

# THE IMPACTS OF INVESTOR SENTIMENT AND GEOGRAPHICAL LOCATIONS ON IPO UNDERPRICING

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## ABSTRACT

*This study examines the impacts of (1) Google abnormal search volume index (ASVI) and (2) geographic locations on firms' initial public offering (IPO) underpricing. The results show that pre-IPO ASVI positively affects IPO first-day returns, implying that IPO underpricing is associated with investor sentiment. Urban and city firms have greater underpricing than rural firms, revealing that the former are more information asymmetric. More importantly, the cross term of high ASVI and urban generates serious IPO underpricing, which makes the respective effects of ASVI and location become insignificant. This finding implies that information asymmetry intensifies investor sentiment to increase IPO underpricing.*

**Keywords:** Initial Public Offerings (IPOs), Underpricing, Search Volume Index (SVI), Geographical locations.

## INTRODUCTION

This study investigates the impacts of Google search volume index (SVI) and the geographic locations of firms on the underpricing of their initial public offerings (IPOs), the former being a measure of investor sentiment and the latter involving information asymmetry. More importantly, we examine whether these two factors generate an interactive effect on IPO first-day returns.

Both investor sentiment and information asymmetry can account for IPO underpricing Ritter & Welch, (2002) for underpricing reasons. Investor sentiment causes IPO underpricing because overoptimistic investors overvalue the IPO stock rather than basing their decisions on its fundamentals. Information asymmetry makes pre-IPO investors generate adverse selection due to the problem of the lemon market or winner's curse, so that issuers would provide relatively low offer prices. On the other hand, more uninformed investors due to information asymmetry would bid prices high on the IPO day, resulting in significant IPO underpricing.

Our first variable, Google search volume, is the number of user queries about a specific keyword during a certain period. Da et (2001) find that abnormal SVI (ASVI) is positively associated with IPO underpricing. They argue that this finding is consistent with the sentiment-based explanation (Derrien, 2005; Cook et al., 2006). That is, high ASVI arises from sentiment investors who ignore firms' future cash flows and risk, so that they would overvalue stock on the IPO first day. We use ASVI similar to Da et al. (2011) measure in our analyses.

Our second variable, geographic locations, is found to generate strong ownership bias. Coval & Moskowitz (1999) find that mutual funds tend to hold portfolios consisting of firms that are

closer to their headquarters and individual investors are even more biased toward local firms. Ivković & Weisbenner (2005) document that the average US household invests 31% of its portfolio in stocks located within a 250-mile radius. Baik et al. (2010) find that the stocks held by local institutional investors earn higher excess returns around future earnings announcements than those held by nonlocal institutional investors. Bernile et al. (2015) discover that institutional ownership in their local stocks is higher in states with lower population densities. These findings reveal that investors prefer local stocks and local investors have informational advantages over nonlocal investors, such as meeting with the stakeholders of the local firms.

Empirically, we separate the IPO firms into the urban, city, and rural groups according to their headquarter locations. Rural firms should have lower IPO underpricing, in that they are mainly invested in by nearby residents who are better informed and can value rural firms more correctly.

We conjecture that ASVI and urban location may generate an interactive effect on IPO underpricing. Evidence shows that individuals' investment decisions rely on information that can be easily obtained, such as well recognized brands (Frieder & Subrahmanyam, 2005) and media contents (Tetlock, 2007). Since urban firms have more informal information and greater liquidity (Loughran, 2007) and are more frequently reported on by the media than rural firms, their IPOs can attract more retail investors' attention. In this case, urban firms with high ASVI's would produce greater underpricing.

The results show that pre-IPO ASVI is positively associated with IPO underpricing, consistent with the argument that extra search volume come from sentiment investors who tend to overvalue IPO stocks. Firms in urban and city areas have greater IPO first-day returns than those in rural areas, implying that investors of rural stocks are better informed about the IPO firms. Surprisingly, when we consider the cross term of ASVI and urban in our regressions, their interactive effect on IPO underpricing is positively significant and the respective impacts of these two factors become insignificant. This finding suggests that the occurrence of investor sentiment for IPOs concentrates in urban firms, in that retail investors have superficial knowledge but little analysis of these firms.

In addition to ordinary IPOs, we use two special types of samples: carve-out and M&A (mergers and acquisitions) IPOs to test whether ASVI and location affect their underpricing. A carve-out IPO is a new entity spun off from its parent firm to conduct an IPO, and an M&A IPO refers to a firm that acquired another firm (firms) within a short period (one year in this study) before they go public. These two types of IPOs are likely to be known by more investors than ordinary IPOs, so that they should be less information asymmetric. We find that the underpricing of the carve-out and M&A IPOs does not significantly differ according to their geographical locations. This finding implies that urban and city investors are well informed about these two types of IPOs, so that rural investors' information is no longer superior to urban and city investors.

In sum, this study contributes to the literature by showing that firms with high ASVI and located in urban and city areas have higher IPO underpricing and these two factors generate a strongly interactive effect. These findings suggest that both investor sentiment and information asymmetry cause IPO first-day returns to rise, the latter intensifying the former to magnify mispricing.

The remainder of this study is structured as follows. Section 2 introduces our measures of ASVI and geographical locations. Section 3 describes our data sources and sample characteristics. Section 4 reports the empirical results. Finally, section 5 provides a conclusion.

## VARIABLE MEASURES

## Abnormal Searching Volume Index

We use the daily SVI's of each IPO stock from (calendar) day  $-56$  to day  $-1$  relative to the IPO day ( $D_{-56}, D_{-55}, \dots, D_{-1}$ ) to calculate ASVI's in the week preceding the IPO (from day  $-7$  to day  $-1$ ).  $n$ -day ASVI can be expressed as follows:

$$n\text{-day ASVI} = \sum_{t=1}^n (D_{-t} - \bar{D}_{-t}^w). \quad (1)$$

where  $\bar{D}_{-t}^w$  is the average SVI of the same calendar weekday as day  $-t$  from week  $-8$  to week  $-2$  (i.e.,  $\bar{D}_{-t}^w = \frac{1}{7} \sum_{\tau=1}^7 D_{-t-7\tau}$ ). This calculation is to avoid information distinction among different weekdays. For instance, the ASVI on the Monday preceding the IPO day is the difference between the SVI on the Monday right before the IPO and the average SVI from week  $-8$  to week  $-2$ .

## Geographic Location

Similar to Loughran (2008), we divide the IPO sample into the urban, city, and rural groups. A firm is classified as urban if its headquarters is located in any one of the top 20 US metropolitan areas in terms of population (based on the 2010 Census data of the US Office of Management and Budget). A firm is assigned to the rural group if its headquarters is at least 70 miles away from top 51 US metropolitan areas (population over one million). All other firms neither in an urban nor a rural area are classified as the city group.

## DATA

We collect data on IPOs during 2004-2016 (13 years) from the Thomson-Reuters SDC New-Issues database. The data items include firm name, CUSIP number, IPO date, SIC code, number of new shares offered, number of shares outstanding, offer price, and listing stock exchange.

Return data come from the Center for Research in Security Prices (CRSP) database. Accounting data, address, and zip code are extracted from the Compustat database, in which address and zip code are used to measure the distance between the IPO firm and the closest cities. SVI's of firms before IPOs are obtained from the Google Trends website by their symbols.

Spinoff and M&A data are obtained from the Thomson-Reuters SDC M&A database. We identify a carve-out IPO if the firm was spun off from its parent and an M&A IPO if the firm conducted an M&A within the one year before the IPO.

## Sample Characteristics

Table 1 Panel A of this table reports the number of the sample IPOs completed during 2004-2016. Each IPO firm's search volume index (SVI) on Google Trends within the 7 days prior the IPO is identified. Firms that do not have enough SVI are named 'No SVI.' The IPO firms are classified as urban if their headquarters are located in one of top 20 US metropolitan areas, as rural if their headquarters are at least 70 miles from any of top 51 US metropolitan areas, and city otherwise. Panel B lists the number of IPO firms that are carved out from their parent firms and

that of firms conducting mergers and acquisitions within one year before IPOs. Panel C lists the 3-day and 7-day ASVI's are the abnormal search volume index (ASVI) in Google within the 3 and 7 days before the IPO, respectively.

Year	All	With SVI				No SVI			
		Total	Urban	City	Rural	Total	Urban	City	Rural
2004	120	87	27	46	14	33	10	21	2
2005	109	95	25	51	19	14	4	6	4
2006	122	106	38	46	22	16	5	9	2
2007	119	111	27	60	24	8	3	3	2
2008	17	16	6	9	1	1	0	1	0
2009	35	35	12	17	6	0	0	0	0
2010	72	69	23	38	8	3	0	3	0
2011	78	76	23	35	18	2	0	2	0
2012	97	96	26	56	14	1	0	1	0
2013	145	141	49	77	15	4	1	1	2
2014	158	154	43	80	31	4	1	2	1
2015	90	88	28	42	18	2	0	2	0
2016	55	52	22	25	5	3	1	1	1
Sum	1,217	1,126	349	582	195	91	25	52	14
%		100%	30.9%	51.7%	17.4%	100%	27.5%	57.1%	15.4%

  

Carve-out IPOs				M&A IPOs			
Total	Urban	City	Rural	Total	Urban	City	Rural
209	67	107	35	118	34	64	20
100%	32.1%	51.2%	16.7%	100%	28.8%	54.2%	17.0%

  

Variable	Q1	Median	Mean	Q3
3-day ASVI	-11.111	0.000	16.211	38.444
7-day ASVI	-20.018	9.729	23.572	65.597

Panel A of Table 1 reports the number of IPOs from 2004 to 2016. Among 1,217 IPOs, 1,126 firms have SVI data, of which about 31%, 52%, and 17% are located in urban, city, and rural areas, respectively. Panel B shows that there are 209 carve-out IPOs and 118 M&A IPOs.

Panel C summarizes ASVI's and several fundamental characteristics of the IPO sample. The median 7-day ASVI is 9.729, indicating that IPO firms receive more investor attention in the week prior to the IPO.

## RESULTS

### IPO Underpricing

Table 2 reports IPO underpricing (first-day return), which is calculated as (IPO first-day closing price/Offer price – 1). The sample contains 1,126 IPOs completed during 2004-2016. In Panel A, ASVI is the abnormal search volume index (ASVI) in Google within the 7 days before the IPO. Panel B separates the IPO firms into the urban, city, and rural groups according to the locations of their headquarters. Panel C divides the urban, city, and rural groups evenly into two subgroups according to their ASVI's. Numbers in the Difference column (in parentheses) are the

probabilities of t-test for mean and Wilcoxon rank-sum test for median. Superscripts \*, \*\*, and \*\*\* represent statistical significance at the 10%, 5%, and 1% level, respectively.

<b>Table 2</b>						
<b>PANEL A IPO UNDERPRICING ACCORDING TO ASVI</b>						
	All (%)	High ASVI	Low ASVI	Difference		
Mean	14.991	16.650	13.334	(0.042 <sup>**</sup> )		
Median	7.000	8.158	6.100	(0.093 <sup>*</sup> )		
<b>Panel B IPO Underpricing according to Location</b>						
	Location			Difference		
	(1) Urban	(2) City	(3) Rural	(1)–(2)	(1)–(3)	(2)–(3)
Mean	16.068	15.634	11.145	(0.819)	(0.043 <sup>**</sup> )	(0.036 <sup>**</sup> )
Median	7.188	8.139	4.917	(0.486)	(0.009 <sup>***</sup> )	(0.089 <sup>*</sup> )
<b>Panel C IPO Underpricing according to ASVI and Location</b>						
	Location			Difference		
	(1) Urban	(2) City	(3) Rural	(1)–(2)	(1)–(3)	(2)–(3)
Mean						
High ASVI	19.920	16.313	11.862	(0.213)	(0.098 <sup>*</sup> )	(0.017 <sup>**</sup> )
Low ASVI	12.070	14.262	10.174	(0.324)	(0.218)	(0.529)
Difference	(0.008 <sup>***</sup> )	(0.344)	(0.618)			
Median						
High ASVI	8.500	9.800	5.926	(0.852)	(0.026 <sup>**</sup> )	(0.086 <sup>*</sup> )
Low ASVI	6.522	6.176	2.929	(0.566)	(0.164)	(0.360)
Difference	(0.137)	(0.067 <sup>*</sup> )	(0.720)			

Panel A of Table 2 shows that the average first-day return is about 15.0%, which is slightly higher than the 12.4% reported in Nielsson & Wójcik (2016) (the sample period: 2004–2014). When the sample is evenly separated into the high and low groups by AVSI's, IPO first-day returns of the high-ASVI firms (mean 16.650%) are significantly greater than those of the low-ASVI firms (13.334%), implying that IPO stocks with greater investor attention tend to have more severe underpricing.

Panel B shows that urban and city firms have greater underpricing than rural firms. For instance, the average IPO first-day returns of the urban and rural firms are 16.068% and 11.145%, respectively, and their difference is statistically significant. These numbers are consistent with the argument that rural investors overvalue IPO firms to a lesser extent than urban investors.

Panel C separates each of the three location groups evenly into the high- and low-ASVI subgroups. Among the three location subgroups with high-ASVI's, the average IPO first-day return of urban firms (19.920%) is significantly greater than that of rural firms (11.862%). However, this situation does not happen among the location subgroups with low-ASVI's, in which the average returns of the urban×low-ASVI and rural×low-ASVI subgroups are 12.070% and 10.174%, respectively, and their difference is not significant. Furthermore, the average IPO first-day returns significantly differ between the urban×high-ASVI (19.920%) and urban×low-ASVI (12.070%) subgroups, but not between the high- and low-ASVI subgroups of rural firms (11.862% and 10.174%). These numbers indicate that the urban×high-ASVI subgroup has the most pronounced IPO underpricing.

In short, this section shows that IPO underpricing is positively associated with AVSI and

locations, respectively, and these two factors together result in more significant IPO underpricing.

### Regression Analyses

This section uses IPO first-day returns as the dependent variable to perform regressions with the yearly effect. The input variables include 7-day ASVI, the urban and city dummies ( $D_{Urban}$  and  $D_{City}$ ), two industry factors, IPO variables, and firm characteristics (total assets (TA) and profitability (EBIT/TA)).

	All IPOs		Carve-out IPOs		M&A IPOs	
ASVI	0.040***	0.023	0.071**	0.080	0.035	0.085
	(0.001)	(0.408)	(0.027)	(0.334)	(0.483)	(0.485)
$D_{Urban}$	4.389*	2.972	9.440	7.421	12.507	13.821
	(0.064)	(0.238)	(0.132)	(0.298)	(0.248)	(0.234)
$D_{City}$	2.405	2.634	4.134	5.423	5.179	7.024
	(0.268)	(0.258)	(0.452)	(0.407)	(0.595)	(0.509)
$ASVI \times D_{Urban}$		0.073**		0.057		-0.046
		(0.044)		(0.558)		(0.782)
$ASVI \times D_{City}$		-0.006		-0.060		-0.073
		(0.861)		(0.537)		(0.620)
Industry						
Industry Returns	0.051	0.053	-0.243	-0.221	0.214	0.199
	(0.357)	(0.331)	(0.206)	(0.251)	(0.466)	(0.517)
Industry HHI	0.000	0.007	-0.561*	-0.554*	0.435	0.540
	(0.990)	(0.979)	(0.071)	(0.074)	(0.396)	(0.343)
IPO Variables						
Offer Price	1.257***	1.249***	2.343***	2.298***	1.820***	1.842***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.004)	(0.004)
Log (Offering Size)	-0.113	-0.157	-8.427**	-8.267**	-3.902	-3.505
	(0.940)	(0.916)	(0.037)	(0.040)	(0.513)	(0.569)
Secondary Shares%	-0.654	-0.389	7.279	8.765	-4.332	-3.771
	(0.852)	(0.911)	(0.345)	(0.258)	(0.795)	(0.824)
Firm Characteristics						
Log (Assets)	-2.308***	-2.307***	-0.448	-0.290	-2.363	-2.667
	(0.001)	(0.001)	(0.803)	(0.871)	(0.526)	(0.486)
EBIT/TA	-0.018	-0.012	-4.867	-4.927	-5.443	-6.101
	(0.845)	(0.897)	(0.137)	(0.131)	(0.460)	(0.421)
Intercept	-11.649	-12.523	75.756*	72.422*	-38.405	-50.988
	(0.781)	(0.764)	(0.057)	(0.069)	(0.514)	(0.434)
# of Observations	1,126	1,126	209	209	118	118
Adjusted R <sup>2</sup>	0.211	0.217	0.404	0.415	0.435	0.437

Table 3 shows the regressions results which use IPO underpricing (First-day closing price/Offer price – 1) as the dependent variable with the yearly effect. The sample contains 1,126 IPOs, 209 carve-out IPOs, and 118 M&A IPOs completed during 2004-2016. ASVI is the abnormal search volume index in Google within the 7 days before the IPO. We divide the IPO firms into the urban, city, and rural groups. Industry returns are one-year stock returns of the industry that the IPO firm operates in. The Herfindahl-Hirschman index (HHI) measures the degree of industry concentration. Offering size is the dollar amount of the new issue. Secondary shares% is the fraction of secondary shares to the new-issue shares. Assets and EBIT are data in the fiscal year preceding the IPO. Numbers in parentheses are  $p$ -values. Superscripts \*, \*\*, and \*\*\* indicate statistical significance at the 10%, 5%, and 1% level, respectively.

The first industry factor, one-year pre-IPO industry returns, is used to capture the effect that investors may be overoptimistic about IPO firms that operate in hot industries. The second factor is industry concentration, measured by the Herfindahl-Hirschman Index by Fama & French's (1997) categories of 49 industries. HHI is included to reflect the possibility that firms in lowly concentrated industries may provide relatively low offer prices to attract investors.

There are three IPO variables: offer price, offering size, and percentage of secondary shares. We conjecture that investors could be optimistic about firms with high offer prices on the IPO first day, in that these firms usually have some strengths such as high profitability and reputational brands. A large offering size represents a high supply of the new-issue stock, which may have a negative impact on the IPO first-day prices. The percentage of secondary shares is the fraction of secondary shares occupied in the new-issue shares. The greater the fraction of secondary shares, the lower the supply of new shares.

Table 3 reports the regression results. For all IPOs, the coefficient of ASVI is positive and significant (e.g., 0.040 in the first column), implying that greater investor sentiment delivers higher IPO first-day returns. The coefficient of the urban dummy (4.389 in the first column) is significantly positive, revealing that urban firms are more information asymmetric. However, when we add two cross terms in the second column ( $AVSI \times D_{Urban}$  and  $AVSI \times D_{City}$ ),  $AVSI \times D_{Urban}$  is significant (0.073) but AVSI and  $D_{Urban}$  become insignificant. This result indicates that IPO underpricing concentrates in urban IPO firms with high attention. In other words, IPO first-day prices of urban firms with strong investor sentiment jump up more significantly than those of other firms.

Industry factors do not significantly affect IPO first-day returns. The coefficients of offer price are positive and significant (e.g., 1.257 in the first column), reflecting investors' optimism about high offer-price stocks. Total assets are negatively associated with IPO underpricing, indicating that larger firms tend to have lower first-day returns.

For the carve-out IPOs, AVSI is significantly related to the underpricing (coefficient 0.071 in the third column), implying that these stocks tend to be overvalued when they receive attention from retail investors. Intuitively, carve-out IPOs should be better known to the market. Nevertheless, retail investors may have little information about these IPOs because a number of carve-out firms go public a few years after their independence from the parents. Further,  $D_{Urban}$  and  $D_{City}$  are not significant, showing that underpricing of the carve-out IPOs does not differ according to firms' locations. The negative coefficients of industry HHI (–0.561 in the third column) indicates that carve-out firms operating in highly competitive industries have greater IPO first-day returns.

Finally, neither AVSI nor the location dummies are significantly correlated with IPO underpricing for the M&A IPOs. These results signify that retail investors' attention does not cause

overoptimism and information asymmetry due to location is not serious for these IPO firms.

## CONCLUSIONS

This study examines the impacts of the Google ASVI and geographic locations of firms' headquarters on their IPO underpricing. Empirically, we find that ASVI is positively associated with IPO underpricing, implying that first-day returns rise due to strong investor sentiment. Urban and city stocks yield greater underpricing than rural stocks, consistent with the argument that rural investors have more information about the firms. Surprisingly, we find that ASVI and location generate a positively interactive effect on IPO underpricing, making the respective impacts of ASVI and location on IPO first-day returns insignificant. This result reveals that information asymmetry causes retail investors to generate serious sentiment.

Overall, this study contributes to the literature by showing a positively interactive effect of ASVI and location on IPO underpricing. This phenomenon implies that information asymmetry intensifies investor sentiment, causing prices to rise on the IPO first day. Future research that incorporates investor sentiment into assets pricing may need to consider the intensified effect of information asymmetry on prices.

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