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Putting Money Where the Mouths Are: The Relation Between Venture Financing and Electronic Word-of-Mouth

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External financing is critical to ventures that do not have a revenue source but need to recruit employees, develop products, pay suppliers, and market their products/services. There is an increasing belief among entrepreneurs that electronic word-of-mouth (eWOM), specifically blog coverage, can aid in achieving venture capital financing. Conflicting findings reported by past studies examining eWOM make it unclear what to make of such beliefs of entrepreneurs. Even if there were generally agreed-upon results, a stream of literature indicates that because of the differences in traits between the prior investigated contexts and venture capital financing, the findings from the prior studies cannot be generalized to venture capital financing. Extant studies also fall short in examining the role of time and the status of entities generating eWOM in determining the influence of eWOM on decision making. To address this dearth of literature in a context that attracts billions of dollars every year, we investigate the effect of eWOM on venture capital financing. This study entails the challenging task of gathering data from hundreds of ventures along with other sources including VentureXpert, surveys, Google Blogsearch, Lexis-Nexis, and Archive.org.

The key findings of our econometric analysis are that the impact of negative eWOM is greater than is the impact of positive eWOM and that the effect of eWOM on financing decreases with the progress through the financing stages. We also find that the eWOM of popular bloggers helps ventures in getting higher funding amounts and valuations. The empirical model used in this work accounts for inherent selection biases of entrepreneurs and venture capitalists, and we conduct numerous robustness checks for potential issues of endogeneity, selection bias, nonlinearities, and popularity cutoff for blogs. The findings have important implications for entrepreneurs and suggest ways by which entrepreneurs can take advantage of eWOM.

Key words: electronic word-of-mouth; blogs; venture funding; VC funding

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1. Introduction

Many successful companies such as Microsoft, Apple, Cisco, Sun, Google, Yahoo, eBay, Amazon, Abaxis, Amgen, and Genentech started as ventures and relied on private equity financing in their early years. Ventures toil hard and receive billions of dollars every year in financing from private equity financiers, typically venture capitalists (VCs). During the era of the dot-com boom, ventures received more than \$135 billion in a single year from VCs. Although the total annual funding amount to ventures has

decreased drastically since 2000, it has never gone below 29 billion dollars, the largest share of which is directed toward IT-related ventures. Table EC.1 details industry-wide and stage-wide investments in the last decade.¹

Because ventures mostly do not have any revenue source, external financing is critical to recruit employees, develop products, pay suppliers, and market

¹ An electronic companion to this paper is available as part of the online version at <http://dx.doi.org/10.1287/isre.1110.0402>.

products/services. In an interview, a very well-regarded VC² explained the importance of financing for a venture as follows:

“VC financing acts as a CPR [cardiopulmonary resuscitation] for a new venture, without which it is difficult for a venture to survive. The two important aspects of financing are amount and valuation. A good strategy for an entrepreneur is to get maximum possible financing in a round at the highest possible valuation and this is exactly what most entrepreneurs do. Raising more money is good because it helps ventures to survive the time when raising another round may become difficult and revenues are not there yet. Higher valuation results in lower loss in entrepreneur’s equity and also signals the market that a venture is performing well.”

Because achieving higher amounts and valuations in VC financing is so critical for ventures, any source that can facilitate in achieving this is valuable. Our survey of entrepreneurs at Venture Capital Summit 2007, held on June 8th and 9th, 2007, in New York, indicated that entrepreneurs believe electronic word-of-mouth (eWOM) to be such a source. Our survey findings suggest that entrepreneurs by and large believe that eWOM can influence both a venture’s valuation and financing amount (see Table EC.2 for survey details). This belief may not be misplaced because VCs³ from many top VC firms (such as Sequoia Capital, Kleiner Perkins Caufield Byers, and Accel Partners) confirmed that they regularly read blogs. Business press has also reported this confidence of startups on blogging: “Instead of tossing away millions of dollars on Superbowl advertisements, fledgling dot-com companies are trying to catch attention through much cheaper marketing strategies such as blogging and user generated content (UGC) campaigns.” (Whitman 2006). However, to the best of our knowledge there is no literature documenting the influence of eWOM on industrial decision making in general or on venture financing in particular. The biggest challenge in undertaking such a research project is to gather proprietary data from companies. Although extant studies have investigated the influence of eWOM on sales of consumer products (such as books, movies, and beer), extending the results of prior studies to an industrial setting such as venture financing is questionable. Not surprisingly, there is a large stream of literature that questions the generalizability of findings from consumer setting to industrial setting (Martilla 1971; Money et al. 1998;

Moriarty and Spekman 1984; Ozanne and Churchill 1971; Webster 1968, 1970; Webster and Wind 1972).

This paper is the first attempt to investigate the influence of eWOM on venture financing, which attracts billions of dollars every year. An important contribution of this paper is to investigate the differential influence of negative and positive eWOM. We also investigate the role of time and the status of actors generating eWOM in determining the effect of eWOM. We find that the impact of negative eWOM is much greater than the impact of positive eWOM; therefore, there is a risk in approaching popular bloggers to start buzz about a venture. If bloggers choose to write positively, it helps a venture, but if they choose to write negatively, it can hurt the future financing badly. Our results also show that as ventures progress through financing stages, the effect of eWOM on financing decreases. Another contribution of this work is to show that eWOM from popular bloggers helps ventures in getting higher amounts and valuations. This work undertakes the challenging task of gathering and assimilating data from a wide variety of sources such as VentureXpert, surveys, Google Blogsearch, Lexis-Nexis, Archive.org, and Hoover. We also interviewed numerous VCs, bloggers, and entrepreneurs, and their inputs were instrumental in directing our analysis. This work also contributes to the venture literature by identifying a source of spurious effect of conventional media such as newspapers on venture financing.

The rest of the paper is organized as follows. Section 2 presents a discussion of relevant literature in the domain of eWOM and venture financing. Section 3 presents the theoretical foundations and develops the hypotheses. Section 4 describes the measures, the sample, the measurement procedures, and the model specification to empirically examine the hypotheses. Section 5 reports the results of empirical analysis and details the results from robustness checks of the key results. Section 6 provides the explanation of phenomenon through which eWOM affects venture financing decisions. Section 7 concludes by presenting a discussion of research and managerial implications of the work.

2. Literature Review

2.1. Electronic Word-of-Mouth (eWOM)

Past work has largely investigated the effect of two dimensions—volume and valence—of eWOM on decision making in various research contexts. We discuss a few representative studies investigating the influence of eWOM and provide an elaborate list of related studies in Table EC.4. Extant studies largely agree about the influence of the volume of eWOM on decision making, but the findings about the valence of eWOM have been mixed. For example,

² This venture capitalist prefers not to be named. He was on the *Forbes* annual Midas 100 list for three times in the last five years.

³ See Table EC.3 for the information about interviewed VCs, their associated firms, and some companies financed by their firms.

Chevalier and Mayzlin (2006) analyzed user reviews from Amazon.com and BN.com and found that an improvement in volume and valence of eWOM leads to an increase in book sales. A similar study in the domain of box office performance of movies reports that the volume of online reviews has significant explanatory power for both aggregate and weekly box office revenues; however, the author did not find any significant association between valence of reviews and box office revenues (Liu 2006). Dellarocas and his colleagues (2007) also investigated the influence of online reviews on box office revenues, but contradicting the findings of Liu (2006), they found that the valence significantly improves the box office revenue forecasts in their model. Using book reviews from Amazon.com, Forman and co-authors (2008) found that the reviewer disclosure of identity-descriptive information is positively related with the “helpfulness” ratings and the higher percentage of reviewer identity disclosures is positively associated with book sales. However, they find that the valence of eWOM does not significantly influence book sales. To summarize, although a large number of studies finds that the valence of eWOM significantly influences (Chen et al. 2007, Chevalier and Mayzlin 2006, Dellarocas et al. 2007, Etzion and Awad 2007, Li and Hitt 2008, Park et al. 2009), many studies report that the effect of valence is insignificant (Antweiler and Frank 2004, Duan et al. 2008, Forman et al. 2008, Godes and Mayzlin 2004, Liu 2006), and a few studies report mixed results for the valence (Clemons et al. 2006, Ghose and Ipeirotis 2010, Zhu and Zhang 2006). Because the past studies report mixed results about the valence of eWOM, there is no result to be generalized about its influence on VC financing decisions.

Another less-investigated dimension of eWOM in literature is dispersion. Using Google’s Usenet newsgroups, Godes and Mayzlin (2004) found that the dispersion of discussion about TV shows, across online consumer communities is an important variable in predicting ratings of TV shows, whereas volume of eWOM is not statistically related with future ratings. Dispersion captures whether a certain volume of discussion is happening within one community or whether it is spread across communities. This measure is less relevant for blogs because the blogosphere constitutes one big community and no clear demarcation exists, as in the case of Usenet groups. In addition, this dimension of eWOM has not received much attention in the literature after the work of Godes and Mayzlin (2004).

Extant studies improved our understanding about eWOM, but they fall short in certain aspects. Past studies did not explore the influence of time and the status of actors generating eWOM on decision making. Though it may seem that Li and Hitt (2008)

investigated the effect of time dimension, their focus was different. Li and Hitt, using book reviews from Amazon.com, demonstrated that positive bias exists in reviews posted in early periods and that customers do not account for this bias while reading these early reviews; this results in smaller consumer surplus. They demonstrated that the reviews coming at the early stage of reviews are more positively biased as compared to the later stage reviews. Simply put, they investigated how the valence may change over time, but they did not investigate how the effect of eWOM may change with time.

Another aspect in which extant literature falls short is the breadth of research contexts explored. Past studies investigate the effect of eWOM on sale of consumer products such as books, movies, and beer. There is an extensive stream of literature that underscores the differences between industrial settings and consumer settings and warns against generalizing the results from consumer settings to industrial settings (Martilla 1971; Money et al. 1998; Moriarty and Spekman 1984; Ozanne and Churchill 1971; Webster 1968, 1970; Webster and Wind 1972). Studies report factors that make industrial decision making highly complex and different from consumer decision making (Moriarty and Spekman 1984, Ozanne and Churchill 1971). These factors are the firm’s budget, cost, and profit considerations (Webster and Wind 1972); the firm’s objectives, policies, and procedures (Webster 1968); complex interaction between multiple people involved in decision making (Martilla 1971, Webster 1968); interaction between individual and organizational goals (Webster and Wind 1972); repeat personal visits from other party’s representatives (Webster 1970); disregard of “psychosocial” consequences (Webster 1995); and politics within a firm (Pettigrew 1975). A consequence of all these factors on industrial decision making is that “[r]esearch findings and theoretical discussions about consumer behavior often have little relevance for the industrial marketer” (Webster and Wind 1972).

2.2. Venture Financing

Many studies in venture literature have demonstrated that ventures need to build legitimacy to acquire financial resources (Pollock and Rindova 2003, Starr and MacMillan 1990, Suchman 1995, Zimmerman and Zeitz 2002, Zott and Huy 2007). Past research found that ventures can build legitimacy if they can get endorsements from secondary sources of information (Sanders and Boivie 2004), specifically endorsements from media such as newspapers (Pollock and Rindova 2003). Research shows that the volume of media coverage has a positive influence, whereas the valence has no significant influence on financing received by ventures (Petkova 2006). However, eWOM differs

from traditional media across multiple dimensions, and results from traditional media may not extend to eWOM.

First and foremost, one difference is that traditional media outlets have limited space and they cannot cover every possible interesting idea, whereas blogs offer infinite space to bloggers and they can express their thoughts on any number of interesting ideas. Hence, the coverage of startups on blogs is much vaster than its coverage on traditional media. Another important difference is that eWOM offers two-way communication between a source and a reader, and hence is more engaging, whereas traditional media is largely a one-way communication channel that only broadcasts information. A third difference is that blogs empower people to publish their ideas unfiltered, whereas in traditional media there is a team of fact checkers, copy editors, proofreaders, and editors who ensure that articles being printed are free of errors. Because blogs are written more candidly and are often syntactically imperfect, information on blogs may be considered to be more of an unaltered opinion of writers as compared to the information on conventional media. Indeed, some work suggests that people find blogs more credible than traditional media (Thomas and Barbara 2004). Because of these differences in the two media, results observed for the effect of conventional media on venture financing may not be extensible to the eWOM domain. To the best of our knowledge, new venture literature has not considered the influence of eWOM on venture financing and has focused primarily on traditional media (such as newspapers and trade magazines) as its secondary source of information.

3. Hypotheses Development

3.1. eWOM by Bloggers

Entrepreneurs know more about their ventures than investors do and, hence, there is a problem of information asymmetry (Sanders and Boivie 2004, Scott and Daniel 2002, Zott and Huy 2007). For situations in which decision makers are faced with information asymmetry, Spence (1973) postulated signaling theory, which explains that observable entity attributes can serve as a signal of quality. In his seminal work, Spence demonstrated that a higher education degree serves as a positive signal for a candidate in the labor market. Signaling theory is widely used in the entrepreneurship literature, where scholars have examined the influence of various attributes serving as signals such as corporate governance characteristics (Sanders and Boivie 2004), board structures (Certo 2003), directors (Yuval and Thomas 2003), and entrepreneurs' actions (Downes and Heinkel 1982). Entrepreneurship literature for the larger part

has focused on how actions and characteristics of founders and management team act as signals about ventures (Bruton et al. 2009, Zimmerman 2008). For a detailed review of the use of signaling theory in management literature, please see Connelly et al. (2011).

Signals are observable attributes of a firm that can change the perception of stakeholders (Sanders and Boivie 2004). Signals need not be broadcast only by firms; rather, any external monitor such as blogs can emanate signals for ventures (Fombrun and Shanley 1990). Two important traits for efficacious signals are that there should be costs associated with producing signals and that signals should be observable (Spence 1973). Because writing blogs costs time and effort, bloggers would write about a given venture only if they feel this venture is worthy enough to express their views about it (Nardi et al. 2004). If more bloggers choose to write about a given venture, then it implies that more resources have been spent in writing about the venture and that bloggers have found expressing their views about this venture to be more valuable than any resources spent writing about the venture. Because it takes more resources to generate more blog coverage, it satisfies the criterion of cost for an efficacious signal. Because more blog coverage is likely to be spotted more readily by an observer, a VC in this context, it also satisfies the criterion of observability for an efficacious signal. Therefore, larger blog coverage should act as a stronger signal to VCs about the worthiness of a venture.

Acting as a signal, eWOM may substitute for unavailable financial and accounting data and thereby help the market in assessing the quality of different ventures (Sanders and Boivie 2004). Such a signal can generate the perception of quality and can raise market awareness of a venture (Aldrich and Fiol 1994). Blogs may direct VCs' attention to those they select for coverage, thus increasing the exposure of ventures. Better-known ventures may be taken for granted (Aldrich and Fiol 1994) and considered legitimate (Rao 1994), increasing their acceptance and decreasing their risk assessment. The increase in volume of eWOM may increase the awareness and familiarity about ventures among VCs; they may become more legitimate and more likely to be considered for funding by VCs. This leads to our first hypothesis:

HYPOTHESIS 1A (H1A). *Volume of coverage by bloggers is positively related to venture financing.*

Along with volume, the valence of coverage may influence the opinions of VCs about the intrinsic value of ventures and legitimization of firms. Valence of coverage refers to the extent to which the overall eWOM is positive or negative. Ventures that have favorable online coverage may get better approval from VCs, whereas negative coverage may negatively

affect ventures' reputations (Fombrun and Shanley 1990, Pollock and Rindova 2003). In addition, when a signal from external sources becomes uniformly positive or negative, i.e., when a majority of bloggers write positive or negative posts, these individual opinions are collectively reinforced and become more likely to be recalled and acted upon (Bonardi and Keim 2005). When signals (eWOM) received from different sources reinforce each other, it increases the reliability of the overall signal. Thus more favorable discussions send a more positive signal to the stakeholders, whereas more unfavorable discussions send a more negative signal. Hence, more favorable discussions will have more positive influence on venture financing; on the contrary, unfavorable discussions will have more negative influence on venture financing (Fombrun and Shanley 1990). This leads to the following hypothesis:

HYPOTHESIS 1B (H1B). *Valence of coverage by bloggers is positively related to VC financing.*

3.2. Negative eWOM Is Stronger than Positive eWOM

Among the large number of business plans received, VCs can finance fewer than 1%. Despite this low number, historically more than 50% of the financed ventures fail. Therefore, VCs find it prudent to keep their rejection rates high. To keep the pile of business plans manageable, VCs reject plans at a slight hint of negative signal. Essentially, VCs scour for negative signals so that they can reject a plan under consideration and move on to the next pending plan for evaluation. Signaling theory suggests that receiver attention affects the effectiveness of a signal (Connelly et al. 2011). Because VCs are highly attentive to the negative signals of ventures as compared to the positive signals, negative blog coverage should have greater influence on financing decisions than positive blog coverage. In addition, every venture underscores its strengths but seldom talks about its weaknesses. It is easy for bloggers to discover the various pros for a venture, but it is difficult to assess the cons for a venture. A blogger will need to spend more time and analyze more rigorously to uncover the hidden shortcomings of a venture. Because the cost of a negative post is likely to be higher than the cost of a positive post about a venture, it will make the negative coverage a stronger signal than the positive coverage (Spence 1973).

Some studies in the literature have found support for this postulate, albeit in different contexts. For an instance, a study by Chevalier and Mayzlin (2006) discovered that negative eWOM has greater impact on book sales than does positive eWOM. Another study examining employee blogs shows that negative posts influence readers much more than do positive

posts (Aggarwal et al. 2011). Based on the aforementioned arguments and prior research, it is plausible to state that negative valence of discussion can affect the venture financing drastically as compared to positive valence.

HYPOTHESIS 2 (H2). *Negative word-of-mouth will have a larger impact than will positive word-of-mouth on venture financing.*

3.3. eWOM by Popular Bloggers

Bloggers who get many citations are connected to large number of bloggers, become popular and more visible, and occupy a central position in the network of bloggers. More citations result in higher ranks in search engines' page-rank indexes, driving further traffic to such blogs and thus positively reinforcing the popularity and centrality of such blogs. Because popular blogs are more observable than non-popular blogs, popular blog coverage should act as a stronger signal to VCs (Spence 1973). Also, individuals who are central can exert more influence by virtue of being linked to many other individuals and thus have a higher status (Burt 1982). Messages from high-status actors attract more attention, are considered more reliable, and are more readily adopted (Hovland et al. 1953). Therefore, messages from high-status actors result in greater attitude change (Hovland et al. 1953) and exert a disproportionate amount of influence on the choice of others (Deeds et al. 2004, Podolny 1993). Aldrich points out that "high status people—with more social resources, power, or prestige than others—play important roles in linking nascent entrepreneurs to resources and opportunities" (Aldrich 1999, p. 87). Higher status affects the quality assessment of investors because it signals the overall quality of senders in terms of their relative standing in the industry (Jensen and Roy 2008). Higher popularity agents typically possess stronger evaluative abilities, which enable them to differentiate among entities better. Popular blogs are more observable and possess higher status among blog networks, and hence the eWOM of popular bloggers should influence the financing decisions of VCs. The discussion above leads to our next hypotheses:

HYPOTHESIS 3A (H3A). *Volume of coverage by popular bloggers is positively related to venture financing.*

HYPOTHESIS 3B (H3B). *Valence of coverage by popular bloggers is positively related to venture financing.*

3.4. eWOM Across Development Stages

Hand (2005) found that the signal value of nonfinancial information decreases for bio-tech ventures with the maturity of these ventures, whereas the signal value of financial information increases with the maturity of ventures. The uncertainty associated with

ventures decreases with the developmental stages of ventures. During early stages of development the financial information of both the eventual winners and losers looks very similar (Zider 1998). At the early stage of financing, VCs evaluate ventures based on the expected future investment opportunities and give less consideration to assets-in-place, which may not reflect future growth potential correctly. Facing information dearth, VCs may consider signals such as information provided by popular blogs at early development stages. But as the ventures progress through the various development stages, VCs are likely to convert the potential investment opportunities faster into assets-in-place than they can spot the investment opportunities (Hand 2005, Spence 1973). As a result, assets-in-place may start to give more meaningful signals in later stages of development and may decrease VCs' incentive to explore other information sources such as eWOM (Stuart et al. 1999). Therefore, at early stages of financing, eWOM should be more strongly associated with VC financing than at later stages of financing.

HYPOTHESIS 4 (H4). *The relation between eWOM and financing decreases at higher stages of financing.*

4. Methodology

4.1. Measures

4.1.1. Dependent Variables. Following the literature we investigate the two dimensions of venture financing—*valuation* (Gompers and Lerner 2000) and *amount* (Gompers 1995). *Valuation* is defined as “the product of the price paid per share in the financing round and the shares outstanding prior to the financing round” (Gompers and Lerner 2000). We use the logarithm of the *valuation* and the logarithm of the stage's financing *amount* in thousands of dollars as dependent variables.

4.1.2. Independent Variables.

Popularity of blogger: We took the number of citations to a blog from other blogs as the measure of popularity of the blogger and took one standard deviation above mean as the cutoff (107) for popular bloggers (see Figure EC.1 for the distribution of citations to blogs). Bloggers that have fewer than 107 citations are considered nonpopular bloggers.

Volume of eWOM: We measure the volume of popular blog coverage (*VolPop*) with the mean centered logarithm of the number of posts by popular blogs citing the name/URL of a venture. We measure the volume of nonpopular blog coverage (*VolNonPop*) with the mean centered logarithm of the number of posts by nonpopular blogs citing the name/URL of a venture. A higher number of posts may attract higher market attention and increased knowledge about a

venture and its offerings. We use the logarithm of the number of posts to dampen the effect of extreme values. We mean centered the logged number of posts by subtracting the mean from each observation in order to consider the interactions of this measure with other measures. Interactions are often highly correlated with the component parts used to define them. Mean centering variables decreases the correlations between the interaction term and the component variables (Jaccard and Turrisi 2003).

Valence of eWOM: We follow the strategy research in the domain of media communication (Deephouse 1996, Pollock and Rindova 2003) and use the Janis-Fadner coefficient of imbalance to operationalize valence of eWOM (Janis and Fadner 1949). The coefficient of imbalance quantifies the extent to which positive, neutral, and negative treatment is accorded to the entity under analysis in mass communications. We measure the valence of popular blog coverage (*ValPop*) by calculating the coefficient of imbalance for posts by popular blogs citing the name/URL of a venture. We measure the valence of nonpopular blog coverage (*ValNonPop*) by calculating the coefficient of imbalance for posts by nonpopular blogs citing the name/URL of a venture.

$$\text{Valence} = \frac{P^2 - PN}{V^2}, \quad \text{if } P > N; \quad 0, \quad \text{if } P = N; \\ \frac{PN - N^2}{V^2}, \quad \text{if } P < N$$

where P is the number of positive posts for a venture, N is the number of negative posts for a venture, and V is the total number of posts; valence is measured by the sum of number of positive, negative, and neutral posts. The range of this measure of valence is from -1 to $+1$.

We followed the literature in classifying posts into positive, negative, and neutral sentiment (Koppel and Schler 2006, Savicky and Furnkranz 2003), and overall prediction accuracy came out to be 72.86%.

4.1.3. Moderating Variables.

Negative popular blog coverage dummy: To test for hypothesis three, we created a dummy (*dNegPop*) whose value is one if the valence of popular blog coverage is less than zero, and zero otherwise.

Higher stage financing dummy: To test for hypothesis four, we created a dummy (*dHigh*) whose value is one if the venture received higher stage (fourth stage) financing, and zero otherwise.

4.1.4. Controls.

Industry domain: There can be systematic differences in both dependent and independent variables for ventures in different industries. Such systematic differences, if not controlled for, can potentially bias our

estimates for eWOM. We used “Major Group” industry classification in VentureXpert database, which categorizes ventures in six industries—biotechnology, communication and media, computer related, medical/health/life science, non-high technology, and semiconductors/other electronics (see Table EC.5 for detail of industry classification). We created five dummies (*dInd*) to capture industry specific effects.

Time: We also include year dummy variables to account for systematic cross-year differences in venture financing. This controls for the unobserved time factors that may be correlated with key predictors. For example, if the amount received by ventures and volume of popular blog coverage both increase with time, then without accounting for such unobserved characteristics we may wrongly overestimate the effect of eWOM. We included year dummies (*dYear*) for years 2004–2007.

Location: Ventures that are located in the regions that get large amounts of venture financing may also attract more financing. Bloggers may also be following investment activities in these regions more closely than in others. Thereby, location of the venture can also lead to the overestimation problem if not controlled for. Following the literature we added two location dummies—eastern states (*dEast*) and western (*dWest*) states (Gompers and Lerner 2000).

Age: Ventures that have been in the market for a longer time are likely to have lower uncertainty for VCs and hence may get a higher amount of financing at higher valuation. A venture that has been around longer is likely to be better known to bloggers and may generate more discussion as compared to a younger venture, resulting in a potentially biased estimate of eWOM. Therefore, we control for the age of a venture. We measured the age of firm with the number of months between the founding date and the date of financing. Log was taken to reduce the effect of extreme values.

Media coverage: Other conventional information sources such as magazine and newspaper articles can influence VCs and bloggers alike. Not controlling for such coverage is likely to bias our estimates and we are likely to overestimate the association of blog coverage with venture financing. We collected newspaper and magazine articles from the Major Newspapers, Journals and Magazines, and Trade Magazines databases of Lexis-Nexis. We added controls for both the volume (*VolMed*) and the valence (*ValMed*) of the media coverage. We measured the volume of media coverage by the total number of articles citing the name of a venture. We measured the valence of the media coverage by calculating the coefficient of imbalance for the articles citing the name of a venture.

Press releases: We collected press release data from Business Wires databases of Lexis-Nexis. We measured the volume (*VolPre*) of press releases by the total number of releases made by a venture. We measured the valence (*ValPre*) of press releases by calculating the coefficient of imbalance for the releases.

Competition: We also control for the number of competitors (*Comp*). A venture that has many competitors may find it difficult to raise financing and is more likely to get mentioned by bloggers when they discuss it or its competitors, which can also potentially bias our estimates. We got the number of competitors from the Hoovers database; missing data were supplemented by primary data obtained from ventures themselves who provided an estimate for the number of competitors to their ventures.

Reputation of ventures' founders (FounRep): Literature has shown that the reputation of the venture team can help firms to obtain resources and affect firm financing (Zott and Huy 2007). *Ceteris paribus*, bloggers may write more about entrepreneurs who have a history of successful ventures, and this may positively bias results. We operationalized this control by the average number of successful exits (IPOs and acquisitions) led by the founders of a venture in the past before a given financing stage.

Relevant experience of ventures' founders (FounExp): Founders who have many years of experience in an industry related to their venture are likely to be better known among bloggers related to the given industry and thus likely to receive more coverage. But founders with many years of relevant industry experience may also receive better financing deals. If the relevant experience of founders is not controlled for, we are likely to overestimate the association between eWOM and venture financing. We used the average relevant industry experience of founders as the measure of relevant experience of ventures' founders.

Past investors' size (InvSize): The size of past financing VCs can positively influence both the venture financing and the blog coverage. Being financed by larger VCs in the past sends a positive signal in the market about a venture and this may help the venture in future financing. Because bloggers are also more likely to discuss the investment decisions of large VCs, not controlling for the prior financing VCs' size may wrongly attribute their effect to eWOM. Following the literature, we measure this control by the total funds under the management of the prior financing leading VC firm (Pollock and Rindova 2003). The VC firm that has invested the largest amount in the previous financing round is referred to as the leading VC firm. This measure was also logged to decrease the effect of extreme values on the analysis.

Past investors' reputation (InvRep): Past investors of a venture can influence the venture's capability in acquiring resources, particularly future financing (Hsu 2004, Sanders and Boivie 2004, Zott and Huy 2007). Bloggers in turn may also write more about a venture that in the past has been financed by a well-known VC, so not controlling for past investors' reputation may overestimate the effect of eWOM. To control for the reputation of financing VCs, we used the number of successful exits (initial public offerings (IPOs) and acquisitions) led by the largest (financing) VC in the previous round of financing (Hsu 2006).

Revenue (Rev): We collected revenue information for the year before funding and used its logged value as a control for the available financial information.

Venture size (Size): Ventures that require large investments may attract more coverage from blogs; hence, not controlling for the required investment size can bias our estimates. We asked ventures for their expected total investment requirements before a successful exit and used the logged value of the reported required investments as a control for the venture size.

4.2. Sampling Procedure

We used the VentureXpert database to get information about ventures in our sample. The VentureXpert database is the industry standard for information on the private equity market and used extensively in the literature to analyze ventures. It is the only database officially endorsed by the National Venture Capital Association and the PricewaterhouseCoopers Money-Tree Survey.

Determining the population for ventures is challenging, particularly for the first two stages of financing. Many ventures remain in stealth mode, and hence it is difficult to identify ventures that may eventually seek early stage financing. However, for financing stages higher than second stage, this is not a problem because potential candidates for higher financing stages are going to be the ventures that had immediately received lower-stage financing. Therefore, we consider the population of ventures for third-stage financing as the ventures that had received second-stage financing between January 1, 2004, and March 31, 2007. Similarly we consider the population of ventures for fourth-stage financing as the ventures that had received third-stage financing between January 1, 2004, and March 31, 2007. While estimating our models, we also control for the possibility that some ventures in a population may not be seeking financing during the period of our study. We explain how we control for this possibility in §4.4.

To give better insight into the data, we tabulate the population of ventures into four strata based on two dimensions: popular blog coverage and received

next stage of financing (see Table EC.6 for detail). Not many ventures are covered by popular bloggers in the observed data. If we took a random sample, we would have observed too few ventures receiving coverage from popular bloggers to do any meaningful statistical analysis. Out of 3,576 ventures that received second-stage financing, only 210 received popular blog coverage and third-stage financing. Similarly, out of 7,208 ventures that received third-stage financing, only 231 received popular blog coverage and fourth-stage financing. Therefore, to get more precise estimates we use a disproportionate stratified sampling technique and oversample strata that have fewer observations. The actual sample sizes in each of the strata are tabulated in Table EC.6.

Even though VentureXpert has the most comprehensive deals data, there are cases in which financing amounts and valuations of ventures at the time of financing are missing. In addition to collecting missing measures, we collected information such as ventures' current status, whether founders have income sources other than venture financing, and the time since the first VC was approached for the next stage of financing. The use of these additional measures is explained in §4.4 where we discuss the sample selection biases in venture financing scenario. We collected the blog coverage data from Google Blogsearch using the names and websites of ventures and downloaded posts citing the names and websites of ventures. We find the popularity of all bloggers discussing venture firms from the number of posts citing their blogs. We also collected whether ventures have approached popular bloggers and whether the top management team maintains blogs for robustness checks. We got complete information for 35.9% of the sampled ventures that received second-stage financing (potential candidates for third-stage financing) and 33.8% of the sampled ventures that received third-stage financing (potential candidates for fourth-stage financing). The detail of various information sources for variables is presented in Table EC.7.

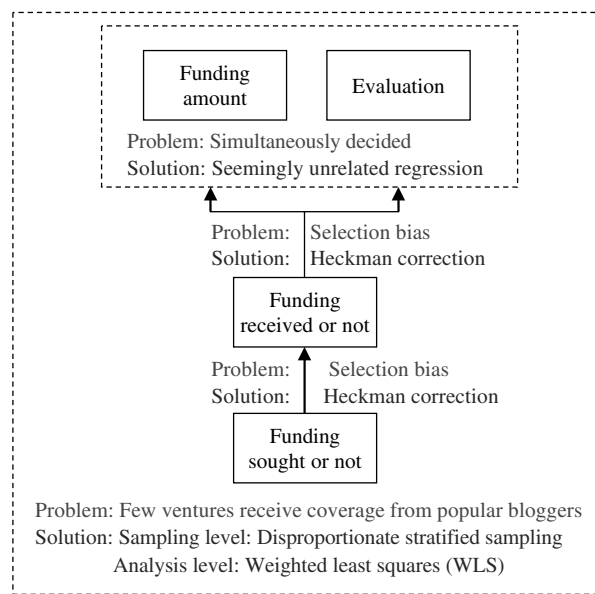
4.3. Summary Information and Statistics

Table EC.7 provides summary statistics for the amounts and valuations of venture financing for the 432 ventures. In addition to financing information, this table also provides statistics about the independent variables and controls without transformations. Table EC.8 documents correlations of all measures, including transformed dependent variables, independent variables, moderating variables, and the relevant interactions.

4.4. Analysis Methods

We estimate a fixed effects model controlling for industry-level, financing stage-level, year-level, and

Figure 1 Analysis Method



region-level effects. This controls for the unobservable factors that may be correlated with key predictors at the industry level, financing stage level, year level, and region level and controls for the differences in average amount and valuation across industries, stages of financing, time, and region. Next, we discuss some of the challenges faced in estimating the model and how we addressed these potential problems. For representation of our estimation technique, see Figure 1.

4.4.1. Sample Selection Problem. There is a sample selection problem at two levels: first, out of all ventures in our sample, ventures that seek financing do not make this decision randomly; second, out of ventures that seek financing, ventures that receive financing do not achieve it randomly. We now elaborate on how these nonrandom selections could bias our estimates and how we controlled for these problems.

4.4.2. Level 1. Founders' decisions to seek financing may depend on unobservable characteristics. Ventures that are not in the market may have received positive coverage from popular bloggers, but they may wait to achieve some favorable characteristics that are unobservable to bloggers. For instance, consider a venture that manages to get good reviews from bloggers but its founders may have conflicting future plans for their venture. Such ventures may want to resolve their issues before proceeding further, whereas ventures seeking financing in addition to achieving good blog coverage may have single goal-oriented founders. Without accounting for such unobserved characteristics of ventures, we may

wrongly attribute the effect of such unobserved characteristics to eWOM and may overestimate the probability of receiving financing. Therefore, to fix this potential bias we created a selection instrument using Heckman's two-step model (Heckman 1979). In the first stage of the analysis, a probit regression was used to estimate the likelihood of a venture seeking financing, using the entire sample of the ventures. In this model, we included all variables in Model 5 of Table 1 and an additional instrument, whether founders have income sources other than venture financing. In the Heckman selection model, if an instrument is weak, near multicollinearity could arise, leading to unstable estimates (Leung and Yu 2000, Prabhala 2007). We tested for multicollinearity and do not find any indication of such a problem. The argument in favor of this instrument is that founders with alternative income sources should be less financially constrained to seek VC financing. The second stage of the analysis, which is the estimation of probability of receiving financing, is conducted using ventures that sought financing.

4.4.3. Level 2. If we ignore VCs' nonrandom decision making, then we disregard scenarios such as ventures that receive financing may have favorable eWOM and favorable unobserved characteristics, whereas ventures stuck in negotiations with VCs may have favorable eWOM but may have unfavorable unobserved characteristics. For instance, ventures that are negotiating with VCs may have gotten favorable coverage from bloggers but may be seeking unrealistic valuations, whereas ventures that received financing may have gotten favorable blogger coverage and may have aspired to realistic valuations. Without accounting for such unobserved characteristics of ventures, we may overestimate the effect of eWOM. Therefore, to fix this potential bias we again created a selection instrument using the Heckman two-step model (Heckman 1979). In the first stage of the analysis, a probit regression was used to estimate the likelihood of a venture receiving financing using the sample of the ventures that are seeking financing. In this model, we included all variables in Model 5 of Table 1, the estimated selection instrument (inverse Mill's ratio, $\lambda_{1,i}$) from the probit regression at Level 1; and an additional instrument, the time since the first VC was approached for next-stage financing. As we mentioned earlier, a weak instrument in Heckman selection model would give rise to near multicollinearity (Leung and Yu 2000, Prabhala 2007). We tested for multicollinearity and do not find any indication of such problem. The argument in favor of this instrument is that typically delays in financing offers indicate VCs' lack of interest in a venture. The second stage of the analysis, which is the estimation of our main model, is conducted using ventures

Table 1 Association Between eWOM and New Venture Financing

Variables	Panel A: Association between eWOM and financing amount					Panel B: Association between eWOM and valuation				
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 1	Model 2	Model 3	Model 4	Model 5
Control estimates are reported in Table EC.9										
Independent variables										
Volume of blog coverage (β_{vol})		0.0001 (0.005) [0.005]					−0.007 (0.011) [0.011]			
Valence of blog coverage (β_{val})		0.0236 (0.028) [0.029]					−0.0685 (0.058) [0.059]			
Volume of popular blog coverage (β_{volPop})			0.0301 (0.018)* [0.019]	0.0562 (0.02)*** [0.021]***	0.0503 (0.014)*** [0.014]***			0.0795 (0.04)** [0.041]*	0.159 (0.042)*** [0.044]***	0.0672 (0.024)*** [0.024]***
Valence of popular blog coverage (β_{valPop})			0.1779 (0.081)** [0.082]**	0.036 (0.061) [0.063]	0.0187 (0.058) [0.06]			0.5154 (0.204)** [0.206]**	0.0113 (0.011) [0.012]	0.0122 (0.123) [0.125]
Volume of non-popular blog coverage ($\beta_{volNonPop}$)			−0.0055 (0.005) [0.005]	−0.0048 (0.005) [0.005]	−0.0053 (0.005) [0.005]			−0.0142 (0.011) [0.011]	0.0369 (0.124) [0.124]	−0.0121 (0.011) [0.012]
Valence of non-popular blog coverage ($\beta_{valNonPop}$)			0.0521 (0.032) [0.033]	0.0506 (0.033) [0.034]	0.0523 (0.033) [0.034]			−0.0231 (0.068) [0.071]	0.0396 (0.069) [0.072]	−0.0314 (0.069) [0.072]
Negative popular blog coverage dummy ($\beta_{dNegPop}$)				−0.114 (0.101) [0.104]	−0.1123 (0.098) [0.102]				−0.0556 (0.033)* [0.033]*	−0.0553 (0.033)* [0.034]
Volume of popular blog coverage * Negative popular blog coverage ($\beta_{volPop*dNegPop}$)				−0.1486 (0.07)** [0.073]**	−0.1639 (0.083)** [0.083]**				−0.122 (0.061)** [0.062]**	−0.2002 (0.089)** [0.093]**
Volume of popular blog coverage * Higher stage dummy ($\beta_{volPop*dHigh}$)					−0.0284 (0.013)** [0.014]**					−0.0347 (0.017)** [0.017]**
Volume of popular blog coverage * Higher stage dummy * Negative popular blog coverage dummy ($\beta_{volPop*dHigh*dNegPop}$)					0.0888 (0.043)** [0.045]**					0.1335 (0.054)** [0.06]**
R^2	0.3417	0.3417	0.3712	0.4002	0.4142	0.3285	0.3293	0.3632	0.3893	0.3927

Notes. Model 1 is our base model and has only controls. In Model 2 we add volume and valence of blog coverage. In Model 3 we split the volume and valence of popular and non-popular blogs and add separate variables for volume and valence of popular and non-popular blogs. In Model 4 we add dummy variable for overall negative blog coverage and its interaction with volume of popular blog coverage. In Model 5 we add interaction of higher stage dummy with volume of popular blog coverage and three way interaction of volume of popular blog coverage, higher stage dummy, and dummy variable for overall negative blog. The total number of observations is 432. SUR model standard errors are in parenthesis (). Robust standard errors are in square brackets [].

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

that received financing, and the estimated selection instrument (inverse Mill's ratio, $\lambda_{2,i}$) from the probit regression at Step 2 is used as a control.

4.4.4. Disproportionate Stratified Sampling Problem. As we discussed earlier not many ventures receive coverage from popular bloggers, and hence we oversampled this stratum to conduct a meaningful statistical analysis. Because we have used disproportionate stratified sampling, to get unbiased cross-strata estimates we used weighted least squares (WLS) and weighted observations in strata by taking the inverse of the sampling fraction used in the strata that the

observations belong to. For instance in the stratum where a second-stage financed venture got third-stage financing and received coverage from popular bloggers, the total observations in the stratum are 210 and in our sample we have 83. We weighted these 83 observations with the inverse of the sampling fraction in this stratum, which is 210/83.

4.4.5. Simultaneously Estimated Dependent Variables. Our dependent variables, the financing amount and valuation for a venture, are decided simultaneously, and hence we expect the errors

to be correlated across the two estimation equations. We use the seemingly unrelated regression (SUR) model to estimate parameters, taking care of the possible correlated errors between equations. By estimating equations simultaneously instead of separately we are able to improve the efficiency of our parameters. Along with reporting errors estimated through the SUR model (numbers in parentheses in Table 1), we also report robust standard errors (numbers in square brackets in Table 1).

4.5. Model Specification

The following is our full model, Model 5 in Table 1:

$$\begin{aligned}
 \text{Amount}_i, \text{Valuation}_i &= \beta_0 + \beta_{\text{Age}} \text{Age}_i + \beta_{\text{InvSize}} \text{InvSize}_i + \beta_{\text{InvRep}} \text{InvRep}_i \\
 &+ \beta_{\text{FounExp}} \text{FounExp}_i + \beta_{\text{FounRep}} \text{FounRep}_i \\
 &+ \beta_{\text{InvMill2}} \lambda_{2,i} + \beta_{\text{Comp}} \text{Comp}_i + \beta_{\text{ValMed}} \text{ValMed}_i \\
 &+ \beta_{\text{Volpre}} \text{VolPre}_i + \beta_{\text{VolPre}} \text{VolPre}_i + \sum_{k=1}^5 \beta_k d\text{Ind}_{k,i} \\
 &+ \sum_{k=2004}^{2007} \beta_k d\text{Year}_{k,i} + \beta_{d\text{East}} d\text{East}_i + \beta_{d\text{West}} d\text{West}_i \\
 &+ \beta_{d\text{High}} d\text{High}_i + \beta_{\text{Rev}} \text{Rev} + \beta_{\text{Size}} \text{Size} + \beta_{\text{Vol}} \text{VolPop}_i \\
 &+ \beta_{\text{Val}} \text{ValPop}_i + \beta_{\text{VolNonPop}} \text{VolNonPop}_i \\
 &+ \beta_{\text{ValNonPop}} \text{ValNonPop}_i + \beta_{d\text{NegPop}} d\text{NegPop}_i \\
 &+ \beta_{\text{VolPop*dNegPop}} d\text{NegPop}_i * \text{VolPop}_i \\
 &+ \beta_{\text{VolPop*dHigh}} d\text{High}_i * \text{VolPop}_i \\
 &+ \beta_{\text{VolPop*dNegPop*dHigh}} d\text{NegPop}_i * d\text{High}_i * \text{VolPop}_i + \varepsilon_i
 \end{aligned}$$

5. Results

5.1. Interpretation of Coefficients

The coefficient β_{volPop} tells the percentage change in the financing for a unit percent increase in the volume of popular blog coverage at a *lower financing stage* with overall *positive popular blog coverage*. The coefficient $\beta_{\text{volPop*dNeg}}$ tells the difference between the percentage changes in the financing when overall popular blog coverage is negative and when the overall blog coverage is positive for a unit percent increase in the volume of popular blog coverage at a *lower financing stage*. This implies that the sum of coefficients $\beta_{\text{volPop*dNeg}} + \beta_{\text{volPop}}$ tells the percentage change in the financing for a unit percent increase in the popular blog coverage at a *lower financing stage* with overall *negative popular blog coverage*. Similarly the sum of coefficients $\beta_{\text{volPop*dHigh}} + \beta_{\text{volPop}}$ tells the percentage change in the financing for a unit percent increase in the popular blog coverage at a *higher financing stage* with overall *positive popular blog coverage*. Extending

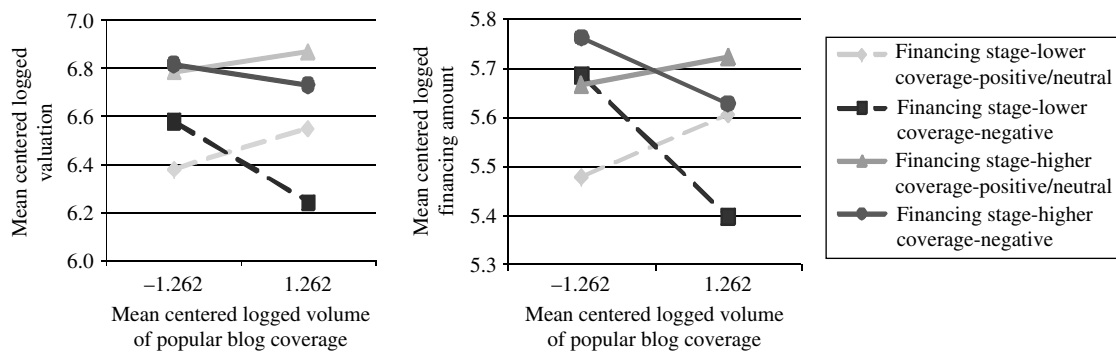
this analogy to the third interaction level, the sum of coefficients $\beta_{\text{volPop*dHigh*dNeg}} + \beta_{\text{volPop*dNeg}} + \beta_{\text{volPop*dHigh}} + \beta_{\text{volPop}}$ tells the percentage change in the financing for a unit percent increase in the popular blog coverage at a *higher financing stage* with overall *negative popular blog coverage*.

5.2. Results of Hypotheses Testing

The detailed results of our analysis are presented in Table 1. We first estimate Model 1, which consists of just the controls. The signs of control variables are as expected and their values are consistent across other model specifications. Model 2 tests our Hypotheses H1A and H1B, which postulate that volume and valence of blog coverage are positively related to venture financing irrespective of the blog popularity. The coefficients of volume and valence of blog coverage are insignificant in Model 2, which suggests that Hypotheses H1A and H1B are not supported. An increase in R^2 between Model 2 and Model 1 comes out to be insignificant and this also corroborates our conclusion regarding H1A and H1B. For the support of Hypothesis H2, the coefficient of interaction between volume of popular blog coverage and negative popular blog coverage dummy should be negative and its absolute value should be larger than the coefficient of volume of popular blog coverage. Model 4 in both panels shows these properties, providing support to our Hypothesis H2. Model 3 tests our Hypotheses H3A and H3B, which postulate that volume and valence of popular blog coverage are positively related to venture financing. Hypothesis H3A is supported in both Model 3 and Model 5, whereas Hypothesis H3B is supported in Model 3 but not in Model 5. Model 5 tests Hypothesis H4, which postulates that the association between eWOM and financing decreases at higher stages. The test of Hypothesis H4 is equivalent to testing the following: the coefficient of interaction between volume of popular blog coverage and higher stage dummy is negative, and the coefficient of interaction between volume of popular blog coverage, higher stage dummy, and negative popular blog coverage dummy is positive. Model 5 in both panels shows these properties, providing support to Hypothesis H4. One interesting finding in Models 4 and 5 is that the valence of popular blog coverage is insignificant, suggesting that the level of favorableness or unfavorableness of the coverage doesn't matter. The only thing that matters is whether the overall coverage is negative or not.

To summarize, H1A and H1B are not supported. H2, which states that the impact of negative eWOM is greater than the positive eWOM, is supported. H3A, which states that the volume of popular blog coverage has significant impact on venture financing, is supported. H3B is supported in Model 3 but is not

Figure 2 Sensitivity Analysis



supported in the final Model 5. Thus once we account for whether overall coverage in popular blogs is positive or not, the valence of popular blogs does not have any significant influence on venture financing. H4, which state that as ventures progress through financing stages, the effect of eWOM on financing decreases, is also supported.

5.3. Sensitivity Analysis

In Figure 2 we summarize the results of our sensitivity analysis. This figure illustrates the nature of the interactions by charting the predicted value of financing corresponding to the volume of popular blog coverage at all four combinations of financing stage and sign of popular blog coverage dummies. From these figures it is easy to see that the percentage change in financing corresponding to overall *negative popular blog coverage* is much larger (slopes are steeper for *negative coverage* versus *positive coverage*) than the percentage change in financing corresponding to overall *positive popular blog coverage*. This suggests that the impact of *negative popular blog coverage* is much higher than the impact of *positive popular blog coverage*. Also, the percentage change in financing corresponding to *higher financing stage* is less (slopes are less steep for *higher stage* versus *lower stage*) than the percentage change in financing corresponding to *lower financing stage*. This suggests that the effect of eWOM on financing may decrease with the stage of financing.

5.4. Economic Significance of Coefficients

We show the economic significance of the coefficients by calculating the change in financing in dollar terms

for a 100% increase in popular blog coverage under all four combinations of stages of financing and the sign of overall popular blog coverage. Specifically, in Table 2a and Table 2b we calculate the change in financing amounts and valuations, respectively, for a 100% increase in popular blog coverage under all four combinations of stages of financing and the sign of overall popular blog coverage.

For example, the value 0.0503 in Model 5 of Panel A in Table 1 suggests there will be a 5.03% increase in the financing amount for a 100% increase in the volume of popular blog coverage at a lower financing stage with overall positive popular blog coverage. In dollar terms the significance of this coefficient is that the financing amount will increase by \$261,427 for a 100% increase in the volume of popular blog coverage at a lower financing stage with overall positive popular blog coverage, taking the average financing amount to be \$5.2 million.

5.5. Robustness of Results

5.5.1. Robustness Check for Endogeneity (instrument Variable). To the best of our knowledge, we have included suggested controls mentioned in the literature that can signal the quality of any venture and hence do not expect any significant endogeneity bias in our analysis. To check for the robustness of our parameters we reestimated our final model by using an instrument variable approach. For this we require instrument variables that are correlated with the volume of popular blog coverage but not with the shock in venture financing (sudden increase/decrease

Table 2a Change in Financing Amount for 100% Increase in Volume of Popular Blog Coverage

	Lower stage of financing (\$)	Higher stage of financing (\$)
Overall positive popular blog coverage	261,427	113,811
Overall negative popular blog coverage	−591,050	−276,662

Table 2b Change in Valuations for 100% Increase in Volume of Popular Blog Coverage

	Lower stage of financing (\$)	Higher stage of financing (\$)
Overall positive popular blog coverage	1,581,548	765,265
Overall negative popular blog coverage	−3,132,486	−805,773

in financing amount and valuation: i.e., the idiosyncratic error). The two instruments that we find suitable are whether ventures have approached popular bloggers for coverage and whether the top management team maintains blogs. We assessed the validity of instruments by examining the orthogonality (exogeneity) of our instruments to structural equations (amount and valuation) using the Sargan test for overidentifying restrictions (Baum et al. 2003). The null hypothesis is that all the excluded exogenous variables, the instruments, are uncorrelated to the regression error in the main equation. Sargan tests for overidentification for both amount and valuation fail to reject the null hypothesis ($p = 0.17$ for amount financed; $p = 0.26$ for valuations) that instruments are uncorrelated with the error term and hence they satisfy the required orthogonality condition. To ensure that our instruments are not weakly identified, we checked the F -statistic value for the first stage regression. We found that its value (24.26) is much larger than the critical value (Stock et al. 2002), which suggests that our instruments are not weakly identified. The argument in favor of these instruments is that there is no evidence either in any trade journal or in the literature about these instruments influencing VCs' decision making, whereas it is understandable that if founders approach popular bloggers or maintain blogs, then bloggers' propensity to discuss corresponding ventures should increase.

We use the Hausman (1978) specification test to compare the ordinary least squares (OLS) estimates with the instrumental variables (IV) estimates to determine if the IV estimation is necessary. The test fails to reject the null hypothesis ($p = 0.24$) that the OLS and IV methods are equivalent. For robustness check results please see Table EC.10. All these results suggest that eWOM is not endogenous in our analysis.

5.5.2. Robustness Check for Endogeneity (Propensity Score Matching). One potential concern with our analysis is that high-quality ventures that are more likely to get higher valuations and financing amounts are also more likely to get covered from popular blogs. To address this potential endogenous selection problem, we reestimated our models using propensity score matching. Two literature streams, labor economics and statistics, often use propensity score matching and recently IS researchers have also used the propensity score matching method to address similar endogenous selection problems (Smith and Telang 2009). Ideally researchers would like to assign similar subjects to control and treatment groups randomly, treat the treatment group with the variable of interest, and then compare subjects in two groups over a dependent variable. But business researchers do not

have this luxury because the choice of subjects undergoing treatment is not under their control. Propensity score matching overcomes this problem by, first, identifying similar subjects over some observable factors among control and treatment groups, and second, comparing only these similar subjects over dependent variables. This approach is likely to undermine the potential endogenous selection problem as in our case. This allows the direct comparison of valuation and financing amounts received for ventures from treatment and control groups that have a similar probability of receiving coverage from popular blogs and hence should reduce the endogenous selection bias. We used logit regression to calculate propensity scores for ventures to receive popular blog coverage using venture level controls. Next we calculated estimates for differences in financing between ventures with and without popular blog coverage that have similar propensity scores. Our estimate for the difference in financing rounds is 0.2134 (p -value < 0.001) and estimate for the difference in valuations is 0.4337 (p -value $= 0.001$). Statistically significant differences in financing between ventures with and without blog coverage indicate that eWOM from popular blogs has significant influence on financing amounts and valuations.

5.5.3. Robustness Check for Endogeneity (Partial Correlations). If controls used are not good, then we expect to find a statistically significant correlation between the quality of a venture and eWOM from popular blogs after partialling out the effect of controls. If such partial correlation persists, then it would indicate eWOM from popular blogs is capturing some effect of the unattributed quality. However, if we find no partial correlation between the quality and eWOM from popular blogs, then it indicates that our controls are adequate. To do this analysis, we first need to identify a good proxy for a venture quality. Management literature suggests that the sales growth of a venture is a good proxy for the inherent quality of a venture (McGee et al. 1995). Our discussions with multiple VCs also confirmed that sales growth is a good proxy for venture quality. Using this proxy variable we found that partial correlations between sales growth and both dimensions (volume and valence) of eWOM of popular blogs are not significant ($p = 0.32$ and $p = 0.26$, respectively).

5.5.4. Robustness Check for Selection Bias. We have earlier argued that accounting for the selection bias is important while estimating our model. We conducted two more analyses related to the use of Heckman selection in our analysis—first, without controlling for any selection bias, and, second, by controlling for selection bias at level 2 only, which means controlling for bias because of nonrandom funding

decisions of VCs and ignoring the potential selection bias because of nonrandom funding seeking decisions of ventures. From the results (see Table EC.10) we found that without accounting for nonrandom selection by founders, we would overestimate the effect of volume of popular blog coverage.

5.5.5. Robustness Check for Alternative Specification. In estimating seemingly unrelated regression we implicitly assumed that financing amount and valuation do not affect each other. We relax this assumption and use a simultaneous equation model with additional instruments to estimate the parameters. We estimated amount and valuations simultaneously using three stage least squares (3SLS).

$$\text{Amount} = \alpha_0^1 + \beta^1 X + \gamma^1 Z_1 + \delta \text{Valuations} + \varepsilon_1 \quad (1)$$

$$\text{Valuations} = \alpha_0^2 + \beta^2 X + \gamma^2 Z_2 + \eta \text{Amount} + \varepsilon_2 \quad (2)$$

where X is the vector of control variables. To identify Equation (1), we need an instrument variable, Z_2 , which is correlated with *Valuations* but is not correlated with ε_1 . Similarly, to identify Equation (2), we need an instrument variable, Z_1 , which is correlated with *Amount* but is not correlated with ε_2 . We identified VC fund size (Z_1) as an instrument for *Amount* because total funds available to VC will influence the *Amount* a VC can fund for any venture but should not be correlated with valuation. To identify (1) we have used the Standard and Poor's (S&P) 500 Index (Z_2) as an instrument for *Valuations*. The S&P 500 is widely regarded as the gauge of the U.S. equities market; hence it will also influence the *Valuations* for the venture but should not be correlated with *Amount*. The results from the simultaneous equation model are qualitatively similar to the OLS estimates and are reported in Table EC.10.

5.5.6. Robustness Check for Popularity Cutoff. We analyzed the sensitivity of the results to the use of one standard deviation above mean as the cutoff to define popular bloggers. We took the number of citations to a blog as the measure of popularity of the blogger and took one standard deviation above mean as the cutoff (107) for popular bloggers. We also analyzed our model using 1.5 and 2 standard deviations above the mean as cutoff for popular bloggers as a robustness check. The results obtained in these robustness checks were qualitatively similar to those obtained by using one standard deviation as a cutoff. For robustness check results, please see Table EC.10.

5.5.7. Robustness Check for any Uncaptured Nonlinearity. We conducted a Ramsey RESET test to check for any uncaptured nonlinearity patterns in the data and we do not find any violation. Results of the test are reported in Table EC.11.

6. Phenomenon Through Which eWOM Affects Venture Financing Decisions

Our findings suggest that eWOM of popular blogs affects venture financing decisions. But one limitation of this analysis is that it cannot pinpoint which of the three possible explanations is responsible for this observed effect. The first explanation is that, similar to consumer decision making, eWOM from popular blogs directly affects the evaluations of decision makers, VCs in our context. A second explanation is that eWOM of popular blogs indirectly affects the evaluations of decision makers. EWOM from popular blogs may be helping ventures only in catching the attention of VCs for serious consideration, but beyond that it may not affect the outcome of any due diligence process. Traditionally VCs pay attention to ventures that have referrals from people they trust and simply ignore startups that pitch to them without any referral. EWOM from popular blogs may substitute for a missing referral, and hence more VCs would consider a venture for funding. Now, one can say with mathematical verity that ventures receiving attention from more VCs are likely to get funding offers from a greater number of VCs. More demand for a venture is likely to empower a venture with better negotiating power, resulting in a better funding amount and valuations. A third explanation is that eWOM of popular blogs may affect evaluation of decision makers both directly (as in our first explanation) and indirectly (as in our second explanation).

To understand the underpinnings of our results, we discussed our findings with many VCs and entrepreneurs, and based on these discussions we structured a survey. We sent this survey to 250 VCs and 300 entrepreneurs and received responses from 82 VCs and 104 entrepreneurs. From the surveys (Tables EC.12 and EC.13) we found that the second explanation is true; popular blog coverage does not directly affect the evaluation of VCs. VCs' decisions to fund ventures after a due diligence process are not affected by eWOM from popular blogs. VCs consider popular blogs coverage as a substitute for referrals and use this information to screen ventures for the due diligence process. Because more VCs now consider ventures receiving good popular blog coverage, competition among VCs force them to give better financing deals to such ventures. Thus, eWOM from popular blogs does not directly affect the valuations and financing amounts for a venture, but it indirectly affects the outcome.

7. Discussion and Conclusions

In this paper, we investigated the association between eWOM and venture financing. Our analysis indicates

that the impact of negative eWOM is greater than the positive eWOM, and the influence of eWOM on financing decreases with higher financing stages. Our results also show that eWOM from popular blogs helps ventures in getting higher financing amounts and valuations.

This research has a number of theoretical contributions. The first and foremost contribution of our work is that we investigated the role of time and status of actors generating eWOM. Another contribution is that we empirically tested the influence of eWOM in a context that is starkly different from the research contexts investigated in prior work. The effect of eWOM investigated in this study is on a VC financing decision, which is worth tens of millions of dollars, as compared to the purchase of consumer products such as books, movies, and beer, which are worth tens of dollars. A VC's decision-making process is highly complex; involves multiple people; relies heavily on the past reputation of parties involved; extends over many weeks; requires evaluation of a large number of factors; and is usually influenced by budget, cost, and profit considerations. On the contrary, the purchase of consumer products is not that elaborate, is more impulsive, and spans a few minutes to a few hours.

Even if the results in the consumer research contexts were applicable, there is no consensus in the results reported by prior studies. We report the results of the prior literature over different dimensions of eWOM in Table EC.4. Our results suggest that the status of actors generating eWOM is an important characteristic, and ignoring this can change the results drastically. Because previous studies largely ignore this important variable, it could be a possible reason behind all these studies reporting different results.

Our work also contributes to the venture literature by identifying a source of spurious effect of conventional media such as business press on venture financing. There are some studies that report a significant influence of conventional media coverage on firms raising IPOs that affects investor behavior (Pollock and Rindova 2003). However in our study we find that after controlling for eWOM, conventional media coverage has no association with venture financing. This indicates that failing to account for eWOM is likely to result in the overestimation of the influence of conventional media on venture financing.

The results provide numerous managerial insights that may save ventures millions of dollars. The question, whether eWOM helps ventures in obtaining a good financing deal, has important implications for ventures. The analysis suggests that ventures that get coverage from popular blogs receive higher valuations. Therefore ventures should try to get the attention of popular blogs and convince them of the quality and viability of their venture. The result that

eWOM of popular blogs can influence VCs' financing decisions also provides a cost-effective way for entrepreneurs to promote their startups. Ventures spend a good proportion of their venture financing in marketing their venture. Thomas (2006) found that the marketing spending of new ventures is significantly high, sometimes as high as 46% of the total capital raised. The findings suggest that popular blogs can help new ventures in marketing, and ventures can utilize the money saved from decreased advertising for other purposes.

Another interesting implication of our work is that as the venture progresses through different funding stages to IPOs, the effect of eWOM decreases over time. So as ventures mature and have accounting data to back their projections, they may not worry about wooing the attention of popular blogs.

So far we have discussed how eWOM can help entrepreneurs in achieving better funding and valuations. However, this easy to use and cost-free platform can also pose big challenge to ventures that want to use this new platform as one of their marketing mix. There is a risk in approaching popular bloggers to start a buzz about the venture. New ventures should not only actively promote positive eWOM but also be wary of and try to reduce negative eWOM. Entrepreneurs that fail to manage negative buzz may find themselves getting rejected by VCs too frequently and may have a hard time raising another round of funding.

Although our results suggest interesting implications for new ventures, there are certain limitations of our current analysis that raise opportunities for future extensions. In this paper we have investigated the association between eWOM and new venture financing. We do not observe the different phases of VCs' decision making that go into the final decision of new venture financing. Thus this work lacks in providing diagnostic insights of a multistage decision making analysis. eWOM from nonpopular blogs also received limited focus in this study and was only used as a control variable. Our result seems to suggest that eWOM from nonpopular blogs does not influence new venture financing. It will be interesting to explore the influence of eWOM from nonpopular blogs in more detail and understand the theoretical underpinning of this result. We have tested the potential influence of blogs on VC financing, but financial capital is only one of the resources essential for a business. Acquiring good human capital is equally important. Though financial capital can help in acquiring good human capital as well, it will be interesting to investigate whether the perceptions of potential employees change toward new ventures after they read blogs.

This paper is an attempt to study the influence of eWOM on a nonconsumer research context, specifically, new venture financing. It will be interesting

to investigate such influence in other settings such as in acquisition and merger decisions, enterprise product adoption decisions, and product continuation/discontinuation decisions. Our understanding of the effect of eWOM in such settings can help us in answering questions such as did eWOM play any role in Google's decision to acquire AdMob as compared to Quattro Wireless? Or was the adoption of Salesforce's CRM solutions out of other possible solutions (Microsoft Dynamics CRM, Zoho CRM, SugarCRM, and others) affected in any way by eWOM? It will be very interesting to see how different domain peculiarities influence the results that we observed in our study.

Electronic Companion

An electronic companion to this paper is available as part of the online version at <http://dx.doi.org/10.1287/isre.1110.0402>.

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