Geographic Dispersion and IPO Underpricing

Dimitrios Gounopoulos

Abstract This study provides empirical evidence that underpricing is larger for more geographically dispersed firms when using a measure that captures the number of states in which firms have economic interests. The findings show that the average underpricing for local firms is 4.85% less than for dispersed firms (firms that have economic interests in more than three states in the USA). The hypothesis that underpricing is larger for more geographically dispersed firms is confirmed, and the evidence is robust for alternative measures of geographic dispersion. Results reveal that the likelihood of a firm committing accounting fraud increases the more geographically dispersed a firm's economic interests become.

Keywords Geographical location · Home bias · IPOs · First-day returns · Underwriter reputation

JEL Classifications: G10, G14, G39

1 Introduction

When Twitter had an initial public offering (IPO) in the USA in November 2013, 70 million shares were sold at $26 a share. At the end of the first trading day, the stocks traded at $44.94 each, up to 72.84%. Twitter could therefore have sold 70 million shares at $44.94 and could have raised more than $3 billion, a billion dollar more than what they did raise. Hence, the issuing firm left $1 billion on the table. Early investors can thus make capital gains on their investments when IPOs are underpriced.

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A substantial body of work regarding the IPO of common stock examines various theories that explain underpricing. These theories come under four broad categories, namely, asymmetric information, institutional reasons, control considerations and behavioural approaches. Beatty and Ritter (1986) and Welch (1989) document strong evidence that information asymmetry contributes significantly to increased underpricing. Cliff and Denis (2004) and Lowry and Murphy (2006) reveal a significant positive relation between underwriter reputation and underpricing. Bradley and Jordan (2002) investigate the effects that revision, overhang, venture capital (VC) backing and hot markets have on underpricing, indicating that all four determinants significantly increase underpricing.

The literature on corporate geography suggests that geographically dispersed information on company earnings and cash flows contributes to increased asymmetric information (García & Norli, 2012; Platikanova & Mattei, 2016). The geographic dispersion of business activities across multiple states in the USA is making it more difficult to achieve efficient and informed investment decisions. Gao et al. (2008) reveal that as a firm's operations become more geographically dispersed, the valuation discount grows. García and Norli (2012) show that monthly returns on common stock for local firms are more than for geographically dispersed firms. Platikanova and Mattei (2016) highlight that analysts' forecasts become less accurate for more geographically dispersed firms due to information asymmetry.

In an important departure from prior evidence, this study focuses on the degree to which geographic dispersion across states in the USA affects underpricing. Prior studies state that there may not be relevant information about company performance and future sales trends for geographically dispersed firms due to inefficiencies in aggregating this information across business activities in multiple states. They further reveal that a firm that has economic activities across multiple states in the USA sees an increase in management discretion, such as shifting profits to different states, which increases information asymmetry.

Heider and Ljungqvist (2015) mention that tax code variation across states in the USA further contributes to the complexity of efficiently aggregating relevant information across states and increases information asymmetry. Therefore, an investigation is conducted here using a measure for geographic dispersion to see if there is empirical evidence consistent with Platikanova and Mattei (2016) that geographically dispersed information contributes to increased levels of information asymmetry and ultimately increases underpricing.

Using publicly listed companies in the USA that file annual 10-K reports with the Securities and Exchange Commission (SEC) and that went public between 1995 and 2015, a measure for geographic dispersion is developed here based on the work by García and Norli (2012), capturing all the economic ties between a firm's economic interests and its headquarters. Using the measure for geographic dispersion and controlling for several determinants for underpricing, the study reveals that the IPOs of firms with business activities in more than three states in the USA are more underpriced than firms that have economic interests in three or fewer states.

The study is robust to using Platikanova and Mattei (2016) measure for geographic dispersion, i.e. concentration, and shows that geographic dispersion is

a determinant of underpricing. The study further shows that as the number of states in which a firm has economic interest increases, the likelihood of that firm committing fraud also increases. The study contributes to the body of knowledge on the geography of corporations and how it affects the efficiency of aggregating relevant information across multiple states in the USA and the impact it has on underpricing.

The study is structured as follows. Section 2 entails a literature review of relevant studies that were curried to investigate the determinants of underpricing and that have examined the role that geographic dispersion plays in information asymmetry and stock returns, valuation, accuracy of analysts' forecasts and earnings quality. Section 3 provides the hypothesis development, related to the effect that geographic dispersion has on underpricing. Section 4 showcases the empirical link between geographic dispersion, underpricing and accounting fraud, while Sect. 5 concludes the manuscript.

2 Literature Review

This literature review looks at the meaning of and provides evidence of underpricing. Firm characteristics that are positively and negatively associated with underpricing are examined, and a further investigation into the theories proposed to explain the causes of underpricing is carried out. The literature on geographic dispersion and its effects on various firm attributes, such as operating efficiency, trading performance, stock returns, forecasting and firm valuation, is explored, and a discussion is started on whether geographic dispersion could be significantly associated with underpricing.

Logue (1973) states that investors who buy common stock IPOs during the offer price period quickly realise substantial systematic profits. This is because the shares that companies sell when they go public are underpriced as there is a substantial jump in price on the first day of trading. Underpricing is defined as the percentage difference between the offer price, the price at which the investors bought the IPO shares and the price that the shares trade at on the market. In advanced capital markets such as in the USA and the UK, the full extent of underpricing is visible quickly, normally by the end of the first trading day.

2.1 Underpricing Theories

2.1.1 Asymmetric Information

Underpricing is to some extent explained through the notion that one of the parties involved in an IPO has privy to more information than other parties. The principal-agent problem thus arises, and these frictions of information lead to underpricing.

The principal-agent problem can be examined through three lenses, i.e. when either the investment bank, the issuing firm or the new investors know more.

Baron (1982) theory assumes that the investment bank knows more than the issuing firm when it comes to demand conditions and thus uses underpricing as a method to drive high-selling efforts. Beatty and Ritter (1986) find that investment banks persuade unwilling issuing companies to purposefully underprice IPO shares to encourage uninformed investors to not leave the IPO market.

The theory by Welch (1989) reveals that the issuing firm has more information about the true value of the firm and uses underpricing as a method to signal to investors. According to Welch (1989), there are two types of firms, namely, good firms (high-quality firms) and bad firms (low-quality firms), and these firms look indistinguishable to outside investors.

A good firm can signal to investors that it is of high quality by underpricing its shares and deliberately leaving money on the table as it will be able to recover it later through a seasoned equity offering. However, this gives low-quality firms the incentive to mimic the actions of good firms, i.e. underprice their shares during the IPO, yet low-quality firms typically refrain from signalling that they are good firms because the risk of detection means that they will be unable to recoup the money left on the table at the post-IPO financing stage.

Rock (1986) with his winner's curse provides an explanation for underpricing from an asymmetric information perspective. He assumes that the investors know more and are able to avoid participating in overpriced IPOs, bidding only for those that are attractively priced. Rock (1986), meanwhile, report that uninformed investors bid indiscriminately for attractive/unattractive IPO offerings. Thus, uninformed investors buy all the unattractively priced shares, and their demand for the attractively priced shares is crowded out by informed investors. Rock (1986), therefore, documents that uninformed investors need to underprice on purpose to prevent informed investors from not participating in the IPO. Lastly, Benveniste and Spindt (1989) make the assumption that as better-informed investors honestly reveal the information they have before the issuing price is finalised, they reduce the amount of money left on the table.

2.1.2 Institutional Reasons

Lowry and Shu (2002) find that in the USA, almost 6% of companies listed between 1988 and 1995 were sued for IPO-related violations. Tiniç (1988) states that underpricing could be intentional as an insurance against such lawsuits. Logue (1973) and Ibbotson (1975) findings indicate that there are institutional explanations for underpricing. They state that the issuing firms deliberately offer their shares at a discount for litigation purposes.

Issuing firms indicate that the likelihood of future lawsuits reduces when the likelihood of shareholders being disappointed with the performance of their shares post-IPO decreases. However, this explanation is mostly significant in the USA, and the risk of being sued is not significant in countries such as Finland, Australia,

Germany, Japan, the UK and Switzerland. Lowry and Shu (2002) reveal contradicting evidence: underpricing decreases when companies are sued. According to Tiniç (1988), Logue (1973) and Ibbotson (1975), underpricing increases when companies are sued.

Another institutional reason is price stabilisation. Ruud (1993) states that companies do not underprice deliberately but rather that IPOs are priced at the expected market value, and those offerings that appear they will fall under the offer price are stabilised in the aftermarket. Ruud (1993) mentions that price stabilisation gives the picture of a positive increase in price. Asquith et al. (1998) state that if Ruud (1993) analysis that underpricing is the consequence of price support is correct, then the underpricing distribution of unsupported offerings should have a mean of zero. Asquith et al. (1998) do not provide any evidence and state that underpricing is caused by other factors rather than price support.

2.1.3 Ownership and Control Considerations

Brennan and Franks (1997) state that managers of firms deliberately underprice to generate excess demand. They mention that the excess demand equips managers to ration investors so that they end up owning a smaller amount of the business. This method of allocating shares strategically enables managers to protect their private benefits and avoid more scrutiny regarding non-value maximising behaviour. Brennan and Franks (1997) therefore consider underpricing as a method to retain control of the business.

Stoughton and Zechner (1998) report that underpricing is a method to reduce agency costs. They state that it might be beneficial to allocate shares to a large institutional investor for monitoring purposes. They assert that while monitoring benefits all shareholders, it has its limits as shareholders will only monitor up to the point where it is no longer optimal for the size of their stake in the company. Stoughton and Zechner (1998) therefore find that to encourage better monitoring, managers should allocate a larger stake to an individual investor with an incentive in the form of underpricing.

2.1.4 Behavioural Approaches and Other Theories

Welch (1992) finds that informational cascades can develop in IPOs when investment decisions are made sequentially through later investors basing their positioning on earlier bids, thereby disregarding their own beliefs and the information they are privy to. Therefore, when initial sales are very successful, later investors believe that earlier bidders held favourable information and choose to invest regardless of the information they possess, and thus demand grows substantially.

In contrast, when initial sales are unsuccessful, later investors may be dissuaded from buying and demand merely remains low over time. Therefore, information cascades give early investors market power and put them in a position to demand

underpricing from the issuing firm in return for committing to the IPO (Welch, 1992).

Bradley and Jordan (2002) investigate the extent to which underpricing can be predicted based on information that are publicly available before the offer date. They examined four variables, namely, overhang and file range amendments; venture capitalist (VC) backing, which had been studied before and for which contradictory results are available; and the hot market issue, which states that there is a cyclical pattern that underpricing is larger when firms go public in hot market years. Bradley and Jordan (2002) define file range amendments (revision) as the percentage difference between the initial file ranges and the final IPO offer prices. They document that revision has a statistically significant effect on underpricing. They highlight that when all things are kept equal, upward revisions are related to more underpricing, and downward revisions are related to less underpricing, compared to issues with no revisions. This supports the findings of Cliff and Denis (2004) that underpricing and revision are positively related.

The third variable of interest in is the effect of VC backing on underpricing. Megginson and Weiss (1991) research on the matter suggests that issues by VC-backed firms are significantly less underpriced compared to non-VC-backed firms. However, Bradley and Jordan (2002) find that the opposite is true in more recent years. The fourth variable of interest, hot market issue, significantly affects underpriced. Their findings are in agreement with Ibbotson and Jaffe (1975), Ritter (1984), Loughran and Ritter (2002) and Goergen et al. (2021) that underpricing is positively correlated with hot market issues.

Carter and Manaster (1990) study on IPOs and underwriter reputation states that it is very costly to the issuing firm to leave money on the table (underpricing), and therefore low-risk firms tend to attempt to reveal their low-risk characteristics to the market. According to Carter and Manaster (1990), low-risk firms do this by selecting highly ranked or prestigious underwriters. They find empirical evidence that underwriters that are highly ranked are typically associated with less risky offerings. This finding supports Rock (1986) study that underpricing is greater for more risky IPOs as investor capital migrates toward them for information purposes. Habib and Ljungqvist (2015) report similar evidence for auditors that firm will try to reveal their low-risk characteristics by selecting a Big 4 auditor; hence, Big 4 auditors should be associated with less underpricing.

Lowry and Murphy (2006) document that underpricing is larger for better-ranked underwriters, and this provides support to Loughran and Ritter (2004), Gounopoulos et al. (2017), Colak et al. (2021a), Economidou et al. (2022a, b) and Gounopoulos and Huang (2022) who state that underpricing is larger for highly ranked underwriters. These underwriters typically have more leverage to underprice the IPO shares, which creates valuable currency which can be allocated to investment banking clients. Cliff and Denis (2004) reveal that more highly ranked underwriters are associated with more underpricing and that increasing an underwriter's rank from 7 to 9 will increase underpricing by 4.5%.

Habib and Ljungqvist (2015) study on underpricing and entrepreneurial wealth losses reveals that leverage significantly affects underpricing. They find that under-

pricing is less when a firm's leverage is larger. This supports the finding by James and Wier (1990) that underpricing is affected by leverage. Both Carter and Manaster (1990) and Cliff and Denis (2004) document weak evidence that offer size (proceeds) is related to underpricing. Both indicate that the coefficient for the natural log of IPO proceeds is not statistically different from zero.

2.2 Geographic Dispersion

Underpricing theories are mainly grouped under four broad categories. This study focuses on geographic dispersion as a variable to explain underpricing. The rationale has come about through various research on the relationship between industry and geographically concentrated firms and factors such as profitability, corporate decision-making, stock returns, firm valuation, earnings quality and accuracy of analysts' forecasts.

Previous research by Grullon et al. (2019) examine whether firms are becoming more industry-concentrated. They define industry-concentrated firms as those that own a large market share in an industry and document that US firms in industries with the biggest increase in product market concentration have larger profit margins and experience more lucrative horizontal merger and acquisition deals. Grullon et al. (2019) identify that the increase in profitability in more concentrated industries can be attributed to lower levels of contestability resulting from increased barriers to entry to the industry. Therefore, lower numbers of competitors allow industry market shareholders to gain wider profits through higher prices and lower production costs. Firms, therefore, seem to benefit from a profitability perspective when they are industry-concentrated.

Gao et al. (2008) state that corporations are ever-expanding their business operations far beyond their headquarters to tap into assets found in those locations, such as larger consumer bases, skilled workforces, proximity to certain natural resources, lower taxes and/or certain corporate tax breaks. However, Gao et al. (2008) reveal that geographic dispersion does affect firm valuation. Specifically, they document that firms that are geographically dispersed, meaning firms that have subsidiaries located in different regions in the USA, experience a valuation discount of 6.2% after controlling for global and industrial diversifications. The results show that as firms become more geographically dispersed by expanding their operations to different regions, the valuation discount increases and, therefore, geographic locations have significant implications for firm valuation.

Landier et al. (2009) suggest that the geographical dispersion of firms, which they define as companies that have a distance between their respective divisions and their headquarters, has an effect on corporate decision-making. Landier et al. (2009) report that geographically dispersed firms are less employee-friendly and those divisions of firms that are geographically closer to their headquarters are less likely to face layoffs. Divisions near headquarters perform significantly worse financially before managers consider divesting or restructuring them.

García and Norli (2012) define geographic dispersion as the number of US states mentioned in the 10-K annual reports that are filed with the SEC. They relate the number of states mentioned in these filing to the number of states that these firms operate in (have business/economic activities in). They create stock return portfolios by geographic dispersion, whereby the local portfolio includes firms that operate in a number of states below the 20th percentile number of states and the dispersed portfolio includes firms that operate in a number of states above the 80th percentile number of states.

Shi et al. (2015) analyse how the earnings management choice between real activities management and accrual-based management is affected by the geographic dispersion of a firm's operations. They define geographic dispersion as the count of the states that are mentioned in the 10-K annual reports filed with the SEC, which is based on the same measure for geographic dispersion that García and Norli (2012) constructed. They reveal that compared with geographically concentrated firms, geographically dispersed firms have higher real earnings management and lower accrual-based management; therefore, dispersed firms prefer real activities management, while concentrated firms tend to prefer accrual-based management. They indicate this effect is due to geographically dispersed firms being in possession of a much wider investor base. These firms typically receive more attention from the media, analysts and financial institutions because if dispersed firms engaged in more accrual-based management, they are exposed to more outside scrutiny.

Platikanova and Mattei (2016) create a normalised measure for geographic dispersion, namely, concentration. They then use concentration as the independent variable and the accuracy of financial analysts' forecasts as the dependent variable. The authors find that for geographically dispersed firms, financial analysts issue less reliable and more biased earnings forecasts, while geographically concentrated firms have more reliable earnings forecasts due to the cost of information gathering being lower.

3 Hypothesis Development

Platikanova and Mattei (2016) state that local and dispersed firms may have varying degrees of information asymmetry due to diversification-related information problems. Thomas (2002) declares that the aggregation of financial information is this type of problem for dispersed firms. Abarbanell and Lehavy (2003) find that asymmetric information exists because, for geographically dispersed firms, managers are privy to more information than outside investors because they can observe cash flows in each state that the company has operations in, while outside investors can only observe noisy estimates of these cash flows.

Prior studies find empirical evidence that more geographically dispersed firms are more likely to issue yearly and quarterly filings with delay, can restate information segments related to sales and have more discretionary managed earnings. They mention that all these factors contribute to information asymmetry. Welch (1989)

finds that when managers have more information, it typically leads to underpricing. The hypothesis is presented as follows: Underpricing is more (less) for firms with more (less) geographically dispersed economic activities.

3.1 Geographic Dispersion Sample Selection and Data Sources

The US Securities and Exchange Commission (SEC) requires an annual 10-K report that gives a comprehensive summary of a public company's performance and operations. Public companies must file such 10-K reports with the SEC within 90 days after the end of their fiscal year. The 10-K statement provides information about the evolution of a company in a fiscal year and reports its financial data (García & Norli, 2012).

Four sections of the 10-K statements filed with the SEC from 1995 to 2015 are collected, namely, "Item 1: Business", "Item 2: Properties", "Item 6: Selected Financial Data" and "Item 7: Management's Discussion and Analysis" (García & Norli, 2012). States mentioned in the collected four sections of the 10-K annual reports are counted and used to identify the number of states in which the firms operate.

In some cases, there are sections missing within the 10-K annual reports, and to address this issue, 10-K/A reports, known as amended filings, are employed whereby the missing sections are added. There are instances where there are no 10-K filings available, and the same procedure, i.e. counting mentioned state names, is repeated for the 10-K405, 10-KSB, 10-KT, 10KSB and 10KT405 filings and the amendments to these filings. Only state names in one filing are counted per year (García & Norli, 2012).

Two measures of geographic dispersion are then constructed, namely, the number of states basis and the concentration basis. Firstly, firms that have operations in a small number of states in the USA are classified as local firms, and firms that have operations in many states across the USA are classified as dispersed. Secondly, firms that have high levels of concentration are classified as local firms, while firms with low levels of concentration are classified as dispersed firms.

3.1.1 Number of States as a Measure of Geographic Dispersion

The degree of geographic dispersion is determined based on the number of US state names that are explored within the four sections of the filed 10-K annual reports. Therefore, firm i based on the fiscal year t has a geographic dispersion that is an integer between 1 and 50, as there are 50 states in the USA. Hence, the geographic dispersion for firm i in year t is the count from the last annual report filed prior to December of year t (García & Norli, 2012).

Desai et al. (2017) shows the number of companies that filed 10-K reports with the SEC and went public each year for the period of 1995–2015, the cross-sectional

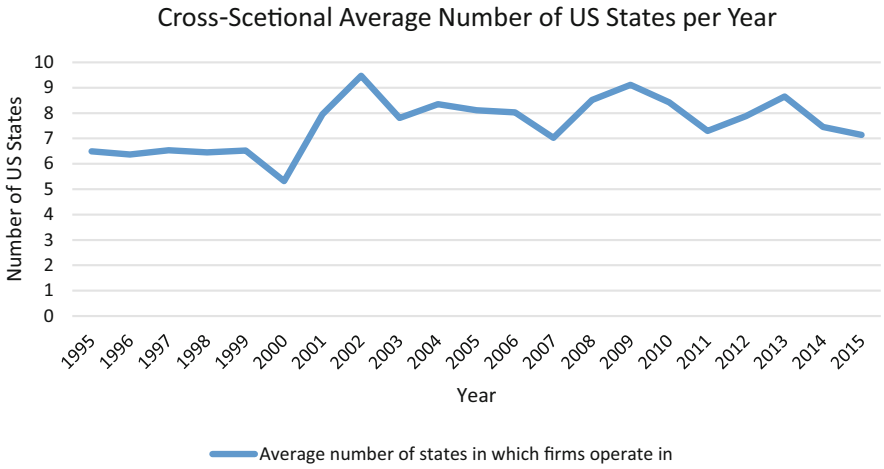

Fig. 1 Cross-sectional average number of US states per year

Table 1 Summary statistics on geographic dispersion (number of states)

	Number of firms	Geographic dispersion (number of states)							
		Mean	Std.	Min	Max	20%	40%	60%	80%
Average	195	7.57	6.84	1	50	2.89	4.58	6.70	10.59
Median	147	7.81	6.67	1	50	3.00	5.00	6.00	10.00
Minimum	21	5.32	4.31	1	50	2.00	3.00	5.00	7.00
Maximum	676	9.47	9.23	1	50	4.00	6.00	9.00	14.80

average number of states that these companies operate in and the standard deviation. Hence, of the 440 companies that filed 10-K annual reports with the SEC and went public in 1995, on average each company operates in 6.49 states, with a standard deviation of 6.63 states.

Figure 1 illustrates the yearly cross-sectional average number of states for the period of 1995–2015. The mean number of states that firms operate in is close to being stable over time between 1995 and 1999, with firms operating in six to seven states on average. A small decline is observed in the year 2000 when, on average, firms operate in 5.32 states, most probably due to the crash of the dot.com bubble causing firms to concentrate their operations. From the year 2001 to 2015, firms have operations in seven to ten states in the USA on average.

Table 1 shows the summary statistics for geographic dispersion. A substantial variation in the geographic dispersion measure (number of US states that firms operate in) is observed with an average of 6.84 states. The cross-sectional variation varies between a minimum of 4.31 states and a maximum of 9.23 states. The average number of (i.e. see Fig. 2), which is calculated as the average of the cross-sectional average time series for the period of 1995–2015. The median number of states that firms operate in, which is calculated as the median of the cross-sectional average

time series, is 7.81 states. The minimum average of states that firms operate in is 5.32 states, and the maximum average of states that firms operate in is 9.47 states. Table 1, Panel B, shows the mean, standard deviation and median of the firm characteristics. The mean underpricing for the data set is 24.69%. Underpricing experiences large standard deviations from the mean of up to 62.50%. The median underpricing is 9.39% (Figs. 2 and 3).

Figure 3 reveals the number of Local and Dispersed firms in the United States. We observe that across our sample the dispersed firms are the majority while over

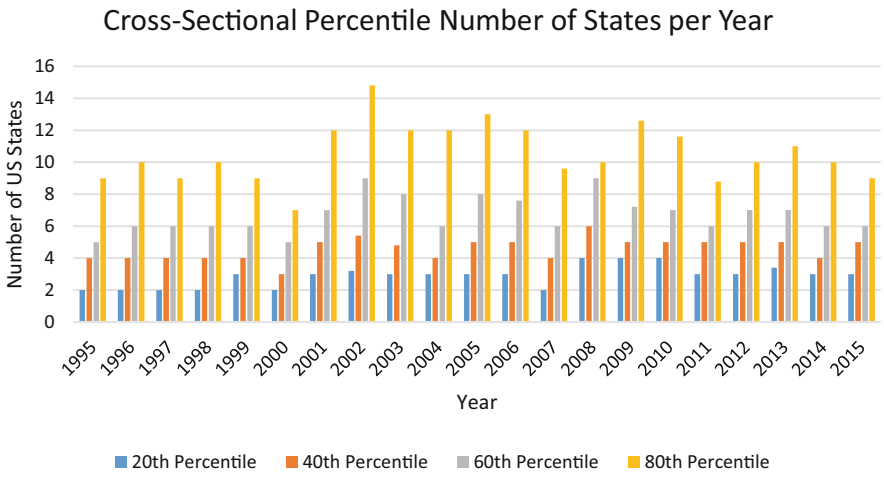

Fig. 2 Cross-sectional percentile number of states per year

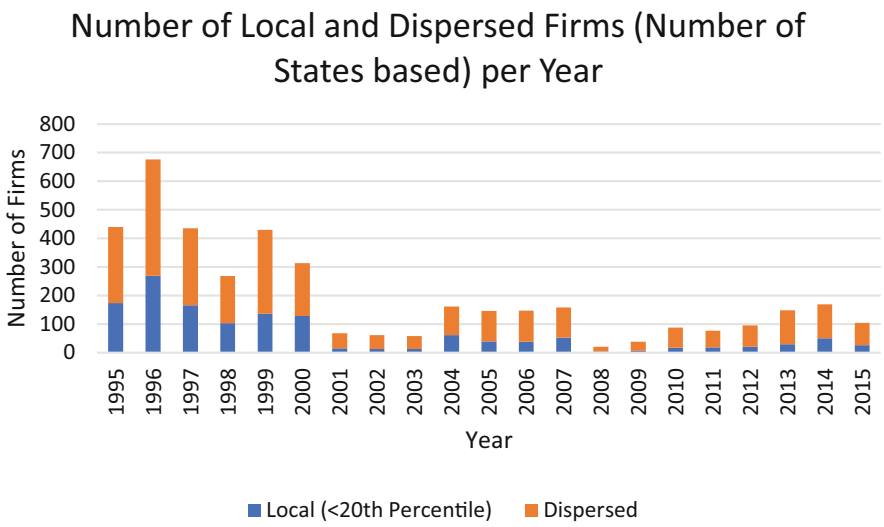

Fig. 3 Number of local and dispersed firms (number of states based) per year

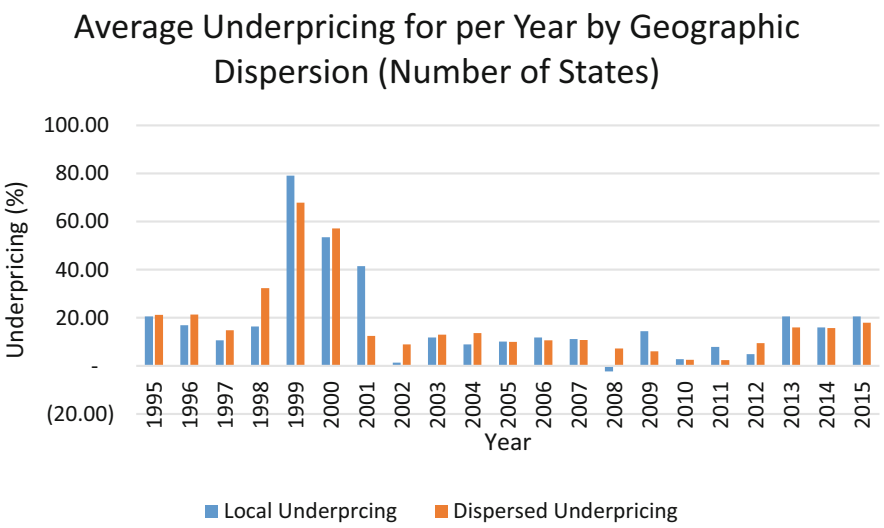

Fig. 4 Average underpricing per year by geographic dispersion (number of states)

the last ten years there are very few local companies. This is a general trend as enterprises diversity their operations.

Figure 4 shows the average cross-sectional underpricing for the local and dispersed portfolios per year for the time period 1995–2015. As discussed, a local firm is defined as a firm that operates in three or fewer states, and dispersed firms are defined as firms that operate in more than three states. Large underpricing is observed in the late 1990s and early 2000s.

Figure 5 also shows the same for leverage, revision, natural log of IPO proceeds, overhang, natural log of total assets and natural log of firm age. The median underpricing for dispersed firms is therefore 12.93%, and for local firms, it is 11.83%, indicating that geographic dispersion could potentially help to explain underpricing. Thus, the hypothesis that underpricing is higher for more geographically dispersed firms may hold true. The median revision for local firms is 0.60% and for dispersed firms it is −0.85%. The medians for leverage, natural log of IPO proceeds, overhang, natural log of total assets and natural log of firm age are higher for dispersed firms.

Table 2 shows the summary statistics on concentration as a measure of geographic dispersion. The average and the median for the cross-sectional average concentration time series is 0.39, the minimum is 0.26 and the maximum is 0.47. A significant variation in concentration is observed with an average variation of 0.23, a median variation of 0.24, and fluctuates between 0.17 and 0.28. On average 195 firms filed annual reports with the SEC and went public each year for the time period 1995 to 2015. The median number of firms that went public each year is 147 firms. The minimum number of firms that went public in a year is 21 firms and the maximum is 676 firms. The minimum is 0.36 and the maximum is 0.74. Firms that have a concentration of more than 0.56 are classified as local firms.

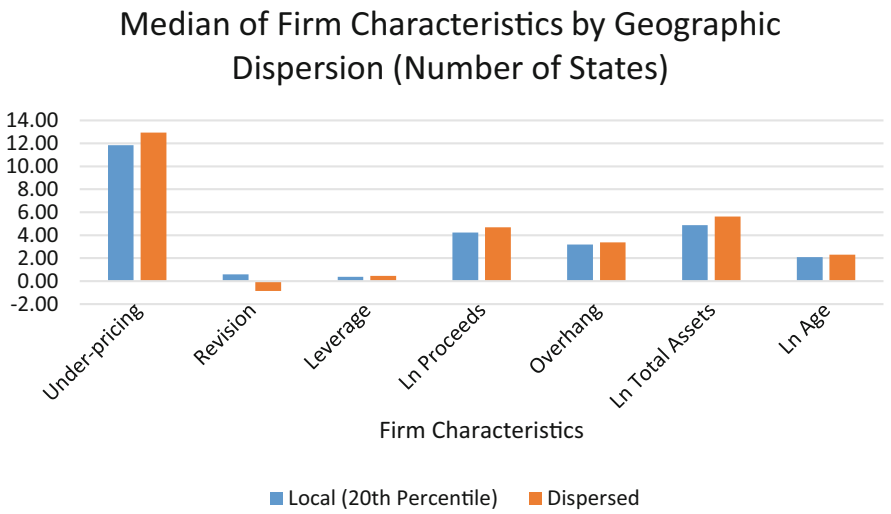

Fig. 5 Median firm characteristics by geographic dispersion (number of states)

Table 2 Summary statistics on geographic dispersion (concentration)

	Number of firms	Geographic dispersion (concentration)							
		Mean	Std.	Min	Max	20%	40%	60%	80%
Average	195	0.39	0.23	1	50	0.19	0.29	0.41	0.56
Median	147	0.39	0.24	1	50	0.19	0.30	0.40	0.56
Minimum	21	0.26	0.17	1	50	0.12	0.18	0.27	0.36
Maximum	676	0.47	0.28	1	50	0.25	0.35	0.49	0.74

3.1.2 Concentration as a Measure of Geographic Dispersion

Building on the number of states measured for geographic dispersion, concentration as a measure for geographic dispersion is constructed. The number of states measured captures the economic ties between a company's headquarters and its geographically dispersed operations, such as plants and equipment, store locations, office locations and acquisition activities, which are reported in the 10-K reports (Platikanova & Mattei, 2016).

The concentration measure is constructed by computing a normalised Herfindahl-Hirschman Index (HHI) of state activities (Platikanova & Mattei, 2016). Firstly, the sum of the squared relative state counts for firm i in year t ($SS_{i,t}$) is calculated as follows:

$$SS_{i,t} = \left(\frac{\#\text{Texas}_{i,t}}{\#\text{Total US States}_{i,t}}\right)^2 + \cdots + \left(\frac{\#\text{Washington}_{i,t}}{\#\text{Total US States}_{i,t}}\right)^2 + \cdots + \left(\frac{\#\text{Florida}_{i,t}}{\#\text{Total US States}_{i,t}}\right)^2$$

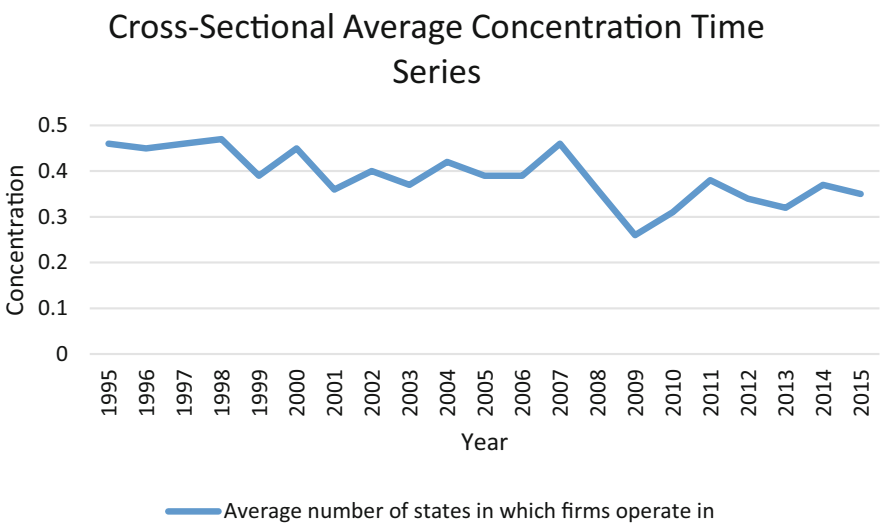

Fig. 6 Cross-sectional average concentration per year

Once $SS_{i,t}$ is calculated, the concentration measure can be calculated as follows:

$$\text{Concentration}_{i,t} = \frac{SS_{i,t} - (1/50)}{1 - (1/50)}$$

Therefore, if a firm has operations that are concentrated in only one state, the concentration measure will be equal to 1. If a firm has operations that are equally concentrated across every 50 US states, the concentration measure will be equal to zero. Therefore, a higher concentration value indicates that a firm's business activities are concentrated in a smaller number of states.

The study shows the cross-sectional average of concentration and the standard deviation per year for companies that filed 10-K annual reports with the SEC that went public in the 1995–2015 period. Therefore, the 440 companies that filed annual reports with the SEC and went public in 1995 have a concentration of 0.46 on average, with a standard deviation of 0.26 from the mean.

Figure 6 shows the yearly cross-sectional average concentration for the 1995–2015 period. Concentration is observed to be stable over time from 1995 to 1998, with a decrease in concentration (geographic expansion) being observed in 1999 due to the Internet boom and the excessive growth that took place at the time. In the year 2000, concentration increases, potentially indicating the crash of the dot.com bubble. From 2007 to 2009, concentration decreases, but it rises again thereafter as the effects of the financial crisis come into play. From 2011 to 2015, the cross-sectional average concentration fluctuates between 0.35 and 0.38.

Figure 7 shows the yearly cross-sectional 20th, 40th, 60th and 80th percentile concentrations for the time period 1995–2015. The 80th percentile concentration

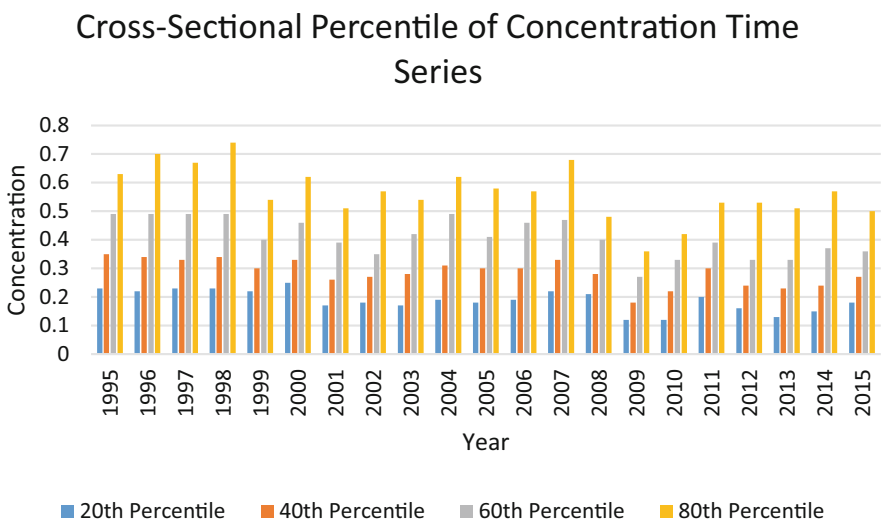

Fig. 7 Cross-sectional percentile of concentration time series

for the year 1995 is 0.63. The highest 80th percentile concentration is 0.74 in 1998. The lowest 80th percentile concentration is 0.36 in 2009. Figure 8 shows the number of firms classified as local and dispersed by concentration for the 1995–2015 period. The median for the cross-sectional 80th percentile time series is 0.56 and is employed to create local and dispersed portfolios. Of the 440 companies that filed 10-K annual reports with the SEC and went public in 1995, 116 companies are classified as local, while 324 are classified as dispersed.

3.1.3 Concentration and Other Firm Characteristics

Figure 9 shows the medians for underpricing, revision, leverage, natural log of IPO proceeds, overhang, natural log of total assets and natural log of firm age for local and dispersed firms for the time period 1995–2015. The median underpricing for local firms is 9.30%, and the median underpricing for dispersed firms is 9.44%, indicating that geographic dispersion could help to explain underpricing and thus the hypothesis that underpricing is more evident for more geographically dispersed firms could hold true. The median revision is 0% for both the local and dispersed portfolios. The medians for leverage, natural log of IPO proceeds, overhang, natural log of total assets and the natural log of firm age are all larger for dispersed firms.

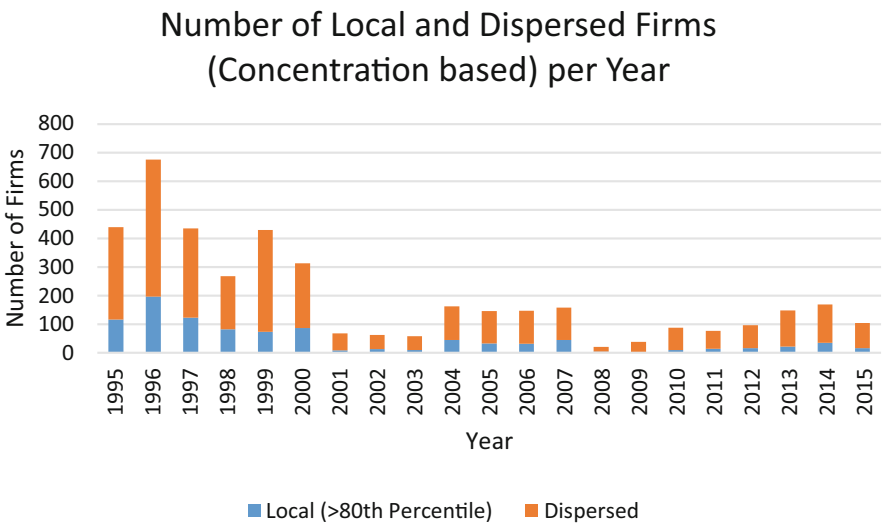

Fig. 8 Number of local and dispersed firms (concentration based) per year

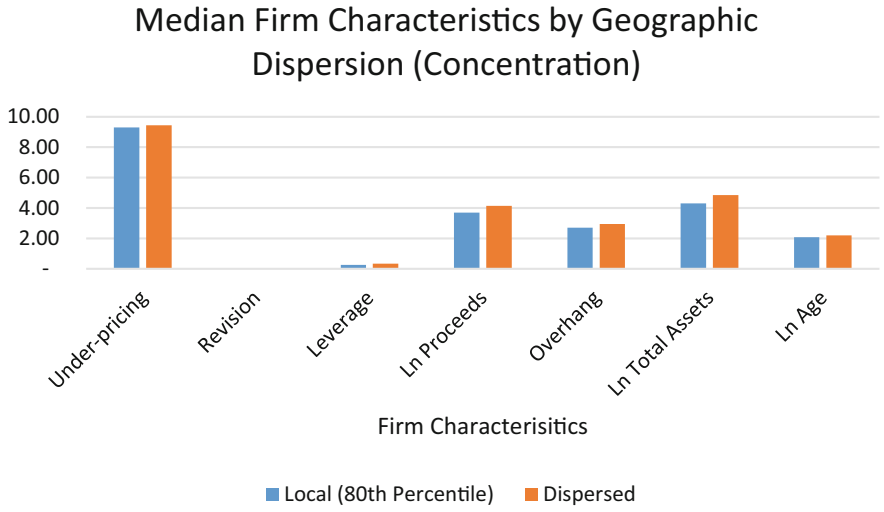

Fig. 9 Median firm characteristics by geographic dispersion (concentration based)

3.2 Litigation (Accounting Fraud)

Based on the finding that more geographically dispersed firms potentially experience more underpricing, it is interesting to see if geographic dispersion could also increase the likelihood of a firm committing accounting fraud, as accounting compliance can be harder to monitor and enforce when a firm's operations are

highly dispersed across the USA. Data on accounting fraud are therefore collected through the *Stanford Law School Securities Class Action Clearinghouse*. This resource provides a detailed case summary and the full class action complaint form for any litigation issues associated with a public company. The case summary is investigated for the possible mentioning of accounting fraud, and if not found, the full class action is investigated for the potential mentioning thereof.

Accounting fraud involves intentionally misrepresenting or altering financial records to manipulate the financial health of a company. This includes overstating revenue/sales, underrepresenting or hiding costs and purposefully misstating assets and liabilities. It also involves inflating the value of a company's stock, illegally obtaining better financing and avoiding paying back debt.

Having already collected data on geographic dispersion and other firm characteristics, a litigation dummy variable can now be created that receives the value of 1 if a company has been identified as having committed accounting fraud, and 0 otherwise. The litigation dummy variable makes it possible to investigate through logistic regression models if geographic dispersion could increase the likelihood of a firm committing accounting fraud while controlling for other firm characteristics.

3.3 Explanatory Variables for Underpricing and Litigation

The median underpricing for dispersed firms is higher than for local firms, and it gives the rationale for a deeper dive into underpricing and geographic dispersion. The phenomenon of underpricing is complex, and comparing underpricing between local and dispersed portfolios is insufficient to make inferences.

Control variables, such as the other firm characteristics discussed, are required to potentially help explain underpricing. These firm characteristics are also suitable as control variables for investigating whether more geographically dispersed firms are more likely to commit accounting fraud.

4 Empirical Results

4.1 Introduction

In this section, regression analysis is conducted to investigate the relationship between geographic dispersion and underpricing while controlling for leverage, revision, IPO proceeds, overhang and total firm assets. The hypothesis states that there is no statistically significant relationship between geographic dispersion and underpricing in a large sample of US publicly listed firms spanning 1995–2015.

Year and industry fixed effects are controlled for to determine if the fixed effects explain the significance of geographic dispersion as a determinant of underpricing.

Robustness tests are conducted using different measures for geographic dispersion to test if the assumptions made are true. Logistic models are developed to investigate if more geographically dispersed firms are more likely to commit accounting fraud while controlling for firm characteristics similar to those used in the underpricing models. The empirical results are reported and discussed within the framework of relevant literature in the field.

4.2 Main Findings/Results

4.2.1 Underpricing and Geographic Dispersion (Local Firm 20) Regressions

After developing the geographic dispersion measures (number of states and concentration) and collecting the data, the next step involves running regression models with underpricing as the dependent variable and geographic dispersion as the independent variable while controlling for the other firm characteristics. The first step in running regression models is to set up the and alternative hypotheses. The hypothesis is defined as follows:

H1: There is no relationship between the independent variable (geographic dispersion and other control variables) and the dependent variable (underpricing). The opposite is true for the alternative hypothesis (Table 2).

Regression models are developed by adding a control variable for each consecutive model to investigate if geographic dispersion loses its significance as a determinant of underpricing when adding a specific control variable. The effects that geographic dispersion has on underpricing, as presented in Tables 3 and 4, are estimated with the model:

$$\begin{aligned}\text{Underpricing}_{i,t} = {} & \beta_0 + \beta_1 \text{Local Firm 20}_{i,t} + \beta_2 \text{Leverage}_{i,t} + \beta_3 \text{VC}_{i,t} \\ & + \beta_4 \text{Revision}_{i,t} + \beta_5 \text{Ln Total Assets}_{i,t} + \beta_6 \text{Overhang}_{i,t} \\ & + \beta_7 \text{Prestigious Underwriter}_{i,t} + \beta_8 \text{New York}_{i,t} \\ & + \beta_9 \text{Hot Market}_{i,t} + \beta_{10} \text{Auditor04}_{i,t} + \varepsilon_{i,t}\end{aligned} \tag{1}$$

In model, controlling for firm leverage, the null hypothesis that geographic dispersion does not have a statistically significant effect on underpricing is not rejected at the 10% significance level. Leverage has a statistically significant effect on underpricing at the 1% significance level. All else remaining equal, if the firm's leverage increases by 1%, the average underpricing will be reduced by 0.2479%. The finding that leverage is significantly negatively associated with underpricing supports the findings of Habib and Ljungqvist (2015).

It also controls for leverage and whether the firm was backed by a venture capitalist; the coefficient for geographic dispersion is negative and significant at the 10% significance level. Hence, if a firm is classified as a local firm, and all

Table 3 Underpricing and geographic dispersion (local firm 20)

Underpricing	1	2	3	4	5
Panel A. Dependent variable: underpricing					
Intercept	35.313**** (12.76)	26.580**** (8.65)	25.341**** (8.03)	20.813**** (5.90)	19.221**** (5.34)
Local firm 20	−2.103 (−1.06)	−3.291* (−1.73)	−3.557* (−1.95)	−3.656* (−1.95)	−3.832** (−2.02)
Leverage	−24.799**** (−5.07)	−19.156**** (−4.51)	−14.843**** (−3.32)	−19.025*** (−2.76)	−20.004*** (−2.83)
VC		16.011**** (7.07)	13.457**** (6.07)	13.566**** (5.56)	11.701**** (4.64)
Revision			1.264**** (20.08)	1.264**** (20.72)	1.244**** (19.63)
Ln total assets				1.217* (1.73)	0.925 (1.25)
Overhang					1.177** (2.15)
Year FE	No	No	No	No	No
Industry FE	No	No	No	No	No
Adjusted R^2	0.0212	0.0361	0.1064	0.1098	0.1171
Number of observations	3982	3982	3934	3804	3724
Panel B. Dependent variable: underpricing					
Intercept	31.560**** (19.73)	26.496**** (13.76)	25.919**** (13.63)	16.159**** (3.94)	15.079**** (3.60)
Local firm 20	−4.077** (−1.99)	−4.503** (−2.20)	−4.832** (−2.40)	−4.721** (−2.27)	−4.745** (−2.25)
Leverage	−13.769**** (−5.14)	−11.822**** (−4.37)	−8.788*** (−3.29)	−12.438**** (−3.55)	−13.740**** (−3.79)
VC		10.316**** (4.69)	7.802**** (3.59)	8.168**** (3.67)	7.220*** (3.19)
Revision			1.044**** (14.32)	1.020**** (13.26)	1.012**** (12.91)
Ln total assets				2.232*** (2.82)	2.099** (2.53)
Overhang					0.779**** (3.74)
Year FE	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.1121	0.1168	0.1606	0.1629	0.1657
Number of observations	3982	3982	3934	3804	3724

Notes: This table reports the effect a firm's geographic dispersion has on underpricing. The dependent variable is underpricing, and the independent variables include geographic dispersion (local firm 20 dummy variable) and a variety of controls that have been identified in other literature. The coefficient, standard error and statistical significance for the intercept and each independent variable are given. ***, ** and * denote statistically significant coefficients at the 1, 5 and 10% levels, respectively. **** denotes a p-value of less than 0.1%

Table 4 Underpricing and geographic dispersion (local firm 20) models (6–10)

Underpricing	6	7	8	9	10
Panel A. Dependent variable: underpricing					
Intercept	23.136**** (5.82)	17.022**** (4.61)	−0.025 (−0.01)	−1.244 (−0.30)	2.308 (0.44)
Local firm 20	−4.056** (−2.13)	−4.307** (−2.26)	−4.683** (−2.45)	−4.676** (−2.45)	−4.451** (−2.31)
Leverage	−18.816*** (−2.81)	−18.486*** (−2.75)	−19.153*** (−2.69)	−18.893*** (−2.67)	−13.555*** (−3.16)
VC	10.231**** (3.93)	8.130*** (2.98)	9.988**** (3.67)	9.389*** (3.25)	9.282**** (3.54)
Revision	1.209**** (19.26)	1.189**** (19.06)	1.089**** (17.32)	1.090**** (17.38)	1.087**** (18.02)
Ln total assets	−0.696 (−0.91)	1.308 (1.62)	2.997*** (3.21)	2.804*** (2.99)	
Overhang	1.064** (2.08)	1.082** (2.18)	1.023** (2.18)	1.024** (2.18)	0.749** (2.26)
Prestigious underwriter	12.445**** (4.66)	13.461**** (4.87)	11.858**** (4.44)	11.524**** (4.43)	12.457**** (4.47)
New York		−16.807**** (−7.00)	−14.572**** (−6.48)	−14.664**** (−6.47)	−13.415**** (−6.54)
Hot market			14.368**** (7.71)	14.645**** (7.69)	14.348**** (7.92)
Auditor4				3.321* (1.68)	3.639* (1.76)
Ln proceeds					2.103* (1.96)
Year FE	No	No	No	No	No
Industry FE	No	No	No	No	No
Adjusted R^2	0.1242	0.1314	0.1411	0.1414	0.1350
Number of observations	3724	3724	3724	3724	3852

Panel B. Dependent variable: underpricing. Controlling for year and industry fixed effects					
Intercept	17.775**** (4.16)	14.276*** (3.25)	11.549** (2.17)	11.090** (2.07)	17.763*** (3.06)
Local firm 20	−4.860** (−2.31)	−4.887** (−2.32)	−4.861** (−2.31)	−4.852** (−2.30)	−4.682** (−2.28)
Leverage	−13.254**** (−3.66)	−13.274**** (−3.67)	−13.309**** (−3.68)	−13.227**** (−3.66)	−9.618**** (−3.50)
VC	6.675*** (2.94)	5.711** (2.50)	5.729** (2.51)	5.511** (2.39)	5.494** (2.44)
Revision	1.000**** (12.75)	0.996**** (12.72)	0.992**** (12.63)	0.993**** (12.64)	1.000**** (13.00)
Ln total assets	1.053 (1.18)	2.180** (2.29)	2.183** (2.29)	2.092** (2.17)	
Overhang	0.732**** (3.50)	0.750**** (3.59)	0.750**** (3.60)	0.753**** (3.61)	0.555*** (3.20)
Prestigious underwriter	7.080*** (3.15)	7.931**** (3.51)	7.937**** (3.51)	7.813**** (3.44)	8.999**** (4.03)
New York		−10.160**** (−3.31)	−10.179**** (−3.31)	−10.245**** (−3.33)	−8.305*** (−2.72)
Hot market			4.376 (0.91)	4.375 (0.91)	4.346 (0.92)
Auditor4				1.465 (0.66)	2.060 (0.95)
Ln proceeds					0.408 (0.32)
Year FE	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.1677	0.1700	0.1699	0.1698	0.1669
Number of observations	3724	3724	3724	3724	3852

Notes: This table builds on Table 5 and shows another four regression models continuing to add a control variable with each model. Ln total assets in model 9 is switched with Ln IPO proceeds, creating model 10. Panel B estimates are obtained with controlling for year and industry fixed effects. ***, ** and * denote statistically significant coefficients at the 1, 5 and 10% levels, respectively. **** denotes a p-value of less than 0.1%

else remains equal, the average underpricing will be reduced by 3.29%. Leverage provides similar results. The VC-backed firm dummy variable's coefficient is positive and statistically significant at the 1% level of significance. Therefore, if a firm is backed by a venture capitalist, and all else is kept equal, the average underpricing will be increased by 16.01%. The finding that VC backing is associated with higher underpricing is consistent with Hamao et al. (2001) and Georgakopoulos et al. (2022).

We further control for leverage, VC-backed firms and revision, and the coefficient for geographic dispersion is negative and significant at the 10% significance level. Therefore, ceteris paribus, if a firm is classified as local, the average underpricing will be reduced by 3.56%. The coefficient for leverage is negative and significant at the 1% significance level. Ceteris paribus, a 1% increase in leverage will lead to a 0.148% reduction in the average underpricing. The VC-backed variable delivers similar results to model 2. The coefficient for revision is positive and statistically significant at the 1% significance level. Thus, if IPO revision increases by 1%, average underpricing will increase by 0.012%. The finding that an increase in revision is associated with higher underpricing is consistent with the findings of Ljungqvist and Wilhelm (2002).

We continue by controlling for leverage, VC, revision and natural log of total assets; the null hypothesis that geographic dispersion does not have a significant effect on underpricing is rejected at the 10% significance level. Ceteris paribus, if a firm is classified as local, average underpricing will be reduced by 3.66%. Leverage, VC and revision deliver similar results to previous models. The natural log of total assets coefficient is positive and significant at the 10% significance level. Therefore, ceteris paribus, if the log of total assets increases by one unit, the average underpricing will increase by 1.217%. The finding that a larger total asset value is associated with higher underpricing is in contrast to Lowry and Murphy (2006) hypothesis that larger firms with greater assets have less underpricing. The finding is consistent with the results regarding geographic dispersion, as larger firms with greater assets are dispersed and are associated with higher underpricing.

Then we control for the same variables as previously and add the overhang variable; the coefficient for geographic dispersion is negative and significant at the 5% significance level. Therefore, ceteris paribus, if a firm is classified as a local firm, average underpricing will be reduced by 3.83%. Leverage, VC and revision deliver similar results. The coefficient for overhang is positive and significant at the 5% significance level. Ceteris paribus, a 1% increase in overhang leads to a 1.177% increase in average underpricing. The finding that greater overhang is associated with more underpricing is consistent with the findings of Bradley and Jordan (2002) and Lowry and Murphy (2006). When firms issue a smaller number of shares relative to the existing shares, the dilution cost is low, which suggests that underpricing is high.

García and Norli (2012) indicate that measures of geographic dispersion could have a strong correlation with industry groups or with the year the IPO occurred; therefore, the findings discussed above can be caused by IPO year or industry fixed effects rather than geographic dispersion. This concern is addressed in the Panel

B regression models. By running the same models while controlling for industry and year fixed effects, the null hypothesis that geographic dispersion does not have a statistically significant effect on underpricing is rejected at the 5% level of significance for all five models. Therefore, the industry and year fixed effects do not explain the significance of geographic dispersion as a determinant of underpricing. Depending on the model, when controlling for fixed effects, ceteris paribus, if a firm is local, average underpricing will be reduced between 4.08 and 4.75%. All other control variables are also statistically significant and affect underpricing.

We continue by controlling for the same variables as previously and add a prestigious underwriter rank dummy variable that is 1 if the underwriter has a rank of 9; the coefficient for geographic dispersion is negative and significant at the 5% significance level. All else being equal, if a company is classified as a local firm, average underpricing will be reduced by 4.056%. The coefficient for prestigious underwriter is positive and significant at the 1% significance level. All else being equal, if the underwriter's rank is 9, average underpricing will increase by 12.45%. The other control variables deliver similar results. The finding that a high underwriter rank is associated with more underpricing is consistent with the findings of Loughran and Ritter (2004), who state that this is due to highly respected and high performing analysts having the leverage to underprice IPO shares.

Further testings take place by adding the New York dummy variable, which is 1 if a firm is listed on the NYSE and 0 otherwise; the coefficient for geographic dispersion is negative and significant at the 5% level of significance. Ceteris paribus, if a firm is classified as a local firm, the average underpricing will be reduced by 4.31%. The coefficient for the NYSE listing variable is negative and significant at the 1% significance level. Therefore, if a firm is listed on the NYSE, average underpricing will reduce by 16.81%.

We continue by including the *Hot Market* dummy variable, which is 1 in years of a bullish market and 0 otherwise; the coefficient for geographic dispersion is negative and significant at the 5% significance level. If else is kept equal, if a firm is classified as local, average underpricing will be reduced by 4.68%. Controlling for the hot market dummy variable, the constant loses its statistical significance. The natural log of total assets becomes statistically significant at the 5% significance level again. Ceteris paribus, a one-unit change in the natural log of total assets will increase average underpricing by 2.99%. The hot dummy variable is statistically significant with effect on underpricing at the 1% significance level. If a firm issues in a hot market year, underpricing increases by 14.37%. This finding is consistent with Ritter (1984), Bradley and Jordan (2002), Loughran and Ritter (2004), Gounopoulos and Pham (2017), Gounopoulos and Pham (2018), Colak et al. (2021b) and Gounopoulos et al. (2022). When controlling for year and industry fixed effects, the hot market dummy variable is no longer significantly associated with underpricing.

We make a step forward by adding the *Auditor4* dummy variable, which is 1 if a firm was audited by one of the Big 4 auditors and 0 otherwise; the coefficient for geographic dispersion is negative and significant at the 5% significance level. This means that if a firm is classified as a local firm, average underpricing will be reduced

by 4.68%. The coefficient for the Auditor4 variable is positive and significant at the 10% significance level, and, all else being equal, if a firm is audited by a Big 4 firm, the average underpricing will be increased by 3.32%. The finding that a Big 4 auditor is associated with more underpricing contradicts Habib and Ljungqvist (2015); however, when controlling for year and industry fixed effects, the Big 4 auditor dummy variable is no longer significantly associated with underpricing.

Next, we control for the same variables as previously but switch the natural log of total assets variable with the natural log of IPO proceeds variable:

$$\begin{aligned}\text{Underpricing}_{i,t} = {} & \beta_0 + \beta_1 \text{Local Firm 20}_{i,t} + \beta_2 \text{Leverage}_{i,t} + \beta_3 \text{VC}_{i,t} \\ & + \beta_4 \text{Revision}_{i,t} + \beta_6 \text{Overhang}_{i,t} + \beta_7 \text{Prestigious Underwriter}_{i,t} \\ & + \beta_8 \text{New York}_{i,t} + \beta_9 \text{Hot Market}_{i,t} + \beta_{10} \text{Auditor04}_{i,t} \\ & + \beta_{11} \text{Ln Proceeds}_{i,t} + \varepsilon_{i,t}\end{aligned} \tag{2}$$

This is due to the variables being strongly correlated. The model delivers similar results to model 9; however, the adjusted R^2 is reduced from 0.141 to 0.135. IPO proceeds are significantly positively related to underpricing at the 10% significance level but lose significance when controlling for year and industry fixed effects. This supports the findings by Carter and Manaster (1990) and Cliff and Denis (2004) that proceeds do not significantly help to explain underpricing.

Panel B gives the coefficients and standard error for the variables of the same models that were run in Panel A, but controlling for industry and year fixed effects to investigate if these fixed effects explain the significance of geographic dispersion as a determinant of underpricing. The coefficient for geographic dispersion is negative and significant at the 5% significance level. Thus, industry and year fixed effects do not explain the significance of geographic dispersion as a determinant of underpricing. Depending on the model, ceteris paribus, if a firm is classified as a local firm, the average underpricing will be reduced by 4.68–4.89%.

4.2.2 Robustness Test with Concentration as a Measure of Geographic Dispersion

Table 5 investigates if there is a relationship between concentration and underpricing. When controlling for firm leverage at the time of IPO, the results show that the hypothesis cannot be rejected at the 10% level of significance and that geographic dispersion (concentration) does not have a statistically significant effect on underpricing. This is the same result reported in baseline model. The results indicates that there is a statistically significant relationship between concentration and underpricing. Thus, if a firm has high concentration, average underpricing will be reduced between 6.66–6.904%, depending on the model. The robustness tests support the finding that geographic dispersion has a statistically significant effect on underpricing and initial returns are lower for firms with less geographically dispersed economic activities.

Table 5 Underpricing and geographic dispersion (concentration) models (11–15)

Underpricing	11	12	13	14	15
Intercept	36.700**** (11.36)	27.014**** (7.64)	27.014**** (7.64)	22.527**** (5.74)	20.762**** (5.20)
Concentration	−4.989 (−1.58)	−6.904** (−2.38)	−6.904** (−2.38)	−6.754** (−2.26)	−6.657** (−2.23)
Leverage	−24.821**** (−5.09)	−14.788**** (−3.33)	−14.788**** (−3.33)	−18.896*** (−2.73)	−19.846*** (−2.80)
VC		13.456**** (6.05)	13.456**** (6.05)	13.541**** (5.53)	11.668**** (4.61)
Revision			1.263**** (20.14)	1.263**** (20.73)	1.243**** (19.63)
Ln total assets				1.185* (1.68)	0.912 (1.23)
Overhang					1.171** (2.15)
Year FE	No	No	No	No	No
Industry FE	No	No	No	No	No
Adjusted R^2	0.0214	0.1064	0.1064	0.1097	0.1170
Number of observations	3982	3934	3934	3804	3724

Notes: This table tabulates additional empirical tests using concentration as the measure for geographic dispersion as a robustness check. The estimates are obtained without controlling for fixed effects. ***, ** and * denote statistically significant coefficients at the 1, 5 and 10% levels, respectively. **** denotes a *p*-value of less than 0.1%

Table 6 uses concentration as the measure for geographic dispersion instead of the local firm 20 dummy variable. The hypothesis that geographic dispersion does not have an effect on underpricing is rejected at the 5% level of significance. Ceteris paribus, if a firm has a concentration of 1, average underpricing will be reduced by 6.43%. There is thus a 99% confidence level that concentration has a statistically significant relationship with underpricing. If an enterprise has a complete concentration, average underpricing will be reduced by 8.23%. The robustness test supports that geographic dispersion does have a statistically significant effect on underpricing and that underpricing is less for firms with less geographically dispersed economic activities.

4.2.3 Robustness Test with Local Firm 80 as Measure of Geographic Dispersion

Table 7 shows results using the local firm 80 dummy variable as the measure for geographic dispersion. The hypothesis that geographic dispersion does not have a statistically significant effect on underpricing is rejected at a 1% level of significance for all five models. Therefore, depending on the model, if a firm is classified as a local firm (has a concentration larger than 0.56), average underpricing will be reduced by 4.67–5.73%. The robustness tests support the findings that geographic dispersion does have a statistically significant effect on underpricing and that underpricing is less for low geographically dispersed firm's economic activities.

The results of Table 8 reveal that if a firm is classified as a 'local', the mean underpricing will be 4.77–5.07% less than for 'dispersed' characterised firms. The results indicate that underpricing is lower for firms with less geographically dispersed economic activities.

4.2.4 Geographic Dispersion and Litigation (Accounting Fraud) Regressions

Logistic regression models are developed to investigate whether firms that have more geographically dispersed economic activities are more likely to commit accounting fraud compared to more geographically concentrated firms. The likelihood of committing accounting fraud as a function of geographic dispersion is estimated by running logistic regression models, starting with controlling for one variable and adding a control variable for every model thereafter, to investigate if geographic dispersion loses its significance as a determinant of the increased likelihood of accounting fraud when controlling for a specific variable:

$$\begin{aligned}\text{Accounting Fraud}_{i,t} = {} & \beta_0 + \beta_1 \text{Number of States}_{i,t} + \beta_2 \text{VC}_{i,t} + \beta_3 \text{Leverage}_{i,t} \\ & + \beta_4 \text{Revision}_{i,t} + \beta_5 \text{Overhang}_{i,t} \\ & + \beta_6 \text{Prestigious Underwriter}_{i,t} + \beta_7 \text{New York}_{i,t} \\ & + \beta_8 \text{Hot Market}_{i,t} + \beta_9 \text{Auditor04}_{i,t} + \varepsilon_{i,t}\end{aligned} \tag{3}$$

Table 6 Underpricing and geographic dispersion (concentration) models (16–20)

Underpricing	16	17	18	19	20
Intercept	24.365**** (5.65)	19.025**** (4.72)	2.197 (0.49)	0.928 (0.21)	4.800 (0.85)
Concentration	−6.426** (−2.17)	−8.231*** (−2.69)	−9.082*** (−2.94)	−8.873*** (−2.91)	−8.241*** (−2.63)
Leverage	−18.649*** (−2.78)	−18.326*** (−2.71)	−18.981*** (−2.66)	−18.732*** (−2.63)	−13.378*** (−3.16)
VC	10.195**** (3.90)	8.082*** (2.95)	9.941**** (3.64)	9.369*** (3.23)	9.249**** (3.52)
Revision	1.207**** (19.25)	1.188**** (19.05)	1.088**** (17.29)	1.089**** (17.35)	1.088**** (18.07)
Ln total assets	−0.672 (−0.88)	1.327* (1.65)	3.017*** (3.22)	2.838*** (3.03)	
Overhang	1.059** (2.08)	1.077** (2.17)	1.017** (2.17)	1.018** (2.18)	0.746** (2.25)
Prestigious underwriter	12.327**** (4.64)	13.349**** (4.86)	11.733**** (4.42)	11.416**** (4.41)	12.450**** (4.47)
New York		−17.159**** (−7.00)	−14.958**** (−6.51)	−15.034**** (−6.49)	−13.601**** (−6.58)
Hot market			14.395**** (7.73)	14.654**** (7.70)	14.253**** (7.92)
Auditor4				3.154 (1.60)	3.516* (1.71)
Ln proceeds					2.006* (1.86)
Year FE	No	No	No	No	No
Industry FE	No	No	No	No	No
Adjusted R^2	0.1240	0.1314	0.1411	0.1413	0.1350
Number of observations	3724	3724	3724	3724	3852

Notes: This table tabulates additional empirical tests using concentration as the measure for geographic dispersion as a robustness check. The estimates are obtained without controlling for year and industry fixed effects. ***, ** and * denote statistically significant coefficients at the 1, 5 and 10% levels, respectively. **** denotes a p-value of less than 0.1%

Table 7 Underpricing and geographic dispersion (local firm 80) models (21–25)

Underpricing	21	22	23	24	25
Intercept	35.734**** (13.98)	26.750**** (9.23)	25.343**** (8.41)	20.670**** (6.30)	18.875**** (5.58)
Local firm 80	−4.900*** (−2.60)	−5.734*** (−3.09)	−5.334*** (−3.01)	−4.891*** (−2.73)	−4.669*** (−2.62)
Leverage	−24.728**** (−5.14)	−18.954**** (−4.56)	−14.617**** (−3.33)	−18.680*** (−2.70)	−19.619*** (−2.77)
VC		16.012**** (7.02)	13.414**** (6.00)	13.510**** (5.50)	11.644**** (4.59)
Revision			1.261**** (20.11)	1.261**** (20.67)	1.241**** (19.58)
Ln total assets				1.211* (1.72)	0.943 (1.28)
Overhang					1.167** (2.15)
Year FE	No	No	No	No	No
Industry FE	No	No	No	No	No
Adjusted R^2	0.0221	0.0370	0.1070	0.1101	0.1173
Number of observations	3982	3982	3934	3804	3724

Notes: This table tabulates additional empirical tests using the local firm 80 dummy variable as a measure for geographic dispersion as a robustness check. The estimates are obtained without controlling for fixed effects. ***, ** and * denote statistically significant coefficients at the 1, 5 and 10% levels, respectively. **** denotes a p-value of less than 0.1%

Table 8 Underpricing and geographic dispersion (local firm 80) models (26–30)

Underpricing	26	27	28	29	30
Intercept	22.434**** (6.07)	16.326**** (4.73)	−0.785 (−0.19)	−1.994 (−0.49)	2.298 (0.45)
Local firm 80	−4.313** (−2.46)	−4.774*** (−2.69)	−4.952*** (−2.79)	−4.857*** (−2.76)	−5.076*** (−2.82)
Leverage	−18.443*** (−2.75)	−18.084*** (−2.68)	−18.718*** (−2.63)	−18.471*** (−2.61)	−13.197*** (−3.15)
VC	10.175**** (3.88)	8.066*** (2.94)	9.902**** (3.62)	9.323*** (3.21)	9.191**** (3.48)
Revision	1.206**** (19.20)	1.186**** (18.99)	1.086**** (17.23)	1.087**** (17.29)	1.086**** (18.01)
Ln total assets	−0.623 (−0.83)	1.389* (1.73)	3.084*** (3.29)	2.901*** (3.10)	
Overhang	1.057** (2.08)	1.074** (2.18)	1.015** (2.18)	1.016** (2.18)	0.747** (2.26)
Prestigious underwriter	12.247**** (4.62)	13.251**** (4.84)	11.644**** (4.40)	11.325**** (4.39)	12.351**** (4.45)
New York		−16.897**** (−7.02)	−14.671**** (−6.50)	−14.756**** (−6.49)	−13.360**** (−6.56)
Hot market			14.290**** (7.71)	14.555**** (7.70)	14.175**** (7.90)
Auditor4				3.197 (1.62)	3.545* (1.72)
Ln proceeds					2.063* (1.95)
Year FE	No	No	No	No	No
Industry FE	No	No	No	No	No
Adjusted R^2	0.1242	0.1314	0.1410	0.1412	0.1351
Number of observations	3724	3724	3724	3724	3852

Notes: This table tabulates additional empirical tests using the local firm 80 dummy variable as the measure for geographic dispersion as a robustness check. The estimates are obtained without controlling for year and industry fixed effects. ***, ** and * denote statistically significant coefficients at the 1, 5 and 10% levels, respectively. **** denotes a p-value of less than 0.1%

Table 9 shows the logistic regression model estimates for all the variables. The models deliver similar results for the control variables that overlap between models, with the pseudo R^2 increasing with each extra control variable that is added. The number of states variable's coefficient is positive, indicating that as the number of states increases, the likelihood of a firm committing accounting fraud also increases, and as the number of states that firms operate in decreases, the likelihood of committing accounting fraud also decreases. The coefficient is statistically significant at the 5% level of significance.

Table 10 shows the logistic regression model estimates. The coefficients are positive for all four models, indicating that firms with more geographically dispersed economic activities are more likely to commit accounting fraud and that firms with less geographically dispersed economic activities are less likely to commit accounting fraud. The number of states coefficient is statistically significant at the 5% level of significance. Therefore, even when controlling for eight other variables, geographic dispersion still has a statistically significant effect on the likelihood of committing accounting fraud.

5 Conclusion

This study examines the association between underpricing, geographic dispersion and the likelihood of accounting fraud. The findings indicate that the geographic dispersion of a firm's operations, measured by the number of states mentioned in its 10-K annual report filed with the SEC, is related to underpricing. Results show a significant negative relationship between underpricing and local firms. The negative association is robust to controls for other significant determinants of underpricing examined in the previous literature, year and industry fixed effects and alternative measures of geographic dispersion. These findings are consistent with the hypothesis that underpricing is more likely among more geographically dispersed firms. Firms that are more geographically dispersed face larger information asymmetry problems, such as the aggregation of financial data across firms.

The study further provides evidence that more geographically dispersed firms are likely to commit accounting fraud than their local counterparts. The finding remains robust for other firm attributes that have been examined in the previous literature. More geographically dispersed firms face larger obstacles in monitoring accounting compliance across states, which may explain this finding.

Managers should be aware that information asymmetries and accounting fraud stem from the geographic dispersion of a firm's operations and economic activities. Managers should thus develop controls and put systems in place to ensure that relevant information can be efficiently aggregated across multiple states and shared with outside investors. Managers should invest in appropriate monitoring and control systems to ensure accounting compliance across states.

Table 9 Geographic dispersion and litigation regression models (31–34)

Accounting fraud	31	32	33	34
Intercept	−4.913**** (19.60)	−4.776**** (−16.19)	−4.798**** (−16.23)	−4.862**** (−15.78)
Number of states	0.029** (2.13)	0.032** (2.39)	0.032** (2.33)	0.031** (2.21)
VC	1.969**** (8.17)	1.881**** (7.49)	1.846**** (7.33)	1.871**** (7.17)
Leverage		−0.291 (−0.76)	−0.205 (−0.54)	−0.332 (−0.81)
Revision			0.013** (2.01)	0.012* (1.79)
Overhang				0.018** (2.18)
Pseudo R^2	0.0809	0.0791	0.0824	0.0880
Number of observations	4104	3982	3934	3852

Notes: This table shows the empirical link between geographic dispersion and accounting fraud while controlling for up to four variables which include other firm. The variables are defined in Table A1. The estimates are obtained without controlling for year and industry fixed effects. ***, ** and * denote statistically significant coefficients at the 1, 5 and 10% levels, respectively. **** denotes a *p*-value of less than 0.1%

Table 10 Geographic dispersion and litigation regression models (35–38)

Accounting fraud	35	36	37	38
Intercept	−5.025**** (−15.76)	−5.016**** (−15.70)	−5.107**** (−14.23)	−5.043**** (−12.99)
Number of states	0.029** (2.04)	0.029** (2.05)	0.029** (2.05)	0.029** (2.06)
VC	1.812**** (6.89)	1.796**** (6.70)	1.809**** (6.72)	1.823**** (6.73)
Leverage	−0.400 (−0.95)	−0.379 (−0.89)	−0.370 (−0.87)	−0.373 (−0.88)
Revision	0.009 (1.33)	0.009 (1.33)	0.008 (1.19)	0.008 (1.20)
Overhang	0.015* (1.75)	0.015* (1.77)	0.015* (1.76)	0.015* (1.76)
Prestigious underwriter	0.564*** (2.91)	0.572*** (2.92)	0.570*** (2.91)	0.582*** (2.94)
New York		−0.089 (−0.29)	−0.040 (−0.13)	−0.037 (−0.12)
Hot market			0.119 (0.56)	0.105 (0.49)
Auditor4				−0.096 (−0.42)
Pseudo R^2	0.0960	0.0961	0.0963	0.0965
Number of observations	3852	3852	3852	3852

This table shows the empirical link between geographic dispersion and accounting fraud while controlling for up to eight variables. The variables are defined in Table A1. The estimates are obtained without controlling for year and industry fixed effects. ***, ** and * denote statistically significant coefficients at the 1, 5 and 10% levels, respectively. **** denotes a p-value of less than 0.1%

Appendix

Table A.1 Variable definitions

Firm characteristic	Description	Data sources
Underpricing	Percentage IPO return = 100 * ((closing price on the first day of trading/offer price)−1) (Cliff & Denis, 2004)	SDC Platinum New Issues Database, CRSP
Revision	100 * (offer price/[0.5 * (P_{High} + P_{Low})]−1), where P_{High} and P_{Low} are defined as the upper and lower bounds of the indicative price range that is filed with the IPO issuer's regulator (Ljungqvist & Wilhelm, 2002)	SDC Platinum New Issues Database
Leverage	Debt/(debt + equity) (Habib & Ljungqvist, 2015)	SDC Platinum New Issues Database
Ln proceeds	Natural log of the proceeds of the offering in millions of dollars = Ln (offer price * number of shares sold) (Aggarwal et al., 2002).	SDC Platinum New Issues Database
Overhang	100 * (pre-IPO shares being retained by pre-IPO shareholders/shares issued in the IPO) (Lowry & Murphy, 2006)	SDC Platinum New Issues Database
Ln total assets	Natural log of total assets in millions of dollars (Butler et al., 2014)	Compustat
Ln age	Natural log of 1 + IPO firm age, where firm age = IPO issue year—the year the firm was founded (Butler et al., 2014)	Jay Ritter Web Site
VC	Dummy is 1 if firm is backed by a venture capitalist and 0 otherwise (Butler et al., 2014)	SDC Platinum New Issues Database
Prestigious underwriter	Dummy is 1 if underwriter reputation is ranked 9 and 0 otherwise (Butler et al., 2014)	SDC Platinum New Issued Database, Jay Ritter Web Site
New York	Dummy is 1 if the IPO listed on the NYSE and 0 otherwise (Butler et al., 2014)	CRSP
Hot market	Dummy is 1 if offering occurred in hot/bullish market and 0 otherwise (Derrien, 2005)	Hot market years include 1995–2000, 2004 and 2006
Auditor4	Dummy is 1 if IPOs use Big 4 auditors (Deloitte, KPMG, EY, PWC) and 0 otherwise (Smart & Zutter, 2003)	SDC Platinum New Issued Database
Local firm 20	Dummy is 1 if firm operates in three or fewer states (<= 20th percentile number of states) and 0 otherwise	EDGAR Database
Local firm 80	Dummy is 1 if firm has a concentration of more than 0.56 (>80th percentile of concentration) and 0 otherwise	EDGAR Database

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