, this over-optimism is subject to time-series variation and is creating windows of opportunity (Lerner, 1994). Here, our figures highlight the poor long-term performance of IPOs that took place during hot periods. It provides an argument in favor of this cyclical effect and indicate that issuers manage to successfully time their offerings.

At this point, we cannot draw any defensible conclusions in relation to Private Equity support and initial underpricing. We will further examine those factors through regression models.

IV.3 Regression results

IV.3.1 Independent variables

	Average	Median	Min	Max
Size (market capitalization in €m)	1,358	125	11	58,037
Offer size (in €m)	269	32	10	7,345
Initial return (%)	8.1%	1.7%	-23.3%	224.5%
Age (years)	12.9	8.6	0.3	102.3
Issuances volume (in # of IPOs)	9	7	1	29
GDP growth (in %)	0.6%	0.7%	-0.4%	1.4%
Sentiment (index point)	106	106	82	121

	Number of firms
Private-equity backed	44
Venture-capital backed	23
New economy	120

Tab. 9. Descriptive statistics for selected independent variables. The sample consists of 290 French IPOs as per previous defined criteria. Market capitalization refers to the first market capitalization available on Bloomberg within the first year from issuance. Initial return is the raw initial return computed as per methodology disclosed in section III.2.; Age is the number of years between the date of incorporation and the pricing date ; the New Economy criterion is defined as firms with activities in the "Technology", "Biotechnology" and "Communications" sectors ; Issuances volume is the number of IPO issuances over a 3-month period centered on the IPO date ; Sentiment is an estimate of French investors sentiment measured using monthly "EUESFR Index" from Bloomberg ; GDP is the closest quotation of French quarterly Gross Domestic Product adjusted for seasonality and working days using "FRGEGDPQ Index" Bloomberg ticker.

Following the review made in section II.2., we have selected 9 indicators to explain and get a better comprehension of abnormal returns. Among them, six are microeconomic indicators – initial return, age, industry, size, VC and PE support – while three are macroeconomic factors – issuances volume, investor sentiment and GDP growth. The industry feature is assessed via a dummy variable depending on the belonging to the New Economy category (i.e. technology, communications and biotechnology sectors). Table 9 sets out descriptive statistics of the corresponding variables for our sample.

More details about the initial returns of French IPOs included in the sample are displayed in Figure 8. Our results strongly support the short-term underpricing anomaly. Indeed, all yearly average are positive and the whole period average amounts for 8.07%. The figure also perfectly exemplifies the cyclical and windows of opportunity patterns already described in sections III.1. and IV.2.

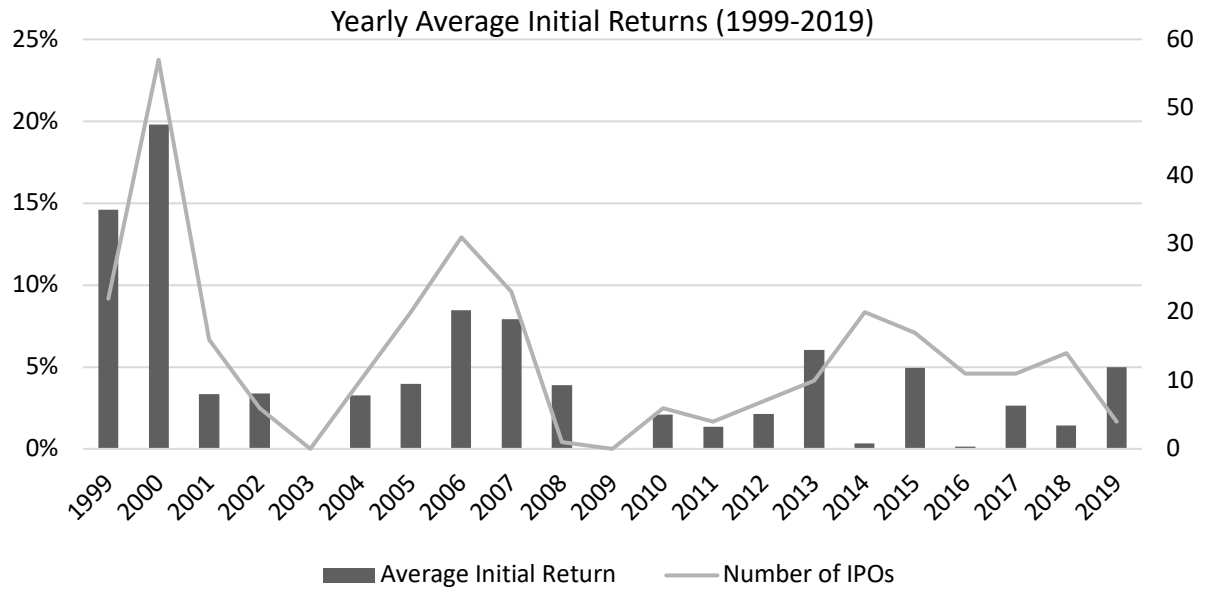

Fig. 8. Average initial returns by year. Initial returns are raw returns computed using Bloomberg data as per methodology disclosed in section III.2. The sample consists of 290 French IPOs as per previously defined criteria.

Expected signs of coefficients describing the effect of variables on the aftermarket performance are described and rationalized in Table 10.

	Selected indicators	Description and measure	Expected sign	Rationale
Micro-indicators	*Initial Return*	Raw first-day performance computed from the offer price to the unadjusted closing price following the first-day of trading	Negative	In accordance with the impresario hypothesis, underwriters tend to voluntarily underprice offerings in order to create favourable impressions among their clients and maximize demand, using initial return as a marketing tool. As these fads disappear on the long-term, high initial returns are associated with poorer long-term results i.e. higher underperformance.

	Size	First market capitalization available from the IPO date	Positive	Small companies tend to be young companies at an earlier stage of business development while large companies are presumably more mature with proven business model combined to a larger history of data. Due to higher asymmetries and growth potential, investors are therefore more subject to fads and misevaluations at issuance when it comes to smaller firms. It results in over-enthusiasm implying future corrections that potentially lead to lower returns on the long term.
	Age	Age of the IPO firm measured as the number of years between incorporation and pricing date	Positive	Similar to size pattern, young companies are usually characterized by faster growth and limited financial data history. Due to higher asymmetries and growth potential, investors are therefore more subject to fads and misevaluations for young companies. Over-enthusiasm at issuance leads to lower returns on the long term.
	New Economy	Dummy variable depending on the industry equals to 1 when business is related to technology, communications or biotechnology sectors	Negative	Firms part of the New Economy are generally innovative firm associated with more growth potential and more risks; their earnings are more difficult to evaluate as value creation derived from intangible assets and unproven technology. At IPO, investors are inclined to over-estimate returns and subsequent corrections may lead to lower returns.
	VC support	Dummy variable equals to 1 when the IPO is backed by Venture Capital	Negative	Venture capitalists have expertise in providing funds and conducting IPOs; thus, they have a greater say on timing. The thing is, venture capitalists typically take firm public during market peaks and use private placements during "cold" periods (Lerner, 1994). Consequently, influence pattern should be similar to the one described for issuance volume.
	PE support	Dummy variable equals to 1 when the IPO is backed by Private Equity fund	Positive	PE-backed IPOs tend to be large and more profitable firm presenting limited underpricing at IPO. In general, they present better results in the aftermarket as investors are positively surprised by their resilience, operating performance and leverage reduction (Levis, 2011).
Macro-indicators	*Issuance volume*	Number of IPOs that took place during the 3-month period centred on the IPO date (i.e. 45 days before and after)	Negative	In line with the "windows of opportunity" theory, issuers try to time their offering and take advantage of momentum during periods of high IPO volumes. They intent to benefit from excess optimism and inflated price at issuance but "hot" periods do not last forever. Later, prices get corrected, thereby affecting long-term performance.

	Investor sentiment	Monthly Bloomberg Investor Economic Sentiment index constructed from various confidence indicators (industrial, service, consumer, construction and retail trade)	Negative	Issuance volume and Investor sentiment patterns are parallel, fitting into the same timing strategy. Indeed, during periods of high investor sentiment, firms tend to opt for IPO in order to take advantage of valuation above fair value. Similar adjustments and corrections happen on the long-run, involving poorer returns in the aftermarket.
	GDP growth	Measure of the French economic activity based on quarterly gross domestic product (GDP) growth that relies on final market value of all goods and services produced	Negative	GDP growth is an indicator of the health of the economy and as such investment opportunities. IPO volumes are generally higher during periods of superior growth. Consequently, we would expect the GDP variable to have the same impact as the volume variable.

Tab. 10. Summary of selected indicators and their presumed influence on the aftermarket.

Correlation matrix of control variables

	IR	Age	NTIC	lnSize	VC	PE	VOL	Sentiment	GDP
IR	1.00								
Age	-0.02	1.00							
NTIC	0.11	-0.18	1.00						
lnSize	0.03	0.36	-0.09	1.00					
VC	-0.05	-0.08	0.05	-0.14	1.00				
PE	-0.09	0.07	-0.09	0.07	0.41	1.00			
VOL	0.09	-0.10	0.14	0.02	-0.14	-0.18	1.00		
Sentiment	0.21	-0.13	0.23	0.05	-0.05	-0.18	0.58	1.00	
GDP	0.23	-0.03	0.13	0.05	-0.13	-0.31	0.41	0.69	1.00

Tab. 11. Correlation matrix of variables used to explain abnormal returns. IR is the raw initial return computed as per methodology disclosed in section III.2.; Age is the number of years between the date of incorporation and the pricing date ; NTIC is a dummy variable equals to 1 when the industry is part of the New Economy (i.e. include the "Technology", "Biotechnology" and "Communications" sectors as per OECD definition) ; lnSize is the natural logarithm of the first market capitalization available on Bloomberg within the first year from issuance ; VC is a dummy variable equals to 1 when the company was backed by a Venture Capital firm ; PE is a dummy variable equals to 1 for Private Equity-backed companies ; VOL is the number of IPO issuances over a 3-month period centered on the IPO date ; Sentiment is an estimate of French investors sentiment measured using monthly "EUESFR Index" from Bloomberg ; GDP is the closest quotation of French quarterly Gross Domestic Product adjusted for seasonality and working days using "FRGEGDPQ Index" Bloomberg ticker.

Table 11 shows the correlation between each pair of control variables and allows us to assess their respective linear relationships. Unsurprisingly, we can observe a strong positive correlation between macro-indicators (issuance volume, investor sentiment and GDP) meaning that in period of significant economic growth, investors' sentiment together with the number of IPOs is high (respective correlation coefficients amounting to 0.69 and 0.41). We can also notice the positive correlation between size and age as well as the negative one between age and industry: TMT companies that are

going public tend to be younger. Another interesting trend here is the fact that companies part of the new economy tend to list during period of favorable environment (positive correlation with macro-indicators) while others and more experienced companies seem to demonstrate more resilience to the timing effect (negative correlation between age and macro-indicators).

Assessing the correlation of variables is particularly relevant in the context of regression analysis as problems and misinterpretations may occur when multiple independent variables are highly correlated. In such case, attributing changes in the dependent variable to one of the control variables rather than another may be difficult and lead to unsound conclusions (e.g. inconsistent sign, statistical non-significance, large coefficient changes when a variable is excluded).

IV.3.2 Regression models

In this section, we performed various ordinary least square regressions with dependent variables being BHARs calculating using CAC Mid & Small benchmark as well as BHARs adjusted for control firms based on size criteria only. These two variables have been preferred to returns deriving from CAC All-tradable and double matching methodologies due to previous inconsistent findings and misspecifications detailed in section IV.1.2.

As one intent of this paper is to put a stress on the relationship between the short and the long-term performance of IPOs, the first model is a basic regression with a unique explanatory variable being the raw initial return.

Model 1: $BHAR_i = \alpha_0 + \alpha_1 IR_i + \varepsilon_i$

Then, we tried to isolate microeconomic (Model 2) and macroeconomic variables (Model 3) in order to differentiate their respective explanatory effect.

Model 2: $BHAR_i = \alpha_0 + \alpha_1 IR_i + \alpha_2 \ln(Age)_i + \alpha_3 NTIC_i + \alpha_4 \ln(Size)_i + \alpha_5 VC_i + \alpha_6 PE_i + \varepsilon_i$

Model 3: $BHAR_i = \alpha_0 + \alpha_1 VOL_i + \alpha_2 Sentiment_i + \alpha_3 GDP_i + \varepsilon_i$

Looking at the three previous models, we elaborate Model 4 taking the independent variables with the higher statistically significance and trying to limit highly correlated variables (i.e. only one macro indicator – the most significant – and excluding Age factor).

Model 4: $BHAR_i = \alpha_0 + \alpha_1 IR_i + \alpha_2 \ln(Size)_i + \alpha_3 GDP_i + \varepsilon_i$

Then adopting a stepwise analysis, we progressively added the various independent variables in order to increase the explanatory power of our multi-regression:

Model 5: $$BHAR_i = \alpha_0 + \alpha_1 IR_i + \alpha_2 \ln(Size)_i + \alpha_3 VOL_i + \alpha_4 Sentiment_i + \alpha_5 GDP_i + \varepsilon_i$$

Model 6: $$BHAR_i = \alpha_0 + \alpha_1 IR_i + \alpha_2 NTIC_i + \alpha_3 \ln(Size)_i + \alpha_3 VOL_i + \alpha_4 Sentiment_i + \alpha_5 GDP_i + \varepsilon_i$$

Model 7: $$BHAR_i = \alpha_0 + \alpha_1 IR_i + \alpha_2 \ln(Age)_i + \alpha_3 NTIC_i + \alpha_4 \ln(Size)_i + \alpha_5 VC_i + \alpha_6 PE_i + \alpha_7 VOL_i + \alpha_8 Sentiment_i + \alpha_9 GDP_i + \varepsilon_i$$

IV.3.3 Coefficients output

The results of the various regression models for the 3-year Buy-and-Hold abnormal returns are disclosed in Table 12. Analogous OLS regressions with dependent variable being 5-year BHARs are reported in the Appendix section. The results of the latter should be considered more cautiously due to the smaller number of observations and the reduced explanatory power of the models. As an illustration, in model 7 R-square is decreased from 9.58% to 6.88% for BHARs based on control firms matched by size.

The first interesting feature that arises from those outputs is the consistently negative sign of the Initial Return coefficient. Even if we fail to find statistical significance in most of the models, the figures meet our expectations and nurture the hypothesis according which high underpricing is correlated with poorer performance on the long-run. Looking at model 1 for 5-year BHARs built from size matching, we even obtain statistical significance at 10% level (-1.08 coefficient with -1.70 t-statistics). This pattern is invariably observed in all our models whatever the methodology (CAC Mid & Small benchmark and size matching) and whatever the long-term horizon (3 and 5 years). The regression outputs thereby corroborate the overreaction, impresario and legal liability hypotheses (see section II.2.3).

Control variables coefficients for 3-year BHARs adjusted for CAC Mid & Small

	n	IR	lnAge	NTIC	lnSize	VC	PE	VOL	Sentiment	GDP	Intercept	R^2
Model 1	230	-0.38									-0.02	0.66%
		(-1.23)									(-0.23)	
Model 2	227	-0.27	0.05	-0.09	0.04	-0.08	-0.05				-0.35	2.42%
		(-1.01)	(0.93)	(-0.79)	(1.24)	(-0.29)	(-0.24)				(-1.63)	
Model 3	227							-0.01	-0.02**	0.66***	1.83**	5.49%
								(-1.07)	(-2.24)	(3.17)	(2.13)	
Model 4	227	-0.39			0.05					0.22	-0.44**	2.60%
		(-1.46)			(1.48)					(1.50)	(-2.22)	
Model 5	227	-0.36			0.05			-0.01	-0.02**	0.68***	1.47*	7.25%
		(-1.35)			(1.53)			(-1.17)	(-2.11)	(3.27)	(1.69)	
Model 6	227	-0.35		-0.08	0.05			-0.01	-0.02**	0.68***	1.43	7.43%
		(-1.30)		(-0.66)	(1.48)			(-1.15)	(-2.01)	(3.27)	(1.63)	
Model 7	227	-0.35	0.02	-0.07	0.04	-0.06	0.05	-0.01	-0.02*	0.68***	1.35	7.53%
		(-1.28)	(0.38)	(-0.58)	(1.28)	(-0.23)	(0.25)	(-1.11)	(-1.92)	(3.12)	(1.51)	

Control variables coefficients for 3-year BHARs calculating using size matching

	n	IR	lnAge	NTIC	lnSize	VC	PE	VOL	Sentiment	GDP	Intercept	R^2
Model 1	207	-0.51									-0.06	1.03%
		(-1.46)									(-0.71)	
Model 2	207	-0.51	0.03	-0.13	0.07	-0.09	-0.13				-0.45	3.02%
		(-1.43)	(0.40)	(-0.81)	(1.36)	(-0.25)	(-0.52)				(-1.54)	
Model 3	207							0.00	-0.04***	0.88***	3.90***	7.35%
								(-0.06)	(-3.50)	(3.21)	(3.45)	
Model 4	207	-0.58			0.08*					0.14	-0.56**	2.67%
		(-1.63)			(1.67)					(0.72)	(-1.98)	
Model 5	207	-0.48			0.08*			0.00	-0.04***	0.90***	3.34***	9.49%
		(-1.37)			(1.71)			(-0.13)	(-3.37)	(3.28)	(2.90)	
Model 6	207	-0.47		-0.05	0.08*			0.00	-0.04***	0.90***	3.31***	9.53%
		(-1.35)		(-0.30)	(1.69)			(-0.13)	(-3.28)	(3.28)	(2.84)	
Model 7	207	-0.48	-0.01	-0.06	0.08*	0.01	-0.08	0.00	-0.04***	0.88***	3.32***	9.58%
		(-1.35)	(-0.11)	(-0.35)	(1.66)	(0.03)	(-0.31)	(-0.14)	(-3.23)	(3.06)	(2.81)	

Tab. 12. OLS regression results with 36-month BHARs as dependent variables and control variables as per models descriptions above. n is the number of observations and R^2 the coefficient of determination indicating the proportion of the variance explicated by the model. IR is the raw initial return computed as per methodology disclosed in section III.2.; lnAge is the natural logarithm of the number of years between the date of incorporation and the pricing date ; NTIC is a dummy variable equals to 1 when the industry is part of the New Economy (i.e. include the "Technology", "Biotechnology" and "Communications" sectors as per OECD definition) ; lnSize is the natural logarithm of the first market capitalization available on Bloomberg within the first year from issuance ; VC is a dummy variable equals to 1 when the company was backed by a Venture Capital firm ; PE is a dummy variable equals to 1 for Private Equity-backed companies ; VOL is the number of IPO issuances over a 3-month period centered on the IPO date ; Sentiment is an estimate of French investors sentiment measured using monthly "EUESFR Index" from Bloomberg ; GDP is the closest quotation of French quarterly Gross Domestic Product adjusted for seasonality and working days using "FRGEGDPQ Index" Bloomberg ticker. T-statistics are disclosed in brackets.

We also found results conforming to our expectations for the NTIC and Size variables. Our results provide argument in favor of a negative correlation between abnormal performance and belonging to the New Economy while size appears to be positively correlated.

Results for VC and Age variables are more unsteady and difficult to interpret. Yet, the overall picture seems aligned with our preliminary conjectures. Looking at outputs for 3-year and 5-year BHARs, we observe a tendency for positive correlation between Age and long-term performance and a negative one for the Venture-Capital parameter.

At this point, we can substantiate and go beyond cross-sectional results by affirming that small young firms with higher initial returns have higher propensity to underperform on the long-run. Being part of the New Economy and/or being backed by VC also typically demonstrate adverse effect. However, we must mention that statistical significance is notably low.

On the other hand, we can hardly draw any reliable conclusion regarding the effect of Private Equity support as sign coefficient is divergent depending on the methodologies and horizons used for BHARs.

Looking at macro-variables, our results suggest a negative relationship between abnormal returns and investor sentiment, which is consistent with what we were expecting. The coefficient for regressions with 3-year BHARs based on size matching is always -0.04 with statistical significance at the 1% level. Still, we cannot highlight any steady trend for the IPO volume variable.

Due to the high level of correlation between the 3 macroeconomic parameters, we have run additional regressions with VOL and Sentiment as only macro-variable in order to control for GDP cannibalization effect over the regression. The models used were: (a) $BHAR_i = \alpha_0 + \alpha_1 IR_i + \alpha_2 NTIC_i + \alpha_3 \ln(Size)_i + \alpha_4 VOL_i + \varepsilon_i$ and (b) $BHAR_i = \alpha_0 + \alpha_1 IR_i + \alpha_2 NTIC_i + \alpha_3 \ln(Size)_i + \alpha_4 Sentiment_i + \varepsilon_i$. Using 3-year BHARs, we found negative coefficients for both methodologies and both variables, thereby confirming our previous results. Comprehensive details are disclosed in Appendix 2.

In contradiction with our expectations derived from the literature review, we found positive and statistically significant coefficient for the GDP. We have looked at a model including all explanatory variables but Sentiment in order to check for correlation effect as GDP and Sentiment have a positive correlation amounting to 69%. The outputs coefficients are displayed in Appendix 2 (model c). Even if the significance decreases, the positive relationship remains. This inconsistency may be due to the fact that we use current and quarterly GDP while most authors usually prefer annualized measure and/or forecasts. By consequence, the positive relationship can be explained by the fact that our measure of

GDP reflects the current and effective level of production as compared to an expected or smoothed one.

In summary, main outcomes of our analysis are recapitulated in Table 13.

Indicator	Results from cross-sectional	Results from OLS regressions	Comments
Initial Return	No clear pattern	Negative	Unchanging coefficient sign and noteworthy magnitude despite low statistical significance in OLS regressions
Size	Positive	Positive	Strong positive relationship observed
Age	Positive	Positive	Tendency for positive correlation but lower observability
New Economy	Negative (Technology and Communications)	Negative	Unchanging negative relationship observed despite limited statistical significance
VC support	n/a	Negative	Tendency for negative correlation but lower observability and only 23 firms included in our sample
PE support	No clear pattern	No clear pattern	No distinguishable explanatory power
Issuance volume	Negative	No clear pattern	Poorer aftermarket performance observed for hot periods in cross-sectional results
Investor sentiment	n/a	Negative	Strong negative relationship observed
GDP growth	n/a	Positive	Strong positive relationship observed

Tab. 13. Summary of main results regarding determinants of long-term performance.

V Conclusion

This paper investigates the existence and determinants of long-term abnormal performance among French companies that went public between 1999 and 2019.

Throughout the analysis, we have observed widely varying results depending on the prevailing methodology. This is not surprising and concurs with the joint-hypothesis dilemma. In that respect, we acknowledge the crucial importance of the benchmark. We consider that the CAC All-tradable index does not fit our sample and that the lower number of observations in the double-matching approach prevents us from extrapolating. Consequently, we give more credit to returns adjusted for the CAC Mid & Small index or a size-matched control firm.

The main finding of this paper is the recognition of an underperformance pattern on the long term. Looking at CAARs, results reveal a reversal of performance leading to negative cumulative abnormal returns from the 12^{th} month following the issuance. BHARs, that tend to provide us with a more realistic appraisal, also confirm the tendency of IPO firms to poorly perform on the aftermarket. For most relevant methodologies, we find an abnormal performance amounting to -4.7% and -10% for the 3-year horizon and to -12% and -30.5% looking at the 5-year window.

The second valuable output of this analysis is to draw up the typical profile of companies that are more severely affected by the underperformance phenomenon. We notice that small young companies that came public during periods of high investor sentiment have poorer performance on the long-run. Running business in the New Economy sectors and beneficiating from VC support seem to adversely affect the aftermarket as well. Interestingly, we discern cyclicality and bring to light a negative correlation between underpricing and the long-term performance. Indeed, for all our OLS models, we find negative coefficient indicating that high initial return is associated with poor long-term performance.

All those conclusions are consistent with the prevalence of fads in the IPO market. Presumably, the latter stem either from investors' optimism and overreaction, from issuers trying to time their offering or from investment bankers wishing to boost the demand. Yet, we should cautiously look at our results as most of them demonstrate a very low level of statistical significance. Improvements may involve other methodologies – such as value-weighted average and standardized calendar-time approach – and comparisons with other geographies. In addition, gauging the effect of Euronext implementation could have also bring interesting and complementary insights about the IPO market in France and its evolution.

VI Appendix

VI.1 Appendix 1: OLS results for 5-year BHARs

	Control variables coefficients for 5-year BHARs adjusted for CAC Mid & Small										
	n	**IR**	**lnAge**	**NTIC**	**lnSize**	**VC**	**PE**	**VOL**	**Sentiment**	**GDP**	**Intercept**	**R^2**
Model 1	189	-0.62									-0.06	1.31%
		(-1.57)									(-0.65)	
Model 2	186	-0.50	0.09	-0.38**	0.07	-0.59	0.22				-0.47	6.97%
		(-1.28)	(1.08)	(-2.00)	(1.25)	(-1.02)	(0.55)				(-1.37)	
Model 3	186							-0.01	-0.01	0.16	0.81	0.84%
								(-0.61)	(-0.58)	(0.43)	(0.58)	
Model 4	186	-0.63			0.11*					-0.01	-0.61*	3.31%
		(-1.55)			(1.93)					(-0.04)	(-1.80)	
Model 5	186	-0.65			0.11*			-0.01	-0.01	0.24	0.05	4.09%
		(-1.58)			(1.92)			(-0.78)	(-0.42)	(0.64)	(0.03)	
Model 6	186	-0.59		-0.38**	0.10			-0.01	0.00	0.21	-0.20	6.23%
		(-1.44)		(-2.02)	(1.72)			(-0.73)	(-0.13)	(0.57)	(-0.14)	
Model 7	186	-0.57	0.08	-0.37*	0.07	-0.61	0.25	-0.01	0.00	0.16	-0.60	7.30%
		(-1.39)	(0.92)	(-1.93)	(1.23)	(-1.05)	(0.61)	(-0.66)	(0.10)	(0.42)	(-0.41)	

	Control variables coefficients for 5-year BHARs calculating using size matching										
	n	**IR**	**lnAge**	**NTIC**	**lnSize**	**VC**	**PE**	**VOL**	**Sentiment**	**GDP**	**Intercept**	**R^2**
Model 1	151	-1.08*									-0.20	1.91%
		(-1.70)									(-1.27)	
Model 2	151	-0.94	0.14	-0.33	0.10	-0.67	0.63				-0.92	6.38%
		(-1.47)	(1.00)	(-1.05)	(0.91)	(-0.65)	(1.05)				(-1.56)	
Model 3	151							0.02	-0.03	0.25	2.89	1.65%
								(0.57)	(-1.36)	(0.40)	(1.30)	
Model 4	151	-1.08*			0.16*					-0.17	-0.96	3.82%
		(-1.66)			(1.66)					(-0.39)	(-1.64)	
Model 5	151	-0.98			0.16*			0.01	-0.03	0.31	1.61	4.72%
		(-1.48)			(1.65)			(0.46)	(-1.16)	(0.50)	(0.71)	
Model 6	151	-0.94		-0.35	0.15			0.01	-0.02	0.28	1.30	5.53%
		(-1.42)		(-1.11)	(1.56)			(0.45)	(-0.95)	(0.44)	(0.57)	
Model 7	151	-0.87	0.14	-0.29	0.10	-0.62	0.63	0.02	-0.02	0.31	0.84	6.88%
		(-1.31)	(0.98)	(-0.91)	(0.92)	(-0.59)	(1.00)	(0.63)	(-0.81)	(0.49)	(0.36)	

Tab. OLS regression results with 60-month BHARs as dependent variables and control variables as per models descriptions above. n is the number of observations and R^2 the coefficient of determination indicating the proportion of the variance explicated by the model.

IR is the raw initial return computed as per methodology disclosed in section III.2.; lnAge is the natural logarithm of the number of years between the date of incorporation and the pricing date ; NTIC is a dummy variable equals to 1 when the industry is part of the New Economy (i.e. include the “Technology”, “Biotechnology” and “Communications” sectors as per OECD definition) ; lnSize is the natural logarithm of the first market capitalization available on Bloomberg within the first year from issuance ; VC is a dummy variable equals to 1 when the company was backed by a Venture Capital firm ; PE is a dummy variable equals to 1 for Private Equity-backed companies ; VOL is the number of IPO issuances over a 3-month period centered on the IPO date ; Sentiment is an estimate of French investors sentiment measured using monthly “EUESFR Index” from Bloomberg ; GDP is the closest quotation of French quarterly Gross Domestic Product adjusted for seasonality and working days using “FRGEGDPQ Index” Bloomberg ticker. T-statistics are disclosed in brackets.
*/**/*** denotes the significance at the 10%/5%/1% level based on conventional t-stat.

VI.2 Appendix 2: OLS results for alternative models checking for correlation effect

Control variables coefficients for 3-year BHARs adjusted for CAC Mid & Small

	n	IR	lnAge	NTIC	lnSize	VC	PE	VOL	Sentiment	GDP	Intercept	R^2
Model a	227	-0.25		-0.07	0.05			-0.01			-0.20	2.93%
		(-0.94)		(-0.61)	(1.55)			(-1.51)			(-0.65)	
Model b	227	-0.22		-0.07	0.05				-0.01		0.23	2.28%
		(-0.81)		(-0.63)	(1.56)				(-0.89)		(0.37)	
Model c	227	-0.40	0.03	(-0.09)	0.04	-0.12	0.05	-0.02**		0.42**	(-0.32)	5.96%
		(-1.49)	(0.54)	(-0.79)	(1.15)	(-0.46)	(0.26)	(-2.33)		(2.45)	(-1.38)	

Control variables coefficients for 3-year BHARs calculating using size matching

	n	IR	lnAge	NTIC	lnSize	VC	PE	VOL	Sentiment	GDP	Intercept	R^2
Model a	207	-0.47		-0.09	0.08*			-0.02			-0.32	3.54%
		(-1.35)		(-0.57)	(1.69)			(-1.31)			(-1.10)	
Model b	207	-0.35		-0.04	0.09*				-0.02**		1.19	4.65%
		(-0.99)		(-0.27)	(1.78)				(-2.02)		(-1.10)	
Model c	207	-0.59	0.01	-0.12	0.08	-0.12	-0.07	-0.02*		0.31	-0.36	4.80%
		(-1.64)	(0.09)	(-0.76)	(1.48)	(-0.33)	(-0.27)	(-1.79)		(1.33)	(-1.12)	

Tab. OLS regression results with 36-month BHARs as dependent variables. n is the number of observations and R^2 the coefficient of determination indicating the proportion of the variance explicated by the model. IR is the raw initial return computed as per methodology disclosed in section III.2.; lnAge is the natural logarithm of the number of years between the date of incorporation and the pricing date ; NTIC is a dummy variable equals to 1 when the industry is part of the New Economy (i.e. include the "Technology", "Biotechnology" and "Communications" sectors as per OECD definition) ; lnSize is the natural logarithm of the first market capitalization available on Bloomberg within the first year from issuance ; VC is a dummy variable equals to 1 when the company was backed by a Venture Capital firm ; PE is a dummy variable equals to 1 for Private Equity-backed companies ; VOL is the number of IPO issuances over a 3-month period centered on the IPO date ; Sentiment is an estimate of French investors sentiment measured using monthly "EUESFR Index" from Bloomberg ; GDP is the closest quotation of French quarterly Gross Domestic Product adjusted for seasonality and working days using "FRGEGDPQ Index" Bloomberg ticker. T-statistics are disclosed in brackets.

VI.3 Appendix 3: Ex-post control for BHARs resulting from double matching procedure

	Portfolio adjusted - MS190								Control firm - Size and BTM		
	Full sample				*Restricted control sample*						
Month	**n**	**BHARs**	**Median**	**t-stat**	**n**	**BHARs**	**Median**	**t-stat**	**BHARs**	**Median**	**t-stat**
1	282	7.67%	0.88%	3.49	180	3.58%	0.66%	2.75	-0.35%	-0.10%	-0.21
6	277	8.54%	-4.16%	2.09	174	1.89%	-5.34%	0.45	-5.53%	-7.81%	-1.10
12	274	7.96%	-11.64%	1.29	170	6.56%	-9.65%	0.96	-6.13%	-8.83%	-0.70
24	250	-1.50%	-22.51%	-0.23	142	0.14%	-17.22%	0.02	-34.35%	-7.26%	-1.48
36	230	-4.74%	-26.85%	-0.72	127	-1.04%	-14.91%	-0.13	-18.15%	-3.94%	-0.95
48	211	-11.96%	-36.48%	-1.81	99	2.38%	-22.06%	0.24	9.14%	-3.89%	0.76
60	189	-12.06%	-43.06%	-1.34	85	5.61%	-25.63%	0.41	2.45%	-8.74%	0.14

Tab. Equally weighted Buy-and-hold abnormal returns measured from first closing market price. Buy-and-hold abnormal returns (BHARs) are computed as described in section III.2. We test the null hypothesis that mean abnormal performance is equal to zero. A conventional test statistic is $\sqrt{n}$S with $S = \frac{BHAR_T}{\sigma_T}$ and n the number of IPO firm observations.

Full sample refers to the 290 IPO firms under study; the number of observations decreases because some companies have delisted or due to time constraint (e.g. 5-year observations are impossible for issuances that took place in 2019). Restricted control sample excludes firms for which we failed to measure BHARs using control firm approach with both Size & BTM criteria. Therefore, the restricted control sample is defined ex-post in order to match and control for observations available under the double matching procedure.

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