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Research Note

Tigerblood: Newspapers, Blogs, and the Founding of Information Technology Firms

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In this paper, we study the impact of increases in media coverage from two sources, newspapers and blogs, on firm founding rates in the context of technology-based entrepreneurship. Although increasing work in information systems (IS) has begun to investigate the effect of user-generated content on entrepreneurial behavior, limited attention has been devoted to how media affects firm founding or the boundary conditions of such an effect. Arguing for the direct effect of increased discourse in traditional and user-generated media in the information technology (IT) industry, results suggest that discourse in traditional media and blogs strongly influences IT firm founding rates. We further consider the differential impacts of media discourse on firm founding in different IT subsectors, over time, and in different locations. We test our hypotheses using entrepreneurial firm founding data from VentureXpert from 1998 to 2007, social media data from the three largest blogging platforms, and traditional media coverage from 11 major U.S. newspapers. Our work contributes to a better understanding of the concurrent effects of multiple forms of media on decision making and adds to the small but emerging literature addressing entrepreneurship-related research questions in IS.

Keywords: entrepreneurship; information technology firms; firm founding; media; newspapers; blogs; user-generated media; econometric analysis
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Introduction

The increased connectivity afforded by the Internet has led to a dramatic increase in the amount of information available to managers, consumers, and decision makers (Siegler 2010). This information comes not only from the traditional institutional sources, such as newspapers, television, and radio but also from newer Internet-based channels such as blogs, social media, and online communities. However, although extant work has investigated the impact of traditional media discourse on firm legitimacy and reputation (Pollock and Rindova 2003), as well as discourse from social media platforms on sales and firm performance (Forman et al. 2008), our understanding of the joint effect of these media is lacking. In this paper, we study the concomitant effect of traditional and user-generated media in a context of significant theoretical and economic importance—firm founding by information technology (IT) entrepreneurs. Furthermore, we examine the boundary conditions of such an effect across industry, time, and location. These analyses, therefore, provide a deeper understanding of the extent to which media influences decision making.

In theorizing about the relationship between traditional (i.e., print) media discourse, and firm founding, we leverage prior work that has postulated two mechanisms by which media influences behavior. On one hand, the presence of firm-specific discourse in media has been argued to legitimize topics, industrial sectors, and firms (Pollock and Rindova 2003), thereby conferring superior legitimacy and reputation on the recipients of such discourse (DiMaggio and Powell 1983). Alternatively, increases in media have also been shown to bias decision making by increasing the availability of ideas for recall (Pollock et al. 2008, Sunstein 2003). Referred to as the availability bias, it can cause decision makers to systematically over- or underestimate the odds associated with events occurring (Sunstein 2003). Applying this rationale to the IT entrepreneur suggests that she is likely to respond to increases in discourse by inferring that the entry of a new venture into a widely discussed technology sector will stand an increased chance of survival. Although these two mechanisms explaining the effect of increased media attention may appear at odds, one arguing that decision making is *normative* (legitimacy) and the other indicating the

presence of *bias* (availability), the influence of media on entrepreneurial decision making is the same; the presence of increased media coverage on specific technology sectors will, on the margin, lead to greater observed firm founding in that sector.

Beyond arguing for the effects of print media discourse on firm founding, we also consider the effects of user-generated content. User-generated content has been observed to be influential in several settings, such as in purchasing behavior (Forman et al. 2008), political donations (Wattal et al. 2010), and venture capitalist (VC) financing (Aggarwal et al. 2012). Moreover, in the firm founding context, discourse in user-generated media (i.e., blogs) may have three significant differences from traditional print media. First, blogs are not limited by space considerations and therefore can be used as information sources and signals for a greater range of topics than traditional media. Second, blogs represent a decentralized, and therefore unfiltered, information source, resulting in a greater possibility of observing diverse opinions, thereby making them more credible (Johnson and Kaye 2004). Finally, unlike traditional media, blogs allow participation and discussion (Aggarwal et al. 2012). For these reasons, the influence of user-generated media may be particularly strong in the context of IT firm founding. We examine these effects in the empirical analyses reported in this paper.

Econometrically, we examine the relationship between increased traditional media (*print news*), user-generated content (*blogs*), and firm founding in the context of IT start-ups in the United States from 1998 to 2007 using the VentureXpert data set (Aggarwal et al. 2012, Sorenson and Stuart 2001). We augment these data using information on media coverage extracted from 11 major U.S. newspapers as well as three major English-speaking blogging services (Typepad, Blogger, and WordPress). Results indicate that increases in coverage on specific technology segments in both forms of media (*print* and *blogs*) have a positive and significant effect on firm founding rates within those technology segments. In post hoc analyses, we find that the effects of both forms of media on firm founding are declining over time and not moderated by the location of the founded firm. Furthermore, we see significant differences in the effects of print and blog discourse across the software, hardware, and services sectors within the IT industry, with print media having a smaller effect on the founding of hardware firms and blog discourse having a larger effect on software firm founding. As we explore these relationships in a secondary data context, we carry out an extensive set of robustness checks to account for potential endogeneity in the estimations.

Our work makes three significant contributions to the information systems (IS) literature. First, we contribute to a better understanding of the effect media discourse has on decision making by juxtaposing, in the context of firm founding, social and traditional media at the same time. Whereas a rich literature on electronic word of mouth attests to the influence that discourse on such channels has on behavior, and a similar body of work has examined the traditional press, we adopt a broader perspective by considering both sources in tandem, thereby allowing comparisons of the effects of each form of media in specific contingencies.

Second, we add to the growing IS literature on entrepreneurship-related topics, thereby responding to recent calls to investigate the broader economic impact of both IS and social media (Aral et al. 2013). On one hand, there is an emerging stream of work addressing the impact of word of mouth venture capital decision making (Aggarwal et al. 2012, Aggarwal and Singh 2013). On the other hand, new research in the sphere of crowdfunding is beginning to address questions of entrepreneurial funding, innovation, and outcomes (Burtch et al. 2013, Lin et al. 2013), with specific attention paid to technology entrepreneurs (Mollick 2013). We argue that these streams represent a broadening of the locus of IS research into areas that, although technology focused, have not been viewed as "IS" topics. Our work therefore builds on prior work by Aggarwal et al. (2012) by extending the study of traditional media and user-generated content into the firm founding decision, a precursor to the actual VC financing decision they model.

Our final contribution is to the entrepreneurship literature by explicitly considering the influence of multiple forms of media on the decision to found a firm. Whereas extant firm founding literature has addressed factors specific to the entrepreneur, such as her social network (Aldrich and Zimmer 1986, Stuart and Sorenson 2005), educational background (Shane and Khurana 2003), and agglomeration effects (Bresnahan et al. 2001, Hannan and Freeman 1987), little attention has been paid to the media discourse that the entrepreneur is exposed to. Through the mechanisms described below, we argue that media discourse may "nudge" the nascent entrepreneur into founding a firm (Thaler and Sunstein 2008).

Theory and Background

IT Firm Founding and the Role of Media Discourse

What causes entrepreneurs to found technology firms? Extant literature on this question can be divided into four distinct but related streams (shown in a selective literature review in Table A5 in the online appendix (available as supplemental material at http://dx.doi.org/10.1287/isre.2015.0603)). The first revolves around the demographic factors of the entrepreneur, such as the entrepreneur's family background (Dunn and Holtz-Eakin 2000, Sørensen 2007) or personal characteristics like age (Braguinsky et al. 2012), gender

(DeMartino and Barbato 2003), and immigration status (Saxenian 2002). The second stream of work focuses on the training, career histories, and professional experience. Research within this stream indicates not only that personal experiences affect the probability of firm founding (Aldrich and Zimmer 1986, Shane and Khurana 2003) but also that experience has a strong hand in enabling entrepreneurs to identify opportunities in the marketplace (Shane 2001a, b). Extensions of this stream form the third—work studying how cognitive and behavioral factors influence the entrepreneur's decision to found a firm. Douglas and Shepherd (2000), for instance, argue that limited risk aversion and a preference for independence affects entrepreneurial entry, a result further corroborated by Sarasvathy et al. (1998). To the extent that opportunity costs also matter, agents with lower opportunity costs or those in flagging organizations are likely to start new firms (Carnahan 2013, Gompers et al. 2005, Iyigun and Owen 1998).

The final stream of work, which is the most pertinent, addresses the sociological and economic influence of the broader environment on the entrepreneur. The economic perspective taken in this stream emphasizes the effect of market conditions on entrepreneurial decision making, such as the presence of competition and congestion (Delacroix et al. 1989), i.e., "munificent or sparse" economic spaces (Dubini 1989), geographic characteristics (Klepper and Graddy 1990), and environmental factors that affect access to resources (Bresnahan et al. 2001). The sociological perspective in this stream studies how the institutional environment (i.e., analysts, critics, and regulatory agencies) (Alvarez et al. 2005) and the entry and exit patterns of existing firms (Hannan and Freeman 1987, Sorenson and Audia 2000) influence entrepreneurial decisions.

Whereas these streams of literature offer many cogent insights into entrepreneurial market entry, Shane and Venkataraman (2003) offer several observations on what differentiates technology entrepreneurs from traditional entrepreneurs. First, technology entrepreneurship requires a deeper understanding of the role of technology, technical developments, and technical institutions in the founding process. These can range from the varying cost of entry, to the extent to which fixed costs are high or low, to even the maturity of the underlying technological platform. Second, technology entrepreneurship is incremental and highly influenced by the path-dependent nature of technology development. As a result, events and information from diverse sources about the focal technology, including market conditions, may strongly influence the entrepreneur's decision to found the firm. Finally, the birth of technology firms is heavily dependent on the environment surrounding the entrepreneur (e.g., entities like VCs, changing regulatory structures, and even media; Alvarez et al. 2005). Strikingly, however, these institutional players have only recently been considered in analyses of high-tech entrepreneurship, leading to increasing calls to expand beyond the entrepreneur and consider the broader institutional environment (Shane and Venkataraman 2003). It is this gap, i.e., how institutional forces like media influence entrepreneurial decision making, that we address.

Interestingly, there is ample anecdotal evidence that trends in discourse are influential among tech entrepreneurs. David Nilssen, investor and the founder of Guidant Financial, wrote: "When you're thinking about starting a business, think first which industries have sustainable momentum. No venture is a sure thing, but if you start your business in an industry with a strong positive trend behind it, you're starting on an easier road. Instead of fighting your competitors tooth-and-nail for a limited or dwindling pool of customers, you will benefit from a rising tide of revenue as the market opens up" (Nilssen 2014). Similarly, Paul Graham, the cofounder of Y-Combinator, wrote: "If you look at the way successful founders have had their ideas, it's generally the result of some external stimulus hitting a prepared mind" (Graham 2014). Among those external stimuli, he includes technologies or technology market segments that experience *strong word of mouth* and *significant media attention*. Unsurprisingly, this need to capitalize on "trends" as part of the entrepreneurial process has garnered attention from both the traditional press and the blogosphere. Print publications like *Forbes* provide articles describing "Five up and coming tech trends for entrepreneurs" (Sofia 2014), which help establish or kick-start media buzz around specific technologies. Similarly, user-generated sites like theverge.com and gigaom.com provide information on technologies experiencing a significant increase in discourse. We next motivate these effects theoretically.

Media Discourse and Firm Founding

Prior work on the impact of traditional media has postulated two complementary, yet distinct, mechanisms of influence—(1) salience and availability (Tversky and Kahneman 1973) and (2) legitimacy (DiMaggio and Powell 1983). Moreover, the literature on entrepreneurial opportunity identification suggests a third path, "learning" and knowledge spillovers from media (Qian and Acs 2013). We next describe each of these arguments.

The first potential path from increased media discourse to firm founding pertains to the salience of information regarding a subject (be it firm, technology, or industry). As the amount of discourse on a subject increases, individuals lose their ability to form accurate judgments regarding the recipient of the discourse. This leads to a systematic bias in judgment, manifesting as inaccurate estimation of the risks associated with events related to the subject (Heath and Tversky 1991). The reason for this biased judgment is the invocation

of the *availability heuristic* (Tversky and Kahneman 1973), which leads to decision makers creating causal linkages between the probability of an event occurring and the ease with which instances or occurrences can be brought to mind. Increasing salience can be a function of many factors that have been studied in extant literature, such as prior experience to the subject at hand, strategically manipulated information (Tversky and Kahneman 1973), or, most relevant here, increased media attention (Sunstein 2003). Thus, entrepreneurs observing significant increases in media discourse on specific technology sectors (e.g., voice over IP, optoelectronics) will, on the margin, overestimate the odds of a venture's success in that technological sector.

An alternative theoretical path suggests that increased media coverage of key events, ideas, or firms acts as a legitimizer of those topics (Aggarwal et al. 2012, Pollock and Rindova 2003). Abrahamson (1996), for example, asserts that public discourse, i.e., media, legitimizes the firm, manager, or technology by providing a tacit or explicit endorsement of it, thereby making it more desirable and acceptable. Alternatively, Pollock and Rindova (2003) show that increased media attention influences investors toward stock purchase at the initial public offering. In these contexts, the presence of media attention is viewed as enhancing the legitimacy of the object of discussion. The use of print media as an indicator of legitimacy has significant support (Benders and Van Veen 2001) since increased discourse conveys the underlying appeal of the topic to a wider audience. In extreme cases, this discourse can even be viewed as a signal of acceptability or quality by third-party observers such as VCs (Aggarwal et al. 2012, Aggarwal and Singh 2013).

The third path relates to incremental learning that media discourse may provide to the entrepreneur. Prior work on opportunity identification within entrepreneurship suggests that between early-stage technological feasibility and later-stage market readiness, the entrepreneur optimizes the product or service based on information observed in the marketplace (e.g., the success of other entrepreneurs, financing trends, and innovation activity of incumbent firms; Grégoire et al. 2010). Thus, information available in the expanded discourse within traditional media could influence the entrepreneur by providing significant knowledge spillovers (Qian and Acs 2013), which, in turn, enables the entrepreneur to capitalize on her privately held market information.[1] As a result, new market and product intelligence gleaned from print discourse could provide the entrepreneur with useful knowledge that then leads to the firm founding.[2]

Although these arguments pertain to media discourse in general, we also investigate whether user-generated discourse, i.e., discourse on blogs, may differ in any systematic way from traditional media. As many IS scholars have noted, new forms of media offer an increasingly important platform for the dissemination of information (Kane and Fichman 2009, Wallsten 2007). Research on the impact of blogs has been diverse, ranging from their impact on sales (Dewan and Ramaprasad 2012) to even their role in politics (Wattal et al. 2010). More pertinent to our work, recent research has highlighted the important role blogs play in entrepreneurial contexts. Aggarwal et al. (2012), for example, showed how electronic word of mouth influences VC decisions, whereas Aggarwal and Singh (2013) documented the influence of technology blogs across domains of VC decision making.

Why would blog discourse influence the nascent entrepreneur? The mechanisms described above are likely to apply to discourse in blogs as well; blog coverage can help legitimize topics as well as provide salience and availability (Aggarwal et al. 2012). Beyond these, theory in journalism identifies three differences between blogs and print media that suggest potentially greater influence on firm founding. First, blogs allow two-way discourse, i.e., participation,[3] which scholarly work suggests is important for catalyzing action on the part of decision makers (Gioia and Thomas 1996, Weick 1995). The process, referred to as sense making, is critical in ambiguous environments because it assists individuals in understanding the competitive landscape and technologies during times of flux. Extensive work in journalism (McCombs and Shaw 1972) and political science (Wallsten 2007) supports this notion: individuals with the option to participate are more likely to take action as a response to discourse. The second difference pertains to peer effects. Members of blogging communities are more likely to be peers, or at least perceived as peers. Prior work in behavioral economics shows that while providing access to information may be useful in eliciting action, the same information provided by peers has a much greater effect (Duflo and Saez 2003). In the technology space, it is common to observe entrepreneurs and technology experts providing commentary and participating in

[1] Although the entrepreneur may learn about the environment or applications of her technology, it is unlikely that she will advance her technical knowledge from information acquired through media (Lazear 2004).

[2] We echo Qian and Acs's (2013, p. 194) point that the focal constructs in this context—knowledge spillover, new knowledge, and entrepreneurial decision making—are almost impossible to observe directly, but may be observed in the aggregate.

[3] Whereas many newspapers have recently implemented blogging technologies on their websites, this option was not available during the time of our study. This is discussed in greater detail in the Empirical Methodology section of this paper.

debates on the relative merits of technologies,[4] thereby ensuring that the entrepreneur observes discourse from peers rather than the relatively distant news media. Third, and finally, to the extent that blogs are often not associated with specific institutions, they represent an unfiltered and decentralized force in the tech industry, resulting in a diverse set of opinions being represented. Wall (2005, p. 157), for example, refers to blogs as "we media" and "post-modern journalism" because of the extent of decentralization observed within the blogging community. Moreover, as the discourse on blogs is often more forward looking (Thomaz et al. 2013), the media on these sites can offer arguably more credible (Johnson and Kaye 2004) opinions and advice on the uncertainty inherent in entrepreneurial decision making within the tech sector (Aggarwal et al. 2012).

In summary, the preponderance of theoretical evidence suggests that print and blog discourse may influence the firm founding rates in the technology sectors they discuss. In addition, there are possible boundary conditions for these effects across time, sector, and location that are informative to theory and practice. Because specific mechanisms for these contingency effects are hard to establish ex ante, we allow the empirical analyses, described next, to guide us.

Empirical Methodology

Data Sources and Coding

To conduct our empirical analysis, we create a unique data set by combining four existing data sources with a set of hand-collected media data. For data on firm founding, we utilize the VentureXpert data set from Thompson Reuters. VentureXpert provides detailed information on VC-backed new ventures, e.g., founding date, location, and the technology sector associated with the firm (Aggarwal et al. 2012, Sorenson and Stuart 2001). We extract the *founding date* for each new venture from this data set, as well as information about the entrepreneurial venture. To account for varying economic conditions over time and location, we use the U.S. Census Bureau's Small Area Income and Poverty Estimates (SAIPE) data set, which contains information on the relative wealth of the population in different areas in the United States. These data are then combined with data from the U.S. Census Bureau's County Business Patterns (CBP) data set and the National Bureau of Economic Research (NBER) patenting data set to control for extant economic activity by region and industry over time. We apply three additional restrictions to form our final sample. First, we include only entrepreneurial firms founded in the United States, because we measure print media discourse using U.S. newspapers and blog discourse using U.S. blogging services (discussed further below). Second, we include only IT entrepreneurs. Finally, we consider only IT firms founded between 1998 and 2007. We limit the data set to 2007 because blogging technology began to be implemented on newspaper websites in and after 2007.

We track firm founding within the nine economic census zones across the United States for the period 1998–2007. Economic zones are defined as the nine geographic areas of the United States ascribed by the U.S. Census Bureau and have not changed since 1984. In addition, we define technology sectors that new firms are associated with using the industry subclass level 3 (ISC3) distinction within VentureXpert. ISC3 is the most granular decomposition of the IT industry and contains 304 subindustries. Finally, we consider the number of new firms founded in *six-month* time periods in our analysis. Therefore, our final sample consists of 54,720 observations tracking the number of new IT firms, by six-month period, in each of nine economic census zones, across 304 IT subclasses in the period 1998–2007. A description of the key independent variables is available in Table 1 and summary statistics are available in Table 2.

Table 1 Variable Descriptions

Variable	Description
Num Founded	Number of firms founded in the economic zone by ISC
Print (thousands)	Level of the print media change
Blog (100 thousands)	Level of the social media change
Poverty	Number of people living in poverty in the economic zone
Median	Median income of the economic zone
Employment	Number of people working in IT in the economic zone
Num Firms	Number of IT firms in the economic zone
Population	Population of the economic zone
VC Capital	VC capital spent in the economic zone
VC Investments	Number of VC deals made in the economic zone
Patenting	Number of patents granted within the industry (past three years)

Variable Definitions

Dependent Variable. The dependent variable (DV), *Num_Founded*, is the number of entrepreneurial IT firms founded in economic zone j as part of industry i during period t. We use a six-month period as our time interval to allow sufficient time to pass that new entrepreneurial ventures are founded, i.e., variation in the dependent variable, as a result of increasing media discourse on that technology sector. In robustness tests, we vary this time period to three months and one year, with consistent results.

[4] Examples include Steve Blank, founder of the "lean start-up" movement, and Seth Godin, pioneer of Internet-based direct marketing, both of whom write well-read blogs discussing nascent trends in IT entrepreneurship.

Table 2 Summary Statistics and Correlations

	Variable	Mean	Std. dev.	1	2	3	4	5	6	7	8	9	10
1	*Num Founded*	0.1309	0.9127										
2	*Print*	0.0207	0.4623	0.001									
3	*Blog*	0.7453	48.4045	0.007	0.093								
4	*Poverty*	329,322.9	179,047.9	0.121	0.001	−0.004							
5	*Median*	39,414.3	4,948.8	0.035	0.003	−0.003	0.538						
6	*Employment*	2,000.5	1,771.2	0.042	0.006	0.024	0.588	0.622					
7	*Num Firms*	126.9	78.8	0.026	0.004	0.001	0.664	0.639	0.816				
8	*Population*	28,585,250.0	1,621,409	0.103	0.000	−0.001	0.950	0.686	0.744	0.812			
9	*VC Capital*	7,077,951.0	30,000,000	0.221	−0.006	0.010	−0.078	−0.061	−0.065	−0.067	−0.074		
10	*VC Investments*	259.196	605.640	0.283	−0.008	0.012	−0.119	−0.098	−0.112	−0.112	−0.123	0.784	
11	*Patenting*	15.185	125.294	0.026	−0.005	−0.002	−0.009	−0.036	−0.008	−0.006	−0.003	0.010	0.025

Independent Variables. Our first independent variable (*print*) measures the change in the discourse that an industry subsector receives in the print media in the time periods preceding the founding of the firm ($t-2$ to $t-1$), i.e., the change in the number of articles which explicitly mention the ISC3. Although media is clearly a broad construct and can include many different sources, e.g., television, print, and film, we focus on discourse from the newspapers for two reasons. First, there is a cumulative tradition within the literature using newspaper-based print media to proxy legitimacy and salience (Benders and Van Veen 2001, Pollock et al. 2008). Second, journalism recognizes the primacy of newspapers, thereby providing precedent (McCombs and Shaw 1972).

We use the count of articles that explicitly mention the ISC3 in *The Wall Street Journal* and *USA Today* as our baseline measure of print media. These two periodicals are the most widely distributed periodicals in the United States (with a daily circulation of 2.06 million and 1.83 million respectively). Using these periodicals allows us to capture discourse in both the business and popular press, thereby increasing the scope of our measurement. Because geographic proximity is also a concern when measuring salience of discourse, we augment this measure by collecting similar data from a newspaper in the entrepreneur's economic zone. A full listing of the economic zones and the newspapers used in each of these zones is available in Table 3.[5]

Our second independent variable of interest is the level of blog discourse. To measure *Blog* discourse, we use a Web scraping tool to determine the number of blog posts that discuss the focal technology subsector on the three major English-speaking blogging services—WordPress, Typepad, and Blogger. These three platforms account for over 66% of personal blogging at the end of the time period of our analysis. Our Web scraping tool measures the number of blog posts that mention the industry subsector in the main blog post as well as in the comments provided by individual readers. Because we are interested in capturing total discourse on the topic that an individual may encounter through blogs, we include the original post and comments in our measure of *Blog*.

Our operationalization of the two sources of media (henceforth *Print* and *Blog*) is based on the *change in discourse over time* (lagged by one period to limit reverse causality). Therefore, for the firm founded in time period t in the industry subclass i, change in discourse is measured between periods $t-2$ and $t-1$. We use a difference measure for these variables because prior work argues that high levels of media ubiquity cause individuals to take the level of discourse "for granted" (Pollock et al. 2008). Changes in discourse are hence more appropriate. Note that because our analysis includes industry-zone and time fixed effects, the difference measure we use captures the changes in the level of discourse in a time period on an industry subclass above and beyond expected change, i.e., deviations from the first moment. Conceptually, this is akin to capturing media discourse *acceleration* rather than simply discourse.

Control Variables. To limit the effect of unobserved heterogeneity, we control for several variables included in models of firm founding. From SAIPE data, we include controls for the number of people living in poverty (*Poverty*) in the economic zone in which the entrepreneurial firm is founded (Armington and Acs 2002), the median income (*Median*) to control for the wealth of the economic zone, and the population of the economic zone (*Population*; Bruno and Tyebjee 1983, Saxenian 1994). From CBP data, we include controls for the number of people in the economic zone currently working in the IT industry (*Employment*) and the number of operating IT firms in the economic zone (*Num Firms*; Saxenian 1994). We classify IT firms in this context as those operating in IT-based NAICS

[5] In each case the regional newspaper is the largest in the economic zone (e.g., *Chicago Tribune, The New York Times*), with two exceptions. We substitute the *San Jose Mercury News* for the *Los Angeles Times* given the importance of Silicon Valley to IT entrepreneurship, and *The Boston Globe* for the *Boston Herald* because the *Herald* News Desk claimed to have implemented blogging in 2002 (well before all other papers).

Table 3 Local Periodicals Used

Zone number	Area	Periodical
1	New England	*The Boston Globe*
2	Mid-Atlantic	*The New York Times*
3	East north central	*Chicago Tribune*
4	West north central	*Minneapolis Star Tribune*
5	South Atlantic	*Washington Post*
6	East south central	*Atlanta Journal Constitution*
7	West south central	*Austin American-Statesman*
8	Mountain	*The Denver Post*
9	Pacific	*San Jose Mercury News*

codes in economic zone j at time t. From VentureXpert, we control for the total capital invested by VCs in industry i within economic zone j (*VC Capital*) and the number of VC funding decisions (*VC Investments*) within industry i, economic zone j, and period t (Bruno and Tyebjee 1983) to account for capital munificence in a specific technology sector. Finally, from the NBER patent data set, we account for regime changes within the focal entrepreneur sector by controlling for the cumulative number of patents granted to entrepreneurs, in industry i, in the two years prior to the focal time period (Shane 2001b).

Estimation Procedure

Because our dependent variable is a count (i.e., the number of firms founded in industry i, economic area j, and time period t), we use a conditional fixed effect Poisson quasi-maximum likelihood estimator (QMLE; Wooldridge 1997). This estimator has been used extensively in recent work (Azoulay et al. 2010) and offers several benefits over other analytical techniques such as the Poisson or negative binomial. First, the QMLE is not constrained by the assumptions the Poisson places on the conditional moment of the dependent variable (namely, that the conditional variance of y given x is equal to the conditional mean). Thus, the assumptions of the model are not violated when the distribution of y given x does not follow the functional form of the Poisson distribution (Wooldridge 1997). Moreover, the estimator allows for the generation of robust standard errors even when the distribution of the dependent variable is not Poisson (Azoulay et al. 2010). We estimate the effect of change in media on firm founding rates using the equation

$$y_{ijt} = \xi y_{ijt-1} + \beta_1(\Delta s_{ijt-1}) + \rho_1(\Delta r_{it-1}) + M'\theta_1 + X'\delta_1 + H'\eta_1 + \varepsilon, \quad (1)$$

where y_{ijt-1} is the lagged dependent variable (included to limit the effect of serially correlated firm founding within industry zone; Bresnahan et al. 2001),[6] Δs_{ijt-1} is the change in print media coverage from $t-2$ to $t-1$, Δr_{it-1} is similarly the change in blog media coverage from $t-2$ to $t-1$, M is the vector of control variables discussed above, X is the vector of industry-zone fixed effects, and H is the vector of period controls. The set $\{\xi, \beta, \rho, \theta, \delta, \eta\}$ represents the coefficients to be estimated, and ε represents the error term. For ease of exposition and consistency, we refer to the variables Δs_{ijt-1} and Δr_{it-1} as *Print* and *Blog* going forward. Results from the QMLE can be found in Columns (1)–(3) of Table 4. Because we include industry-zone fixed effects, economic zones that do not experience any new firm founding in a focal ISC3 are dropped from the analysis, leading to a smaller sample size for these regressions. To ensure that this process of dropping ISC3s with no firm founding does not bias the estimations, we replicate these analyses using an ordinary least squares (OLS) estimator, the results of which are in Columns (4)–(6) of Table 4. Finally, it is plausible that heterogeneity in the time trends exist across technology sectors, i.e., the maturation of one technology sector is independent of other technology sectors. As a result, increases in media coverage, despite being lagged, may be a response to idiosyncratic changes in the technology's lifecycle. This introduces endogeneity, through omitted variable bias, which is not fully accounted for by the time fixed effects. To resolve this potential confound, we reestimate our equation including industry-time as well as industry-zone fixed effects.[7] Results are in Columns (7)–(9) of Table 4.

The presented model, though extremely conservative, is prone to two significant sources of bias that may influence the estimated coefficients. First, it is possible that an idiosyncratic omitted variable, unrelated to the technology's general chronological progression, could increase both media coverage and firm founding rate for an industry subsector. For instance, significant changes in technological regimes in a sector, driven by the introduction of a new product or technological innovation, could lead to media coverage on that technology sector and subsequently increase firm founding (Shane 2001b). If so, the coefficient estimates for both *Print* and *Blog* on firm founding would be biased (Wooldridge 2009). Second, opportunistic entrepreneurs with high social capital may leverage their social connections in both the print and blogging communities to increase coverage of their own technologies and then found their firms, thereby increasing the odds that these new firms receive positive responses from the entrepreneurial community (Aggarwal et al. 2012).

[6] We thank the anonymous reviewer for the suggestion to include the lagged DV. Results are consistent without the lagged DV and are available on request from the authors.

[7] We define the industry-time fixed effects at the ISC2 level. We do this for two reasons. First, defining the industry fixed effects at the ISC3 level would drastically reduce the power of the estimations. Second, because the *Blog* variable does not vary geographically within time, it would be perfectly predicted by the ISC3-time fixed effect.

Table 4 Baseline Estimations of Media on Firm Founding

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
DV	*Num Founded*	*Num Founded*	*Num Founded*	*Num Founded*	*Num Founded*	*Num Founded*	*Num Founded*	*Num Founded*	*Num Founded*
estimator	QMLE	QMLE	QMLE	OLS	OLS	OLS	OLS	OLS	OLS
Num Founded$_{(t-1)}$	−0.0105	−0.0108	−0.0107	0.244***	0.244***	0.244***	0.511***	0.511***	0.511***
	(0.00831)	(0.00841)	(0.00835)	(0.0760)	(0.0760)	(0.0760)	(0.0641)	(0.0641)	(0.0641)
Print	0.124**		0.123**	0.00860***		0.00796***	0.00838**		0.00768**
	(0.0506)		(0.0561)	(0.00291)		(0.00294)	(0.00345)		(0.00348)
Blog		0.00204***	0.00200***		0.000114***	0.000110***		0.000123***	0.000119***
		(0.000536)	(0.000516)		(3.02e–05)	(3.02e–05)		(2.64e–05)	(2.66e–05)
Poverty	−6.08e–07	−6.92e–07	−6.45e–07	−1.24e–06***	−1.24e–06***	−1.24e–06***	1.04e–06***	1.04e–06***	1.04e–06***
	(3.01e–06)	(3.02e–06)	(3.01e–06)	(3.38e–07)	(3.38e–07)	(3.38e–07)	(2.10e–07)	(2.10e–07)	(2.10e–07)
Median	0.000116	0.000114	0.000114	−4.52e–05***	−4.52e–05***	−4.52e–05***	1.28e–05***	1.28e–05***	1.28e–05***
	(7.99e–05)	(7.99e–05)	(7.98e–05)	(6.48e–06)	(6.48e–06)	(6.48e–06)	(2.74e–06)	(2.74e–06)	(2.74e–06)
Employment	−3.07e–05	−2.98e–05	−3.02e–05	−2.53e–06*	−2.55e–06*	−2.54e–06*	9.97e–06***	9.95e–06***	9.97e–06***
	(3.79e–05)	(3.78e–05)	(3.78e–05)	(1.37e–06)	(1.37e–06)	(1.37e–06)	(2.39e–06)	(2.39e–06)	(2.39e–06)
Num Firms	0.00131**	0.00131**	0.00132**	5.14e–05	5.12e–05	5.14e–05	−0.000132	−0.000132	−0.000132
	(0.000652)	(0.000651)	(0.000651)	(7.81e–05)	(7.81e–05)	(7.81e–05)	(0.000113)	(0.000113)	(0.000113)
Population	2.16e–06**	2.14e–06**	2.15e–06**	−9.91e–07***	−9.91e–07***	−9.91e–07***	−1.12e–07***	−1.12e–07***	−1.12e–07***
	(9.67e–07)	(9.64e–07)	(9.64e–07)	(1.26e–07)	(1.26e–07)	(1.26e–07)	(2.86e–08)	(2.86e–08)	(2.86e–08)
VC Capital	2.08e–09***	2.10e–09***	2.09e–09***	6.13e–10***	6.14e–10***	6.13e–10***	8.92e–10***	8.93e–10***	8.92e–10***
	(6.35e–10)	(6.28e–10)	(6.29e–10)	(2.01e–10)	(2.01e–10)	(2.01e–10)	(2.29e–10)	(2.29e–10)	(2.29e–10)
VC Investments	−8.94e–05	−8.88e–05	−8.85e–05	0.000221***	0.000220***	0.000220***	1.42e–05	1.40e–05	1.41e–05
	(6.75e–05)	(6.69e–05)	(6.69e–05)	(3.70e–05)	(3.70e–05)	(3.70e–05)	(4.33e–05)	(4.33e–05)	(4.33e–05)
Patenting	−0.000122	−0.000136	−0.000137	3.66e–06	3.81e–06	3.67e–06	−3.97e–05	−3.96e–05	−3.97e–05
	(0.000173)	(0.000176)	(0.000176)	(3.56e–05)	(3.56e–05)	(3.56e–05)	(4.91e–05)	(4.90e–05)	(4.90e–05)
Constant				5.407***	5.404***	5.406***	−0.594***	−0.595***	−0.594***
				(0.604)	(0.604)	(0.604)	(0.108)	(0.108)	(0.108)
N	21,451	21,451	21,451	51,984	51,984	51,984	51,471	51,471	51,471
Wald χ^2	1,671.74	1,689.71	1,690.91						
R^2				0.128	0.128	0.128	0.397	0.397	0.397

Notes. In Columns (1)–(3), the quasi-maximum likelihood Poisson estimator and year and industry-zone fixed effects were used. In Columns (4)–(6), ordinary least squares and year and industry-zone fixed effects were used. In Columns (7)–(9), ordinary least squares and industry (ISC2)-year and industry-zone fixed effects were used. Robust standard errors are in parentheses.

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

Here again, any association between media and firm founding is likely biased.

To resolve these concerns, we employ a dynamic panel model (Arellano and Bond 1991).[8] The dynamic panel model assumes that though the explanatory variables of the model are not exogenous, it is possible to treat the lagged values (i.e., the independent or dependent variables or, in our case, the lagged differences in the independent variables) as exogenous, and therefore as instruments. The Arellano–Bond estimator (through a differences GMM (generalized method of moments) approach) helps resolve both endogeneity issues described above (omitted variable bias and reverse causality). Moreover, the model allows us to use a differences GMM, resulting in the time-invariant industry-zone fixed effects being differenced out of the equation. As a result, any correlation between the fixed effect and the explanatory variable is removed, leaving the fixed effect wholly contained in the error term. Therefore, no observations are dropped from the analysis. A potential drawback of the Arellano–Bond estimator is that the final stage estimation is assumed to be linear and not a count. However, the large number of possible values our DV can take (the supremum being 87) indicates that a linear model is a reasonable approximation (Wooldridge 2009). We therefore reestimate our results using a differences GMM Arellano–Bond estimator where the endogenous variables (*Print* and *Blog*) are instrumented using the changes in the exogenous independent variables, with a minimum lag difference of one and a maximum lag difference of five periods. Results are available in Table 5.

[8] An alternative strategy would be to use instrumental variables in two stage least squares (2SLS). In unreported analyses, we estimate a 2SLS model instrumenting for print and blog media using the number of weather-related deaths in a region as well as the amount of foreign media coverage. Results, available on request, are consistent and indicate a strong direct effect of both media on firm founding.

Table 5 Arellano–Bond Estimation of Media on Firm Founding

	(1)	(2)	(3)
DV	*Num Founded*	*Num Founded*	*Num Founded*
Num Founded$_{(t-1)}$	−0.365***	−0.243**	−0.218***
	(0.0932)	(0.111)	(0.0631)
Print	0.00744**		0.00788**
	(0.00300)		(0.00307)
Blog		0.000144***	0.000106***
		(3.92e–05)	(3.31e–05)
Poverty	−2.36e–06	−2.55e–06*	−2.71e–06**
	(1.82e–06)	(1.47e–06)	(1.07e–06)
Median	0.000406**	0.000477***	0.000408***
	(0.000201)	(0.000130)	(0.000101)
Employment	−1.02e–05	1.16e–06	−4.22e–06
	(6.78e–06)	(6.60e–06)	(4.34e–06)
Num firms	−0.000132	−0.000210	−0.000211
	(0.000418)	(0.000318)	(0.000244)
Population	5.39e–06***	6.84e–06***	6.99e–06***
	(1.65e–06)	(1.95e–06)	(1.22e–06)
VC Investments	0.000440***	0.000436***	0.000447***
	(0.000110)	(0.000108)	(9.97e–05)
Patenting	−0.000350**	−0.000393*	−0.000341**
	(0.000171)	(0.000205)	(0.000151)
Wald χ^2	510.55	324.08	276.47
N	49,248	49,248	49,248
AR(2) statistic	0.235	0.595	0.815
Hansen's test statistic	0.723	0.764	0.16

Notes. In Columns (1)–(3), the Arellano-Bond estimator and year fixed effects were used. Robust standard errors are in parentheses.
*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

Results

We first observe consistent results with respect to the control variables in our analyses, speaking to the validity of the estimated models; these results are not discussed here in the interest of space. We turn our attention to the results of the baseline QMLE model in Table 4. In Columns (1) and (3) of Table 4, we see a positive and significant coefficient of *Print* on the number of firms founded in that technology subclass, thereby providing strong support for our expectations of the positive effects of print media. Moreover, in support of the expectation for blogs, we also see a significant and positive correlation between *Blog* discussion and the number of firms founded (Columns (2) and (3) of Table 4). When we examine these results in the OLS regressions with additional fixed effects imposed (Columns (4)–(6) with year and industry-zone fixed effects, Columns (7)–(9) with industry-year and industry-zone fixed effects), we see fully consistent results. Across all three specifications, we see clear evidence for the association between media discourse in print and blogs and firm founding.

We next consider the effect of media on firm founding in the Arellano–Bond estimations (Table 5). We first note that we see no evidence for second-order autocorrelation in the model (as indicated by the AR(2) test statistic) and that the Hansen's test statistic is insignificant (indicating that the instruments have been properly constructed). Moreover, consistent with the QMLE and OLS regressions, we see a positive and statistically significant effect of both *Print* and *Blog* media on the number of firms founded (Columns (1) and (2)). These relationships remain significant in the full model as well (Column (3)). Unlike the QMLE, the Arellano–Bond estimations allow us to use the full sample, with accommodations for the lagged DV. The full set of results across multiple regression specifications leads us to conclude that both *Print* and *Blog* based media are strongly correlated with entrepreneurial firm founding in that sector of the IT industry.

Taken in sum, results from multiple empirical specifications strongly support the correlation between *print* media, *blogs*, and the founding of de novo IT ventures. We also conduct analyses to rule out the possible effects of bias resulting from: the native data set (i.e., only private equity receiving entrepreneurs biasing the estimates), discourse tone on firm founding, and the effects of reverse causality (i.e., firm founding causing media discourse). A full description of these tests is provided in the online appendix.

Empirical Extensions—Contingent Effects of Print and Blog Media

Time-Varying Effects of Media

Although discussion of the changing influence of media has become commonplace in extant literature (Greer and Mensing 2006), much of this work emerges from journalism and political science (Bagdikian 2004). In our context, it is plausible that the effect of print and blog discourse may change over time. The advent of the Internet has had a profound effect on traditional news reporting (Greer and Mensing 2006). In addition to significant consolidation among news providers (Bagdikian 2004), the last decade has seen the introduction of online media providers such as *The Huffington Post*, and a changing competitive landscape in which the traditional news media operates. Traditional media has waned, whereas online media sources such as blogs and online newspapers have flourished. To test whether the effect of media and IT firm founding changes over the period of our study, we interact each of the focal independent variables (*Print* and *Blog*) with a linear time spline to examine the changing marginal effect of media over time. Because the value of the spline is perfectly predicted by the time fixed effects, the direct effect of the spline is not shown (although it is controlled for). The results using the QMLE and time series OLS are in Table 6.

Results show a significant decline in the influence of print media over time (as seen by the interaction between *Print* and *Time* in Columns (2) and (4) of Table 6)

Table 6 Estimations of Media Effect on Firm Founding Over Time

DV estimator	(1) *Num Founded* QMLE	(2) *Num Founded* QMLE	(3) *Num Founded* OLS	(4) *Num Founded* OLS
Num Founded$_{(t-1)}$	−0.0107	−0.0105	0.244***	0.244***
	(0.00835)	(0.00829)	(0.0760)	(0.0760)
Print	0.123**	0.420***	0.00796***	0.0480***
	(0.0561)	(0.0967)	(0.00294)	(0.0168)
Blog	0.00200***	0.00536**	0.000110***	0.000286***
	(0.000516)	(0.00218)	(3.02e–05)	(9.34e–05)
Print × *Time*		−0.0762***		−0.00731***
		(0.0268)		(0.00263)
Blog × *Time*		−0.00103*		−4.21e–05***
		(0.000585)		(1.57e–05)
Poverty	−6.45e–07	−6.60e–07	−1.24e–06***	−1.24e–06***
	(3.01e–06)	(3.03e–06)	(3.38e–07)	(3.38e–07)
Median	0.000114	0.000112	−4.52e–05***	−4.51e–05***
	(7.98e–05)	(7.98e–05)	(6.48e–06)	(6.48e–06)
Employment	−3.02e–05	−2.92e–05	−2.54e–06*	−2.60e–06*
	(3.78e–05)	(3.76e–05)	(1.37e–06)	(1.37e–06)
Num Firms	0.00132**	0.00132**	5.14e–05	5.06e–05
	(0.000651)	(0.000650)	(7.81e–05)	(7.81e–05)
Population	2.15e–06**	2.13e–06**	−9.91e–07***	−9.90e–07***
	(9.64e–07)	(9.59e–07)	(1.26e–07)	(1.26e–07)
VC Capital	2.09e–09***	2.10e–09***	6.13e–10***	6.13e–10***
	(6.29e–10)	(6.25e–10)	(2.01e–10)	(2.02e–10)
VC Investments	−8.85e–05	−8.89e–05	0.000220***	0.000221***
	(6.69e–05)	(6.66e–05)	(3.70e–05)	(3.70e–05)
Patenting	−0.000137	−0.000129	3.67e–06	4.45e–06
	(0.000176)	(0.000178)	(3.56e–05)	(3.56e–05)
Constant			5.406***	5.400***
			(0.604)	(0.604)
N	21,451	21,451	51,984	51,984
Wald χ^2	1,690.91	1,703.99		
R^2			0.128	0.128

Notes. In Columns (1) and (2), the quasi-maximum likelihood Poisson estimator and year and industry-zone fixed effects were used. In Columns (3) and (4), ordinary least squares and year and industry-zone fixed effects were used. *Time* indicates linear time spline. Robust standard errors are in parentheses.
*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

across both QMLE and OLS regressions. However, surprisingly, we observe a weak and marginally significant decrease in the influence of *Blogs* over time ($p < 0.10$) in the QMLE analysis (Column (2)), and a negative and significant interaction for the OLS estimations (Column (4)). Whereas the reduced impact of print media is consistent with accepted wisdom, the reduction in the role of blogs is striking. However, the analyzed period coincides with the continued introduction of new forms of social media (e.g., MySpace, Facebook) that offer new avenues for content sharing and creation. Therefore, the results may be providing some evidence of the "crowding out" of *Blogs* by other social discourse. Our analysis cannot clearly establish this dynamic, but it remains a fruitful avenue for future work.

Location-Specific Effects of Media

As the influence of media may not only differ across time but also by location, we extend our analysis to determine how geography may moderate the effect of media on firm founding. Extant work in entrepreneurship, for example, suggests that the density of the social network connecting the entrepreneur to her financiers strongly affects the likelihood of receiving funding (Sorenson and Audia 2000, Sorenson and Stuart 2001), and the influence of blogs and print discourse may have differential impacts across areas in the nation where the densities of such financiers are high, leading to varying levels of influence attributable to media. Furthermore, entrepreneurs operating in high-density regions of the country may observe opportunities from media discourse differently (i.e., they are more easily "nudged" into firm founding) compared to their counterparts from other regions (Sorenson and Stuart 2001). If true, the effects of media discourse would only emerge in traditional entrepreneurial hotbeds (with a high density of entrepreneurial activity and active entrepreneurial ecosystems). Alternatively, if media is simply increasing the amount of information available to *all* nascent entrepreneurs, no such

Table 7 Estimation of Media Effects in Hotbeds of Entrepreneurial Activity

	(1)	(2)	(3)	(4)
DV	*Num Founded*	*Num Founded*	*Num Founded*	*Num Founded*
estimator	QMLE	QMLE	OLS	OLS
Num Founded$_{(t-1)}$	−0.0107	−0.0107	0.244***	0.244***
	(0.00835)	(0.00835)	(0.0760)	(0.0760)
Print	0.123**	0.149**	0.00796***	0.0103**
	(0.0561)	(0.0604)	(0.00294)	(0.00432)
Blog	0.00200***	0.00168***	0.000110***	0.000102***
	(0.000516)	(0.000459)	(3.02e–05)	(3.88e–05)
Print × *Hotbed*		−0.123		−0.00645
		(0.104)		(0.00493)
Blog × *Hotbed*		0.00242**		2.20e–05
		(0.00110)		(6.05e–05)
Poverty	−6.45e–07	−5.85e–07	−1.24e–06***	−1.24e–06***
	(3.01e–06)	(3.00e–06)	(3.38e–07)	(3.38e–07)
Median	0.000114	0.000116	−4.52e–05***	−4.52e–05***
	(7.98e–05)	(7.98e–05)	(6.48e–06)	(6.48e–06)
Employment	−3.02e–05	−3.07e–05	−2.54e–06*	−2.56e–06*
	(3.78e–05)	(3.79e–05)	(1.37e–06)	(1.38e–06)
Num Firms	0.00132**	0.00134**	5.14e–05	5.15e–05
	(0.000651)	(0.000651)	(7.81e–05)	(7.81e–05)
Population	2.15e–06**	2.12e–06**	−9.91e–07***	−9.92e–07***
	(9.64e–07)	(9.64e–07)	(1.26e–07)	(1.26e–07)
VC Capital	2.09e–09***	2.08e–09***	6.13e–10***	6.13e–10***
	(6.29e–10)	(6.28e–10)	(2.01e–10)	(2.01e–10)
VC Investments	−8.85e–05	−8.82e–05	0.000220***	0.000220***
	(6.69e–05)	(6.68e–05)	(3.70e–05)	(3.70e–05)
Patenting	−0.000137	−0.000137	3.67e–06	3.68e–06
	(0.000176)	(0.000178)	(3.56e–05)	(3.56e–05)
Constant			5.406***	5.406***
			(0.604)	(0.604)
N	21,451	21,451	51,984	51,984
Wald χ^2	1,690.91	1,696.78		
R^2			0.128	0.128

Notes. In Columns (1) and (2), the quasi-maximum likelihood Poisson estimator and year and industry-zone fixed effects are used. In Columns (3) and (4), ordinary least squares and year and industry-zone fixed effects are used. *Hotbed* indicates location in Boston, New York, or Silicon Valley. Robust standard errors are in parentheses.
*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$

systematic variation should exist across locations in the United States.

We test these dynamics through the creation of a dichotomous variable (*Hotbed*) that indicates whether or not the new entrepreneurial firm is in one of three established VC hotbeds: Boston, New York, or Silicon Valley. We choose these locations because over 80% of the VC funding of new IT ventures has occurred in these locations since 1980 (Sorenson and Stuart 2001). We interact this variable with our indicators of media (*Print* and *Blog*). As with our previous estimations, the base effect of *Hotbed* status is not estimated because it is perfectly collinear with industry zone fixed effects. Results of both the QMLE and OLS estimators are shown in Table 7. Whereas the results continue to show the direct effects of media on founding, they show no moderation of *Print* media across economic zones (Columns (2) and (4) of Table 7). Furthermore, there is mixed evidence of the effects of *Blogs* (the QMLE renders a significant and positive interaction, but the OLS coefficient is not significant). In summary, while blog discourse is somewhat more influential in firm founding in entrepreneurial hubs (not surprising, since many bloggers reside in these hubs), we see no compelling evidence of geographical variation in the influence of media discourse.

Differential Effects Across IT Sectors

Our final empirical extension is to examine whether print and blog discourse have differential impacts on firm founding across software, hardware, and services firms in our data set. To the degree that sector-specific factors are instrumental in allowing a new firm to be established, an investigation of the variation of the effect size is warranted. Received research in entrepreneurship suggests that software firms, as opposed to hardware or services firms, require low start-up capital and physical infrastructure, but high levels of skilled human capital (Cusumano 2008, Shane and Venkataraman 2003; witness the metaphor of the "next

big software firm" born in a garage). Moreover, intellectual property (IP) protection, as a precondition for firm founding, is systematically deemphasized in the software industry (Mann and Sager 2007), where patents are viewed as relatively ineffective. Finally, the software industry has high clockspeed, i.e., a rapid change of technology and product markets, thereby influencing the entrepreneur considering entry (Patel et al. 2014).

These factors are in direct contrast to hardware start-ups, where high levels of capital and IP protection are needed (Patel et al. 2014). Hardware design, testing, and manufacturing requires specialized expertise that is not as fungible as in software development, nor is this expertise as easily available in a decentralized manner (Cusumano 2008). Hardware firms also experience higher barriers to entry, which is not surprising given the higher capital costs and the importance of IP (Mendelson and Pillai 1998). Services firms are located on the continuum between hardware and software firms; the resources needed are more fungible than those needed for hardware, but services firms are not location or market agnostic, as they condition their offerings to the specific (and often localized) markets they target. Therefore, founding constraints they face may be lower than those faced by hardware firms, but higher than those faced by software firms.

Acknowledging the presence of this a priori heterogeneity across technology sectors, we ask, are there likely to be sectoral differences in the influence of print and blog discourse on firm founding? We note, of course, that such sectoral differences are not binding, in that all hardware firms incorporate software (in the form of firmware and embedded software), and all IT-based services firms essentially include software. Therefore, although clear predictions of differential impacts are difficult, we can still empirically examine differences in the effect of blogs and print discourse across these sectors.

To examine these differences, we create dummy variables capturing the specific type of industry in which the new firm is founded (*Hardware*, *Software*, and *Services*). Because VentureXpert does not provide a clear mapping from ISC3 to IT sectors, we manually map ISC3 categories into *Hardware*, *Software*, and *Services* based on the ISC3 description provided by VentureXpert as well as an examination of representative samples of firms within the ISC3. The mapping, performed by the authors independently, resulted in a near-complete agreement in terms of assignment of ISC3s. For example, the ISC3 "Computer Training Services" was assigned to the *Services* sector, whereas the ISC3 "Optoelectronics" was assigned to *Hardware*. We then interact the *Hardware* and *Software* dummies with our indicators of *Print* and *Blog* discourse (*Services* serves as the base case) and regress the number of firms founded on them. The results are shown in Table 8.[9]

Results from Table 8 are striking regarding the effect of media across IT sectors. First, as indicated by the base coefficients of *Print* and *Blog*, both forms of media have a significant effect on the founding of *Services* firms. Furthermore, we see a negative interaction of *Print* and *Hardware*, indicating that the effect of print media is significantly smaller on the founding of hardware firms. Similarly, compared with services firms, we see an intermittent negative interaction between *Print* and *Software* (significant in the QMLE but insignificant in the OLS estimations), suggesting equivocality. In other words, there appears to be no compelling differences in the influence of print media on software and services firms. Given that most services firms rely on a core of software, and that many software firms view themselves as services, this is not surprising. We note, however, that the cumulative effect of print on firm founding is still net positive across all three sectors.

Moving to the effects of blogs, we see a distinctly different pattern of results. Blogs have no discernible difference in influence between services (the base case) and hardware firms. However, blog discourse has a large and positive moderated effect on software entrepreneurs. The magnitude of this effect is even larger than the main effect of blogs, indicating a particularly close relationship between blogs and the founding of software firms. The potential for participation and peer conversation, specific to blogs, is likely to be of particular value in the case of software-related start-ups. As we conjecture about these links, and our analysis cannot isolate the precise mechanisms at play here, we leave these as topics for future research. In summary, we see that print media is notably influential in services (less so in hardware), whereas blog discourse is particularly influential in the software sector.

Discussion and Conclusion

Firm founding remains a phenomenon of vital importance, in terms of driving economic growth as well as fostering technological progress. This is notably true in the IT sector, where recent developments in technological platforms, applications, and services have come about through the creation of new entrepreneurial ventures. As economic and technological conditions evolve over time, new drivers of firm founding emerge. In this paper, we investigate how the rising tide of discourse on technologies, in both traditional and nascent user-generated media, influences the rate of IT firm

[9] Note that because the industry-zone fixed effects perfectly predict the base effect of *Hardware* and *Software*, we do not estimate the beta coefficients for these variables (although they are controlled for by industry-zone fixed effects).

Table 8 Estimation of Media Effects Across Industry Sectors

	(1)	(2)	(3)	(4)
DV	*Num Founded*	*Num Founded*	*Num Founded*	*Num Founded*
estimator	QMLE	QMLE	OLS	OLS
Num Founded$_{(t-1)}$	−0.0107	−0.0108	0.244***	0.244***
	(0.00835)	(0.00839)	(0.0760)	(0.0760)
Print	0.123**	0.190***	0.00796***	0.0106***
	(0.0561)	(0.0579)	(0.00294)	(0.00332)
Print × *Hardware*		−0.371***		−0.0210***
		(0.0978)		(0.00739)
Print × *Software*		−1.122***		−0.0170
		(0.434)		(0.0206)
Blog	0.00200***	0.00248***	0.000110***	0.000106**
	(0.000516)	(0.000694)	(3.02e–05)	(4.44e–05)
Blog × *Hardware*		−0.00102		−1.70e–05
		(0.000833)		(5.92e–05)
Blog × *Software*		0.00625***		0.00117***
		(0.00149)		(0.000418)
Poverty	−6.45e–07	−6.24e–07	−1.24e–06***	−1.24e–06***
	(3.01e–06)	(3.01e–06)	(3.38e–07)	(3.38e–07)
Median	0.000114	0.000114	−4.52e–05***	−4.52e–05***
	(7.98e–05)	(7.99e–05)	(6.48e–06)	(6.48e–06)
Employment	−3.02e–05	−2.94e–05	−2.54e–06*	−2.53e–06*
	(3.78e–05)	(3.79e–05)	(1.37e–06)	(1.37e–06)
Num Firms	0.00132**	0.00134**	5.14e–05	5.13e–05
	(0.000651)	(0.000651)	(7.81e–05)	(7.80e–05)
Population	2.15e–06**	2.14e–06**	−9.91e–07***	−9.91e–07***
	(9.64e–07)	(9.66e–07)	(1.26e–07)	(1.26e–07)
VC Capital	2.09e–09***	2.07e–09***	6.13e–10***	6.13e–10***
	(6.29e–10)	(6.26e–10)	(2.01e–10)	(2.01e–10)
VC Investments	−8.85e–05	−8.75e–05	0.000220***	0.000220***
	(6.69e–05)	(6.67e–05)	(3.70e–05)	(3.70e–05)
Patenting	−0.000137	−0.000133	3.67e–06	3.78e–06
	(0.000176)	(0.000175)	(3.56e–05)	(3.55e–05)
Constant			5.406***	5.404***
			(0.604)	(0.604)
N	21,451	21,451	51,984	51,984
Wald χ^2	1,690.91	1,744.95		
R^2			0.128	0.128

Notes. *Hardware* and *Software* indicate broad industrial classifications. Robust standard errors are in parentheses.
*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

founding. Using data on new IT ventures and aggregate measures of media discourse from newspapers and blogs, we address this open question. Results provide four key takeaways. First, there is a strong and significant impact of media discourse, from blogs and print, on the founding of firms in the specific technological sectors receiving this discourse. Second, the effects of both forms of media on firm founding appear to be declining over time. Whereas this effect is expected in the case of print, the waning effect of blogs is noteworthy. Third, there appears to be no systematic geographical differences in the influence of media. Finally, there are strong differences in the size of the effect each media type has on each industrial sector. Whereas print media has a markedly smaller effect on hardware entrepreneurs, blogging has a significantly higher effect on software entrepreneurs. In sum, these findings provide a nuanced analysis of the effects of media discourse on firm founding, complementing the IS literature addressing questions of innovation and entrepreneurship.

We compute the economic impact of increases in media coverage by calculating the number of times that spikes in media coverage have increased the predicted number of founded firms to the next integer value, compared to the predicted number of firm founding events in the absence of media. Over the course of our study, an additional 288 firms have been "nudged" into founding as a result of spikes in traditional and social media (56.3% of them software firms). Considering that only 7,162 IT firms received private equity during the course of the sample, this constitutes a 4% increase in the overall genesis of IT firms, which can be directly attributed to increased media discourse. Moreover, as fewer than 1% of IT entrepreneurs actually receive VC financing (Goldfarb et al. 2005), thereby appearing in VentureXpert, the total impact of media discourse on firm founding is likely to be substantially higher. Finally,

if we consider these two media sources independently, 247 of the 288 could have been pushed into founding by print media alone, whereas 254 of the 288 could have been incentivized by only blogs. This suggests that there is considerable parity in the economic impact across the two media types, indicating that the scope and volume of blog media makes up in effect size for any differences in the magnitude of regression coefficients.

Beyond economic impact, our work has implications for entrepreneurs and policy makers. From the perspective of the entrepreneur, two direct implications are suggested. First, media spikes will influence many entrepreneurs with similar intentions simultaneously, resulting in more new firms being founded during the same time period. Effectively, this will lead to greater competition for critical resources, such as funding, human capital, and customers, among these newly formed firms. As a result, new ventures founded as a result of media "buzz" will face harsher competition, all else equal. Second, because the effects of availability are a result of "biased" judgments, and legitimacy can change over time (Abrahamson 1996), many of the firms founded during media spikes may fail since they are not "high-quality" firms. In other words, media discourse may cause an excess of weak firms to be founded by inducing inflated judgments of success, and such firms will show higher than normal failure rates during the maturation process. Thus, ironically, firms founded during the heights of media "buzz" in certain tech sectors may show greater attrition, on average, than other ventures. Although these expectations may not deter the nascent entrepreneur, they still have implications for how entrepreneurs may choose to manage their new venture after founding.

For policy makers wishing to incentivize economic growth in their jurisdictions, our work also provides insights. First, results suggest one viable method policy makers may use to encourage new ventures is through increasing discussion and discourse through local media sources on the benefits of entrepreneurial activity, potentially in specific technology sectors. Examples of local and municipal policy makers using social media, print media, and blogs to publicize activities in local entrepreneurial hubs[10] are not difficult to find. Many local and state jurisdictions have already realized the value of such activities, as witnessed by recent industry reports (Bouvard et al. 2011), which specifically mention the effect media has on entrepreneurial culture (underscoring the fact that governments should "support proactive promotion of entrepreneurship through associations, TV entrepreneurial contests, and global entrepreneurial business-plan competitions" (p. 5)). Our work provides more robust evidence of such an effect. Furthermore, knowing that media discourse can lead to differentially high rates of firm founding across sectors allows policy makers to be judicious in allocating resources to entrepreneurs in specific sectors (potentially in the form of tax subsidies or regulatory assistance). Finally, our work cautions policy makers against assuming that all new firms entering the market due to disproportionately high media discourse are necessarily promising. Although every nascent entrepreneur may experience the nudge factor, not all new ventures formed are necessarily of high quality. Policy makers should guard against these very same biases that influence potential entrepreneurs in their judgments of value.

Theoretically, our work contributes to two nascent themes within extant IS research. Whereas formal analyses of entrepreneurship have remained largely confined to strategy and entrepreneurship, our work closely relates to two emerging themes that are establishing a beachhead for entrepreneurship research in IS. The first pertains to the study of the effect of user-generated content (viz., social media) on entrepreneurial decision making. Aggarwal et al. (2012), for example, analyze how firm-level discussion on blogs influences venture capital decisions. In a similar study, Aggarwal and Singh (2013) demonstrate that blogs have varying influences on multiple decisions taken by venture capitalists—blogs influence selection decisions differently than they affect funding decisions. The work we present here fits well within the stream by considering the concurrent influence of blogs and traditional media on the actual firm founding decision. Given the variety of emerging social media technologies creating vast amounts of discourse on new technology and products, there are many critical decisions within the entrepreneurial process where this discourse is likely to be influential.

The second theme relates to crowdfunding and crowdsourcing (Burtch et al. 2013, Lin et al. 2013), and addresses how projects or ideas posted on online platforms raise "democratized" capital investment. Whereas current research in this domain is based on understanding crowdfunding dynamics and outcomes, our work suggests that media may affect the type of entrepreneurial projects submitted to these platforms ex ante (Jeffries 2013). If there are significant trends in the media, or certain technologies are seen to be "hot,"[11] it follows that there may be an increased likelihood of such products

[10] See http://www.selectgreaterphiladelphia.com/industries/entrepreneur-hub/, http://www.business.ca.gov/Programs/Innovation.aspx, and http://www.nyssbdc.org/index.aspx.

[11] The blog post (Clifford C 2012 What venture capitalists are investing in right now. *Entrepreneur Magazine* (July 17), www.entrepreneur.com/blog/224074) describes the technologies that VCs are currently investing in and includes what would be considered to be the most desirable industry sectors—mobile technology, cloud computing, and social computing.

being submitted to the platform as well as funded by investors. Indeed, an emerging trend is for entrepreneurs to found a firm and then use crowdfunding sites to raise seed funding (Forrest 2014), effectively bootstrapping the project. In such contexts, our work has direct implications for when an entrepreneur founds the firm, and which projects are likely to show up on crowdfunding sites. As crowdfunding seeks to expand a vital part of the entrepreneurial process (*valuation* and *funding* of new ideas) to a much *wider* set of participants through technology, the influence of media in such a setting is likely to be even more pronounced, raising several interesting questions for future research.

Our work is subject to certain limitations. First, our measure of firm founding is based only on data from VC-backed firms. We address this limitation by extending our analysis to a different data set (the CBP data set) and showing consistent results. Because our focus is on IT entrepreneurs and more than 70% of VC-backed firms are technology entrepreneurs, the resulting bias in our sample may not be as pronounced as it would be were we to consider other entrepreneurs. However, this remains a potential limitation. A second limitation pertains to endogeneity of the media variables. We account for this through multiple regression specifications as well as through unreported instrumental variable analyses. However, methodologically, we acknowledge that bias may persist (which can only be eliminated through randomized experiments). Third, we intentionally avoid examining individual articles and blog posts, instead focusing on counts. Empirically, the sheer scale of the sample (304 industries in 11 newspapers over 10 years, five million blog posts) makes capturing information on specific articles, or considering the order in which media discourse representing positive and negative sentiment is viewed, infeasible. However, our auxiliary analyses on tone (described in the online appendix) show that the discourse is mostly neutral or positive, minimizing the impact of tone if any. Finally, although we argued for multiple mechanisms that may allow media to "nudge" the entrepreneur, we cannot identify dominant mechanisms. We leave the isolation of these mechanisms to future research.

In conclusion, in this work, we investigate the effect of increased media attention, in the form of electronic word of mouth (blogs) and print media, on the decision by IT entrepreneurs to found a firm. We show how these sources of media exert a significant effect on the rate of entrepreneurial entry. Furthermore, our work suggests differential levels of influence of blog and print discourse on firm founding over time and on subsectors of the IT industry. We further identify the implications of our work for nascent entrepreneurs as well as policymakers interested in fostering local tech-based entrepreneurship. We hope that this work will serve as a call for further research at the intersection of IS, media, and entrepreneurship.

Supplemental Material

Supplemental material to this paper is available at http://dx.doi.org/10.1287/isre.2015.0603.

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