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Incumbents? Overlooked Role in Discontinuous Technological Change in the US newspaper industry

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Abstract

This paper focuses on incumbents' reactions to discontinuous technological change and examines the relationship between the way in which incumbents respond to discontinuous change at the product-feature level and their adoption performance in the U.S. newspaper industry. I argue that incumbent firms can improve adoption performance by emphasizing product-feature similarity, which is defined as co-option in this paper. By co-opting technological change, incumbents are more likely to be acceptable to external audiences and in turn, can make their current assets more valuable and appropriable in the new market. Consequently, they can be more successful in shaping an ex ante discontinuous technological change into an ex post less discontinuous one. Fixed-effects panel regression analyses from 2002 to 2012 support my theoretical arguments: newspapers that deemphasized interactivity on the web, the characteristic that most distinguish digital media from print media, had higher online and net-combined readerships. Furthermore, the effect of co-option on readerships increased over time, which could potentially create a ?print-media-like? digital media.

Discontinuous technological change and the responses of incumbents and new entrants to the change have been a prominent subject of research in strategy and organizational theory (Schumpeter, 1934; 1942; Abernathy and Utterback, 1978; Tushman and Anderson, 1986). Discontinuous technological change refers to the creation of a new technological paradigm and interrupts the current technological trajectory (Dosi, 1982; Christensen and Rosenbloom, 1995). This line of research generally assumes that the technical and product-feature properties of technological change are pre-determined before diffusion (Anderson and Tushman, 1990), and argues that incumbent firms, as a group, often fail to actively respond to discontinuous change (Reinganum, 1983; Tushman and Anderson, 1986; Leonard-Barton, 1992; Henderson, 1993). In addition, studies in this literature pay less attention to the ways in which discontinuous technological change is differently adopted by participants, especially by incumbents. The deep uncertainty related to discontinuous change, however, creates variation in adoption form (Westphal, Gulati, and Shortell, 1997; Goodrick and Salancik, 1996) and incumbents may also differently respond to discontinuous change depending on their needs, motivations, and histories (cf. Bijker, Hughes, and Pinch, 1987). Hence, the consideration of incumbents' reactions to discontinuous change and consequent performance with respect to this change could be critical to fully understand a technological advance.

Specifically, I examine the relationship between the incumbents' adoption performance with respect to discontinuous change and their co-option at the product-feature level (cf. Benner and Tripsas, 2012; Rindova and Petkova, 2007). Co-option refers to augmenting "existing product and service offerings to appeal to new customers" (Christensen, Anthony, and Roth, 2004: 46). Following and extending this definition, I focus on co-option at the product-feature level, as product features—interfaces between producers and customers—may have a significant

impact on the technological advance (cf. Hargadon and Douglas, 2001). In this paper, therefore, co-option is defined as offering products that incorporate new technologies, but at the same time have similar product features to previous ones. If they select adoption forms with different sets of product features (Ansari, Fiss, and Zajac, 2010; Goodrick and Salancik, 1996), incumbents will differ from one another in terms of their levels of co-option. Based on this definition, I argue that more co-option may help incumbents improve their adoption performance by being more preferable to external audiences (Jensen, 2006; Benner, 2007; 2010). Through co-option, incumbents can further leverage their current set of resources and capabilities effectively in the new market (Hannan and Freeman, 1984). The superior performance of co-option, especially over time, indicates that incumbents that focus on this co-option are more likely to be successful in shaping an *ex ante* discontinuous change into an *ex post* less discontinuous one.

I test my theoretical arguments in the newspaper industry after the emergence of digital media. Digital media, an electronic edition of newspapers on the web, is regarded as discontinuous from print media (Gilbert, 2005; 2006). The characteristics that distinguish digital media from print media include product features, newsroom practices, customers, and business models (Foust, 2009; Gilbert, 2005; 2006). Specifically, the difference between print and digital media at the product-feature level is important for the purposes of this study (Foust, 2009; Peng, Tham, and Xiaoming, 1999; Pavlik, 2008). Digital media, for example, enables newspapers to publish the most up-to-date news immediately (immediacy). Newspaper firms can also provide sound-, animation-, and video-based news on the web (multimedia capability). Most distinctively, digital media allow readers to take an active part in the news creation process (interactivity), a development that challenges the several century-old notion that newspapers are news producers and readers are recipients (Thompson, 1995). In contrast to the view that newspaper on the web

would be very different from newspaper in print, especially in terms of interactivity, there exists substantive variation in the way news is published on the web and consequent online readership (Boczkowski, 2005; Hindman, 2009). I argue and show empirically newspapers which co-opt digital media –newspapers which deemphasize interactivity on the web to establish ‘print-media-like’ digital media—have better adoption performance in the online market (Bijker, Hughes, and Pinch, 1987; Fenton, 2010).

DISCONTINUOUS TECHNOLOGICAL CHANGE AND INCUMBENT FIRMS

Discontinuous technological change is defined as “an exogenous [radical] technical innovation that modifies the components, systems, techniques, or methods required for producing organizational outputs” (Lavie, 2006: 154; Schumpeter, 1942). Technological discontinuity draws upon a fundamentally new set of knowledge bases, routines, and capabilities; which can potentially displace products, firms, and the overall social systems situated in existing technologies (Anderson and Tushman, 1990; Dewar and Dutton, 1986; Dahlin and Behrens; 2005). In the nineteenth century, for example, harvested-ice firms using refrigeration in the natural ice industry faced a technological discontinuity when machine-made ice was first introduced (Jones, 1984). Discontinuous technological change is generally regarded as the first stage of the evolutionary model of technological change, a three-stage model (Abernathy and Utterback, 1978). It initiates the era of ferment, the period when technical or product-feature variation is substantially high, as alternative forms compete for dominance. The variation significantly reduces only after the emergence of a dominant design, the industry-wide agreement on core subsystems and their linking mechanisms (Tushman and Murmann, 2003). Around the newly emerged dominant design, organizations then focus on incrementally improving these products, before this period is punctuated by another technological discontinuity.

In this paper, I study the early period of technological change and examine how *incumbent firms* improve their adoption performance during this period, which can potentially affect the nature of a dominant design.¹ For the purposes of this study, I define the adoption of or a response to a technological change as the commercialization of products applying the new technology (Lavie, 2006; Benner, 2007), and examine the adoption performance of these new products with respect to technological change. Furthermore, I restrict my attention to “the market dimension of a dominant design,” not the technological one (Benner and Tripsas, 2012: 280; Rindova and Petkova, 2007). The dominant design of any product class defines how the product in question and its producers are “supposed to look and operate in the minds” of audiences, including producers, customers, and institutions (Utterback, 1996: 25; Tushman and Murmann, 2003; Anderson and Tushman, 1990). Most studies in this line of research mainly concentrate on technical properties of discontinuous change. According to the definition of the dominant design, it is also important to understand why various participants in technological change come up with different sets of product features, and how a specific set of standard product features is chosen in the end as a dominant design (c.f. Utterback, 1996; Benner and Tripsas, 2012; Rindova and Petkova, 2007). Extending this stream of research, I study the market dimension of the dominant design, that is, co-option at the product-feature level.

Finally, in order to examine a condition where co-option has a significant impact on incumbents’ adoption performance, I examine a situation when the uncertainty of technological change is high and its improvement pace is slow. Lavie (2006) argued that two aspects of

¹ Following previous studies (Benner, 2007; Methe, Swaminathan, and Mitchell, 1996), I define incumbents as ‘those firms in an industry that have been directly affected by discontinuous technological change. From this definition, I exclude other established firms or diversifying firms that entered the industry in question after the emergence of discontinuous change.

technological change—uncertainty and pace—have important effects on incumbents’ responses to technological change. The uncertainty is defined as the industry-level ambiguity about the future trajectory of technological change, and the pace of technological change refers to “the rate of improvement in the price/performance frontier of a product class or an industry” (Lavie, 2006: 162; Tushman and Anderson, 1986). Both the high uncertainty and slow pace of technological change are important assumptions in my study, as they provide more room for incumbents to potentially affect technological change. Hence, I examine how co-option improves incumbents’ adoption performance, especially when the uncertainty of technological change is particularly high and its improvement pace is significantly slow.²

Incumbents’ Passive Response to Discontinuous Change?

In a large body of technology research, scholars have argued that incumbents and entrants in general play differential roles during the evolution of technological change (Schumpeter, 1934; Abernathy and Utterback, 1978; Tushman and Anderson; 1986). Entrepreneurial firms tend to more actively respond to discontinuous change than incumbents. As newcomers, they worry less about abandoning any existing know-how bases, resources, physical utilities, or even psychological commitment, since they are not “bound by traditions, sunk costs and internal political constraints” (Tushman and Anderson, 1986: 444). As outsiders, entrepreneurial firms also have stronger incentive to overturn the existing order since they have less to lose (Utterback,

² When introducing its smartphone, the iPhone, Apple emphasized distinctive product features, such as touchscreen and no physical keypad (West & Mace, 2010). The rapid success of the iPhone forced others to incorporate these distinctive features into their new products, affecting the dominant design of a smartphone from the market dimension. Although the role of established firms or diversifying firms like Apple is important in terms of technological change as in this example, my study mainly focuses on the role of incumbents, not diversifying firms, when the market dimension of a dominant design is still uncertain.

1996). History is indeed full of industry examples, including domestic passenger airlines, Portland cement manufacturing, mini-computer manufacturing (Tushman and Anderson, 1986), and lighting (Utterback, 1996), showing that entrepreneurial firms initiated ‘creative destruction,’ the process of destroying the old system by creating a new one (Schumpeter, 1934). In contrast, incumbent firms play another important role of incrementally improving existing innovations or initiating the diffusion of competence-enhancing innovations that often consolidate the existing industry order (Tushman and Anderson, 1986).

Previous literature mainly focuses on two different perspectives to explain why incumbents were often passive in adapting to discontinuous change—less incentive to invest in and their incapability of perceiving or coping with the new change (Wu, Wan, and Levinthal, forthcoming). First, incumbents have less incentive to invest in discontinuous change, since the change often cannibalizes their existing revenues (Reinganum, 1982), destroys their existing capabilities (Tushman and Anderson, 1986; Henderson, 1993), or weakens current customer bases (Christensen and Rosenbloom, 1995). Incumbents instead tend to focus on maintaining the status quo, as they have invested in the existing technological trajectory (Utterback, 1996). Incumbents also often fail to respond to discontinuous change because of their inability of appropriately perceiving or dealing with discontinuous change (Kaplan and Tripsas, 2008; Leonard-Barton, 1992; Henderson and Clark, 1990). Organizations develop repertoires of routines that influence their business activities or production processes (March and Simon, 1958). Since search processes for new opportunities are also governed by current routines, results tend to be biased, reflecting past core technologies, experiences, and orientations (Cyert and March, 1963). Semiconductor equipment engineers, for example, confronted difficulties of identifying

the differences between new competitive machines and current ones, as their perceptions and decisions were often pre-determined by the past core technologies (Henderson and Clark, 1990).

Given these disadvantages in motivation or capabilities, incumbents tend to have worse adoption performance even when they decide to respond to discontinuous change (e.g. Christensen and Rosenbloom, 1995; Henderson, 1993; Gilbert, 2005). Although a growing body of research explores how incumbent firms can avoid falling into economic decline when facing discontinuous change (e.g. Ahuja and Lampert, 2001; Rothaermel and Hill, 2005), incumbents' performance in the new market tend to be constrained by their existing technologies and experiences. They often try to morph the new technologies and consequent products to fit into its existing processes, routines, and orientations, inevitably ignoring the unique opportunities created by the change (Christensen, Anthony, and Roth, 2004; Cyert and March, 1963). When responding to a digital imaging change, Kodak, an American imaging and photographic equipment company, first focused on developing a product that might replace silver halide film in its core market, and bypassed the emerging inexpensive digital imaging, which has become the center of the new technological change (Gilbert and Bower, 2002). Gilbert (2005) also argued that newspapers often replicated its products-in-print on the web, instead of embracing the discontinuous nature of digital media, which could negatively affect their adoption performance on the web during its early days.

Interestingly, the discussion of incumbents' response to discontinuous change pays less attention to the ways of how they respond to and their effect on the change itself, especially at the product-feature level (some exceptions Benner and Tripsas, 2012; Rindova and Petkova, 2007). Most studies in technological change literature have focused more on *ex ante* incentive or capabilities of incumbent firms and their effects on *ex post* firm-level adoption performance of

discontinuous change (e.g. Rothaermel and Hill, 2005; Tripsas, 1997; Wu, Wan, and Levinthal, forthcoming). The adoption process, or, how incumbents respond to discontinuous change, has consequently been less explored. In other words, previous studies have given less attention to the possibility that it might be more beneficial for incumbents to understand and interpret technological change differently from other participants and try to shape or co-opt this change to best fulfill their needs (Bijker, Hughes, and Pinch, 1987). Since the meaning and contents of any discontinuous change inherently possess uncertainty (Anderson and Tushman, 1990), participants, including incumbents, can appreciate how products related to technological change look and operate in the minds of stakeholders based on their own experiences (Bijker, Hughes, and Pinch, 1987; Cyert and March, 1963; Utterback, 1996). As previously mentioned, the motivations and experiences of incumbents have been centered on the existing technologies, making co-option at the product-feature level one of their natural (and perhaps inevitable) reactions to discontinuous change.

The next question then is whether co-option indeed has a positive impact on incumbent's adoption performance. If incumbent firms tend to have better adoption performance through co-option, it can be regarded as a viable and reasonable alternative that incumbent firms can (or should) consider when facing technological change. That is, incumbents may highlight co-option, not only because they are less interested in or incapable of handling technological change, but also they want to shape the technological trajectory more favorable to themselves. Specifically, to study the effect of co-option on adoption performance, I focus on an incumbents' variation in performance by the level of co-option. The deep uncertainty of technological change enables various incumbents to respond differently to the same technological change depending on their previous experiences, capabilities, or motivations (Westphal, Gulati, and Shortell, 1997;

Goodrick and Salancik, 1996), which creates a variation in the level of co-option. In order for co-option to be a viable alternative for incumbents at the group level, incumbents that emphasize co-option when facing technological change should have better adoption performance at least compared to other incumbents and this effect should maintain over time. Therefore, I will hypothesize the relationship between co-option and adoption performance among incumbents in the next section.

Incumbents' Attempt to Co-opt Discontinuous Change

According to the definition, if they co-opt discontinuous technological change by presenting similar product features in spite of the distinctive nature of the new change, incumbent firms strive to shape the shared understanding of how products should look more similar to the previously dominant one. When it was first introduced in the 1980s, for example, a cellular phone was regarded as discontinuous from a fix-lined phone at least from the technical point of view (Christensen, Anthony, and Roth, 2004). A wireless voice technological change drew on a different set of technical knowledge bases from a wired line technology, such as mobility and battery. A cellular phone had much poorer call quality compared to a wired line phone, but it presented an unprecedented opportunity for firms to offer convenience and ubiquity. Based on this discontinuity, the appearance of a wireless phone could have been very different from that of a wired phone. Incumbent firms at that time, such as Verizon or AT&T, however, co-opted the technological change and the look and even operations of a cellular phone has mirrored those of a wired phone. In order to explain how this co-option positively affects incumbents' adoption performance as in the cellular phone industry, I specifically focus on the two advantages of co-option: Being preferred by external audiences who are often important

resource providers (Jensen, 2006; Benner, 2007; 2010), and more efficiently mustering their current internal resources and capabilities (Christensen, Anthony, and Roth, 2004).

First, co-option is more likely to be accepted by external audiences (Benner, 2007; 2010; Durand, Rao, and Monin, 2007; Tripsas, 2009). The market dimension of a dominant design, in the end, is how external audiences believe that products in the new field should look and operate (Utterback, 1996; Benner and Tripsas, 2012). Discontinuous technological change is not only novel to the organizations in action but also to external audiences, making the change and participants difficult to be classified (Ansari, Fiss, and Zajac, 2010). Since “unclassifiable actors and objects suffer social penalties because they threaten reigning interpretative frameworks” (Zuckerman, 1999: 1399; Tripsas, 2009), responding to discontinuous change inherently possesses a high possibility of social penalties from audiences. Security analysts, for example, largely ignored and were negative toward incumbents’ responses to discontinuous change in the photography and wired communication industries (Benner, 2010). By helping them overcome some of these social penalties, co-option positively affects incumbents’ adoption performance, since their interpretation is more familiar to external audiences or fits well with audiences’ current frameworks (Benner, 2010; Zuckerman, 1999). Similarly, it has been emphasized that entrepreneurs should “initially present ... their innovations ... in the language of existing institutions by giving them the appearance of familiar ideas” (Hargadon and Douglas, 2001:478). By definition, incumbents are better positioned to offer this appearance of familiar ideas as they are part of these familiar ideas.

Importantly, through co-option, incumbent organizations can also appropriate their current set of resources and capabilities more effectively in the new market, which further improves their adoption performance. The appearance similarity between wired and wireless

phones, for example, made it easier for incumbents at that time to apply the same business model in the wireless market. Then their assets from the wired communication industry, such as their knowledge about a huge up-front investment over a large subscriber, became more relevant and valuable in the wireless communication market (Christensen, Anthony, and Roth, 2004). Interestingly, one of the most important capabilities in this adoption process is ironically their organizational inertia. Organizational inertia is generally regarded as one of the main reasons why incumbents often fail to implement change, such as responding to a new potentially beneficial technological change (Hannan and Freeman, 1984). By emphasizing the similar aspects (or deemphasizing the distinctive aspects) of the technological change at the product-feature level, however, incumbent organizations attempt to create a situation where their organizational inertia can, in effect, be beneficial to themselves. Through co-option, they try to fix the technological trajectory of discontinuous change around their old resources (Mitchell, 1989), shaping an *ex ante* discontinuous technological change into an *ex post* less discontinuous one.

In contrast, given increased organizational discretion (Goodrick and Salancik, 1996), incumbent organizations can also focus on the distinctiveness of technological change, mainly to differentiate themselves from other incumbents. These incumbents, however, tend to face more difficulty improving their adoption performance than other incumbents who focus on the similarity between the two technological changes. Apart from unfavorable reactions from external audiences (Benner, 2007; 2010), emphasizing the distinctive product features of discontinuous change means that these firms also need to develop a new set of resources and skills. Organizational changes often produce “a liability of newness” (Hannan and Freeman, 1984: 160), and these incumbents are likely to suffer the liability of newness when they develop

the new set of resources and skills. Interactive websites, for example, mean that reporters and editors need to be retrained themselves in order to handle and control the flow and quality of reader-created content, which is very different from what they are accustomed to, that is, news reporting (Chung, 2007). Therefore, by focusing on the distinctive aspect of technological change, incumbent organizations put themselves into a more disadvantageous position, where they cannot take the full advantage of their current set of resources and skills and the appearance of familiarity.

Therefore, I argue that co-option is a viable and potentially beneficial response option for incumbent firms. Specifically, I focus on the most distinctive product feature of discontinuous change and operationalize co-option in terms of whether incumbents deemphasize this most distinctive product feature of technological change: Deemphasizing the most distinctive product feature of technological change means that incumbents strive to co-opt discontinuous change in order to enjoy aforementioned co-option benefits. Hence, my first hypothesis of co-option is about a performance variation among incumbents by co-option, which is presented below:

Hypothesis 1: An incumbent firm that deemphasizes the most distinctive product feature of discontinuous technological change has better adoption performance in the new field created by discontinuous technological change compared to other incumbents.

Effect of Co-option over Time

Now, I discuss how the co-option effect changes over time. The inherent uncertainty related to discontinuous change indicates that when a technological change is first introduced, the participants of this movement do not fully understand what exactly the change is about (Anderson and Tushman, 1990). It also takes time for participants, including incumbent firms, to appreciate which product features represent the similar or distinctive aspects of the technological

change. That is, given the two assumptions of this study –high uncertainty and slow improvement pace of technological change (Lavie, 2006), the effect of co-option can increase over time, as the characteristics of discontinuous change become better known to participants and as incumbent firms more clearly understand their role with respect to technological change. In particular, the stronger effect of co-option over time means that incumbent firms’ general failures to actively respond to discontinuous technological change could be understood alternatively in that incumbent firms actively participate in the technology shaping process and strive to co-opt potentially discontinuous change. In other words, a technological change could have been regarded as a discontinuous one *ex ante*, but it turns out to be a less discontinuous one *ex post*, because of incumbent firms’ active intervention.

This possibility of co-opting discontinuous change leads to a reconsideration of the role of incumbent firms in a technological advance. Incumbent firms can be also active in terms of responding to technological change: the emergence of *discontinuous* change tends to be perceived only when their active intervention fails. In sum, the moderating effect of time or experience on the relationship between co-option at the product-feature level and adoption performance may be positive, as my second hypothesis suggests below:

Hypothesis 2: The effect of co-option at the product-feature level increases as incumbents spend more time in the new field created by discontinuous technological change.

Co-option and Performance in the Existing Market

The discussion so far has been centered on how emphasizing co-option can improve incumbents’ adoption performance in the new market over time. I further argue that co-option can improve incumbents’ performance in the existing market and in the combined market as well. Discontinuous technological change does not indicate a sudden performance change in the

current market (Gilbert, 2003). It often takes time for a technological change to replace the existing industry order, even if it achieves its potential. Hence, the consideration of different types of firm performance—performance in the existing market, performance in the new market created by discontinuous change, and combined performance in both markets—is important. In the newspaper industry, for example, digital media was first introduced in 1993 (Boczkowski, 2005), but the market for print-based newspapers is still large, with the total daily print-newspaper circulation of more than 45 million a day in the U.S. in 2011 (NAA, 2011). Media critics have even made contradictory predictions about the future of newspapers in print (Rosenberg, 2009; Meyer, 2009). Some argue that print-based newspapers will be extinguished in a decade (Dawson, 2010), while others predict that print- and online-based media will continue to co-exist (Meyer, 2009; Jones, 2009). Therefore, it is critical to examine firm performance not only in the new market created by discontinuous technological change, but also in the existing market in order to fully understand the adoption performance of discontinuous change by incumbent firms.

I previously argued that emphasizing co-option at the product-feature level can positively affect incumbents' performance in the new market. Differential adoption forms of discontinuous change, that is, the levels of co-option, can also affect performance in the current market and in turn the combined market. Investment in the new set of skills to implement the new technological change differently from the existing market indicates that incumbents that pay less attention to co-option might experience disadvantages in the current market as well.

Organizations possess a limited amount of resources or attention (March and Simon, 1958; Ocasio, 1997). Consequently, the more resources they invest in distinctive activities in the new market, the fewer resources they can invest in existing activities in the current market. In contrast,

incumbents that focus on co-option at the product-feature level do not necessarily sacrifice a significant amount of resources to recreate the new set of skills, which is already similar to their current set of resources. As a result, incumbent firms that focus on co-option tend to have better performance than other incumbents in the current market. In sum, firms that focus on co-option may have better performances not only in the new market created by the new technological change, but also in the existing market, which results in better combined performance. Therefore, my last two hypotheses about performance in the current and combined markets will be:

H3: An incumbent firm that deemphasizes the most distinctive product feature of discontinuous technological change has better adoption performance in the current market over time than other incumbents.

H4: An incumbent firm that deemphasizes the most distinctive product feature of discontinuous technological change has better adoption performance in the combined market—the combination of the current market and the new market—over time than other incumbents.

METHOD

Digital Media in the U.S. Newspaper Industry

A daily newspaper is in the business of “producing and disseminating information [daily] about contemporary affairs of general public interest and importance” (Schudson, 2003: 11). The business of newspapers is unique since newspapers are in manufacturing and service markets simultaneously (Picard and Brody, 1997): Daily newspapers create content, including editorial news and advertising spaces, manufacture copies regularly, sell physical copies to readers and provide a service –access to readers—to advertisers through advertising spaces. As a result, financial resources for newspapers come from two different sources, revenue from copy sales and revenue from advertising sales. In particular, U.S. daily newspapers, on average, rely on

about eighty percent of their revenue from advertising sales and are among the most dependent upon revenue from advertising around the world (Project for Excellence in Journalism [PEJ], 2010). There were 1,457 daily newspapers in the U.S. in 2002, falling to 1,382 in 2011 (NAA, 2012). In terms of firm size, most daily newspapers in the U.S. are small local newspapers with circulations of less than 25,000 and primarily focus on local reporting and local or classified advertising (Mogel, 2000; Thompson, 1989). Yet, there are a few national newspapers (e.g. the *Wall Street Journal*, or *USA Today*), regional newspapers (e.g. *Boston Globe* or *Dallas Morning News*), and some local newspapers (*Pensacola News Journal* in Florida or *Wichita Eagle* in Kansas), which tend to serve readers beyond the boundaries of their own local markets (Mogel, 2000; Picard and Brody, 1997).

Although there have been several technological innovations in the newspaper industry, including the advents of telegraphy, photography, and videotext; newspaper practices, business models, and the newspaper market have not changed much since the nineteenth century (Pavlik, 2008; Fenton, 2010). Since the emergence of digital media, however, the U.S. newspaper industry has been undergoing a dramatic transformation (Gilbert, 2006; Pavlik, 2008; Boczkowski, 2005). Specifically, I focus on digital media as publishing the electronic version of news by daily newspapers that is accessible through the World Wide Web (Li, 2006). Introduced by the WWW in 1993, digital media was quickly diffused to most newspapers in the U.S. (Dottinga, 1999). The *News and Observer* in NC, the *San Francisco Chronicle* and the *San Jose Mercury News* in CA were among the first to launch their own websites in late 1993 (Li, 2006), and prestigious newspapers, such as the *New York Times*, the *Washington Post*, and the *Wall Street Journal*, followed the trend in early 1996. The number of newspapers-in-print that launched their own websites reached the critical point of fifty percent in late 1997 (Dottinga,

1999). There exists variation in terms of entry timing, but, most daily newspapers participated in digital media by 2000 (Boczkowski, 2005).

Importantly, many scholars argue that digital-publishing technology is discontinuous from print-publishing technology (Boczkowski, 2005; Gilbert, 2005; 2006). Digital media is not only a new medium of delivering news, but it also changes newsroom practices, contents, business models, and overall markets (Pavlik, 2008; Gilbert 2005, 2006). The leading advertiser for print media, for example, is a large company, like a department or retail store, whereas digital media is preferred by local advertisers (Gilbert, 2003). Digital media also enables newspapers to offer a distinctive set of product features, such as interactivity or multimedia capability, which are almost impossible to offer in print media (Foust, 2009; Peng, Tham, and Xiaoming, 1999). Due to these new product characteristics, reporters need a different set of skills to publish multimedia-based news or to facilitate and control the readers' intensified interactions (Fahmy, 2008; Gilbert, 2006; Chung, 2007). The differences between the business models of print- and digital-media also have received particular attention (Anderson, 2009; Doctor, 2010; Kaye and Quinn, 2010). Unlike print readership, readers often expect free contents on the web, so many newspapers offer free online subscription and focus on online advertising revenue (Anderson, 2009; Kaye and Quinn, 2010). However, more newspapers, including the *New York Times*, have started to consider digital subscription revenue recently (Peters, 2011).

In particular, it is important to note the interactivity of digital media at the product-feature level. Interactivity refers to bi- or multi-directional communication between sources and recipients, which indicates that newspapers and newspaper readers have communicated with each other much more easily since the emergence of digital media (Pavlik, 2008; Zeng and Li, 2006). Traditional media, including newspapers-in-print, mostly offer a one-way communication

from sources to recipients only, which is described as “the mundane character of receptive activity” from the receiver perspective (Thompson, 1995: 35; Schultz, 1999). Interactivity, however, makes the boundary between newspapers and readers more blurred, threatening the identity of newspapers as sole news producers: it has become much easier for readers to participate in the news creation process on the web (Zeng and Li, 2006). Therefore, interactivity has been regarded as the most distinctive characteristic of digital media, compared to print media at the product-feature level. Furthermore, this characteristic can potentially affect the emergence of a new dominant design around digital publishing. Many scholars indeed predicted that interactivity would open up active interactions between newspapers and readers and change the notion of what a newspaper is, from the sole producer of daily news to the facilitator of news creation (Pavlik, 2008; Schultz, 1999; Thompson, 1995).

In sum, the U.S. newspaper industry is an appropriate setting to examine the relationship between incumbents’ response to discontinuous technological change, digital media, and the adoption performance. Newspapers have been responding to digital media since they launched their own websites (the commercialization of products incorporating the new technology). Three types of performance—one in the new market (online readership), one in the existing market (print circulation), and one in the both markets (combined readership)—have been available, and will be presented in detail below. Also, when digital media was first introduced, newspapers and readers did not fully agree on what to expect from this novel medium or from the organizations in this field (Li, 2006; Pavlik, 1997). The uncertainty of digital media has not been fully reduced even after the fifteen years of its presence (Boczkowski, 2005; Pavlik, 2008), which means the uncertainty and the pace of a technological change are high and slow, respectively. Finally, given that interactivity is the most distinctive characteristic of digital media, there exists a variation in

the level of co-option. To develop websites with fewer interactive features means to co-opt the technological change, whereas to pay more attention to interactivity indicates an emphasis on the distinctive aspect of digital media. Hence, the effects of interactivity and interaction term on adoption performance will be negative if co-option increases incumbents' adoption performance over time as hypothesized.

Sample and Statistical Model

I limit the boundary of my research interest primarily to large regional or local newspapers-in-print. First, online-only newspapers, such as *The Huffington Post*, and *POLITICO*, or national newspapers, such as the *New York Times* or *USA Today*, were excluded from the study. As I examine the performance of *incumbents* with respect to discontinuous change, newspapers-in-print are the focus of the study. Also, national newspapers often have different performance measures to other regional or local newspapers, making it difficult to compare their performance measures to other newspapers' ones (Perry, 2009). Second, although there are about 1,400 daily newspapers in the U.S., most newspapers are small local newspapers that primarily focus on local reporting and local/classified advertising (PEJ, 2010; Picard and Brody, 1997).³ To obtain a comprehensive sample of the U.S. large daily newspapers, which have similar journalistic ambition, business models, and formats and reach a broad audience, I sampled all the top 100 largest newspapers by circulation and the largest newspapers in each state during the period of 2002 to 2012, apart from national newspapers (126 newspapers). Finally, there is evidence that Pulitzer Prize awardees or nominees tend to be similar in terms of reporting

³ Small newspapers' business models, operations, and newsroom practices are often different from larger daily newspapers (Mogel, 2000). They are likely to be family-owned and this type of newspaper tends to show idiosyncratic responses to new innovations, such as digital media.

practices when compared to non-awardees (Hansen, 1990). The Pulitzer Prize is regarded as the most prestigious prize in journalism (Bogart, 2004; Harris, 2007), and I added smaller newspapers with Pulitzer Prizes or nominations to capture not-large, but significant players in the U.S. daily newspaper industry, producing a base sample of 179 newspapers.⁴

I derived my sample and data from three sources, the *Editor and Publisher International Yearbook*, the Internet Archive, and Audience-FAX. The *Yearbook* is an annual directory of the U.S. daily newspapers. This publication includes data about daily newspaper organizations and print-circulation data. The Internet Archive is a website that contains archived websites, including those of U.S. daily newspapers. Finally, I used the Audience-FAX, a U.S. daily newspaper audience-reporting initiative by the Audit Bureau of Circulation (ABC), the most credible U.S. circulation-auditing organization (now known as the Alliance for Audited Media [AAM]). Audience-Fax has provided a semi-annual measure of newspaper readership, that is, a combined measure of print and online readership since 2007. The detailed offline-, online-, and net-combined readership information of 87 newspapers in my sample is available and I aggregated the semi-annual data into annual data points to match to other annual measures.

In this study, I focus on the period of 2007 to 2012 to examine my hypotheses. This period helps to understand the differences in adoption performance, because newspapers focused on both print and digital media during this time. The Pulitzer Prize has accepted online-journalism in entries since 2007 (Gissler and Farmer, 2006), meaning that since then, digital media has been regarded as a legitimate player in the field. Moreover, Audience-FAX has reported print, online, and net-combined readership data since 2007. Several other sources may have published online traffic data before 2007, but Audience-FAX is one of the most

⁴ Given the distinctive characteristics of small local newspapers (Picard & Brody, 1997; Mogel, 2000), I focus on the Pulitzer Prize winning newspapers of circulations of more than 30,000.

comprehensive sources that covers more newspapers' websites in a coherent way (Perry, 2009). Finally, the dramatic transformation in the newspaper industry has been accelerated since the sudden economic recession in 2008, triggered by the collapse of the financial institutions (Kirchhoff, 2010). Seventy to eighty percent of a newspaper's revenue comes from advertising revenue (PEJ, 2010) and the sudden drop in advertising revenue after the economic recession has intensified newspapers' responses to digital media.

Dependent Variables and Independent Variable: The three main dependent variables are newspaper's online, print, and net-combined readerships, which were derived from Audience-FAX and the *Yearbook*. According to the definition of Audience-FAX's performance, online readership is the number of audiences that visited the website of a newspaper during the past 30 days and this number is inferred from telephone interviews of audiences in the designated market area (DMA) of the newspaper (ABC, 2011). The designated market area (DMA) is a standardized television viewing area. Each newspaper, which is audited by the ABC, is assigned to one DMA, that is, the geography for readership, and its online-readership is defined with respect to its own DMA. In order to measure print-based readership, I used the *Yearbook* provided ABC audited circulation data. Since daily newspapers can be published in the morning, in the evening, on Saturday, on Sunday or some combinations of these, average daily circulation is calculated as a way to measure its size using a uniform method (Meyer, 2009).

$$Print\ Readership = \frac{(Morning\ or\ Evening \times 5) + Saturday + Sunday}{Number\ of\ Issues\ Per\ Week}$$

The net-combined audience refers to the number of audiences within the DMA during last 30 days that read newspapers in print or visited the website. This total number does not include duplication between print and online readership. For all three types of performance measures, I took the natural logarithm of performance variables because of the decreasing effect of size and

the skewed distribution (*Online Readership [ln]*, *Print Readership [ln]*, and *Combined Readership [ln]*).

The main independent variable is the five-year interactivity of a newspaper's website. In order to measure the independent variable, I first measured the level of website interactivity each year by applying a coding schema to the front-page website of a newspaper (refer to Appendix). The index was created based on several studies (Lowrey, 2003; Zeng and Li, 2006; McMillan, 1998; Kiernan and Levy, 1999). I further emphasized the visibility of the items on the front page since this was the only page I focused on. Newspaper front-pages contain the most important information and most attractive elements (Foust, 2009); therefore, a front page is an appropriate unit to capture the company's adoption form of digital media at the product feature level. I collected the front pages of newspapers per quarter from 2002 to 2011 (four front pages per year per newspaper firm) from the Internet Archive. Then, I counted components contributing to interactivity on its website to create the index of interactivity for the front page. The annual average interactivity index score had a total of 9 points (an average of four front pages) and a higher interactivity index indicates a more interactive website. Finally, I summed the annual average index of interactivity for five successive years to create the main independent variable, the level of five-year interactivity (*Five-year interactivity*). The first year in which this five-year interactivity was available was 2007, based on the interactivity from the period of 2002 to 2006, and I obtained five five-year interactivity measures from 2007 to 2012.

Finally, the moderator variable was used to test my Hypotheses 2 to 4. To test whether the effect of co-option changes as newspapers spent more time in digital media, I multiplied five-year interactivity with the number of years a newspaper had had its own website. Since 1993, the *Yearbook* has provided the website address of each newspaper, if it has one. This information

enabled me to access the website launch date on a yearly basis. For example, if the *Yearbook* published in 1995 had a newspaper's website address, but the 1994 version did not, then I coded that the newspaper launched its website in 1995. Based on this source, I calculated the length of web presence on a yearly basis and created the interaction term (*Interaction [interactivity*length]*).

Control Variables: I use a number of variables to control for alternative explanations for the hypotheses. At the online operation level, I controlled for the aforementioned length of web presence to rule out the entry order or experience effect on performance (Lieberman and Montgomery, 1988; 1998) (*Web Presence Length*). In addition, recently many newspapers have erected paywalls on their websites, charging fees for online readership (Sneed, 2013). Hence, I created a dummy variable, coded as a "1" if a reader does not have unlimited free access to newspaper's online articles to control for the price-tag effect on performance (*paywall*).

At the newspaper's other business level, I controlled for three important print-business characteristics. First, I included a previous-year print circulation to control for the potential effect of size on performance (*Lagged Print Circulation [ln]*). Print circulation has been regarded as an indicator of firm size or resource availability, which can have a significant impact on firm performance (Schultz, 1999; Zeng and Li, 2006). Second, I added the single-copy price of a newspaper as a price change can increase or decrease different types of readership (*Issue Price*). Like the average circulation, I calculated the average price for one issue (Meyer, 2009). Third, most of the newspapers have been suffering a significant print-based circulation drop, especially after the sudden economic recession in 2008 (Jones, 2009; Kirchoff, 2010). Yet, there are a few newspapers that have shown a circulation growth during this difficult period. I included a dummy variable, coded as a "1" if a newspaper experienced at least a five percent increase in its

print-based circulation in the previous year to control for any impact of the positive print performance in the previous year on this-year firm performance (*Positive Previous Circulation*).

At a broader newspaper level, I controlled for the status of a newspaper by including the sum of the number of Pulitzer Prize and half weighted number of finalists that the newspaper had ever been awarded (*Pulitzer*). Digital journalism is argued to be better-fit to quick and light news (Jones, 2009), thereby decreasing the reliability of news articles. As it becomes more difficult to evaluate the quality of newspaper articles prior to news consumption, people start to rely more on the status of an organization (Podolny, 1993), which can influence newspaper readership. The broader environments where a newspaper is located, including its parent company or geography, may also affect its adoption performance of digital media. First, I considered two characteristics of a newspaper's parent company, that is to say, whether the newspaper is a member of a larger media chain and whether the stock of the media conglomerate is publicly traded. It has been well-documented that media ownership affects newspaper's behaviors and outcomes, including newspaper contents, development policy and firm performance (Bagdikian, 2000; Lacy, Shaver, and St. Cyr, 1996). Therefore, I included two dummy variables to control for these potential impacts on performance (*Media Conglomerate* and *Public Company*). I also measured the population size of a county where a newspaper is located, since the size of the primary market could have an effect on newspaper performance (Meyer, 2009) (*County Population*). Finally, regarding different consumption behaviors of readers by age or education level (Mindich, 2005), I measured the proportion of the young generation and that of highly-educated audiences in the newspaper's county. The young generation is comprised of the population between 18 to 34 years old and the highly-educated population is defined as those possessing a bachelor's degree or more education in the given county (*County Young Generation Rate* and *County High*

Education Rate). The annual county-level data from 2007 to 2012 was obtained from the American Community Survey (ACS) of the U.S. Census Bureau and was matched to each newspaper that primarily represents the county.

Annually updated *Yearbook* data were used to measure all the control variables and Table 1 contains summary statistics and bivariate correlations.

[INSERT TABLE 1 AROUND HERE]

Statistical Analyses: Since the sample is a panel data with 481 observations of 87 newspapers from 2007 to 2012, I estimate fixed-effects regression models with robust standard errors, focusing on within-firm variation over time and addressing heteroscedasticity concerns (Rabe-Hesketh and Skrondal, 2012). I also included a year dummy to control for year-fixed effects.

RESULTS

Table 2 presents the results of the readership analyses, providing overall support for my hypotheses stating the negative effects of interactivity and interaction term on readerships. Model 1 includes only the control variables, and the result shows that the longer a newspaper has its own website, the more people visit its website. In other words, there are some first-mover advantages or learning effects in the new market. Moreover, if a newspaper raises the price of its print version, more readers visit its website, as readers might look for cheaper or free access to information. Winning a Pulitzer Prize also increases the number of people who visit the website of a newspaper. If a newspaper becomes a member of a media chain, then its online readership increases by eighteen percent, indicating a corporate level benefit in terms of increasing online readership. Finally, a newspaper in a county with more young people has fewer visitors on its website. In Model 2, the independent variable, five-year interactivity, is added and the result

indicates that interactivity has a partially negative impact on online readership: Developing an interactive website marginally decreases online readership, providing a partial support for Hypothesis 1 that predicted the negative effect of interactivity on online readership. In Model 3, I add the interaction term of the five-year interactivity and the length of web presence. The results can be interpreted that as a newspaper spends more time or has more experience in the new market, focusing on the most distinctive feature of digital media may have a more negative impact on its performance in the new market, providing strong support for Hypothesis 2.

In Models 4 and 7, I examine whether co-option in the new market affects performance in the current and combined markets, respectively. In Models 4 and 5, the interactivity variable and the interaction term do not have a significant impact on print readership, which does not support my third hypothesis. That is, with respect to the performance in the current market, the length of the operation in another market, but not the adoption form, may have a negative impact. All the control variables have expected effects on print readership. Most noticeably, erecting a paywall on its website has a positive effect on print circulation, probably because print subscribers often get free digital access. In contrast, as shown in Model 7, the interaction term reduces combined readership: as a newspaper has been on the web for a longer time, the more interactive websites a newspaper had in the previous five years, the fewer overall audiences it has in the current year, supporting my fourth hypothesis that predicted the negative effect of interactivity on the net-combined readership.

[INSERT TABLES 2 AND 3 AROUND HERE]

To ascertain that my results are robust, I performed different robustness checks –mainly in the online market—and report the most important ones in Table 3. First, I estimate the models using a random-effect Tobit regression to eliminate the concern that the dependent variables, the

numbers of audiences that visited the website of the newspaper inferred from telephone interviews of audiences in the DMA or the average number of print-copy sales, are larger than zero, even though no newspaper company in the sample actually is bound (Tobin, 1958; Baum, 2004). The new results still corroborate my hypotheses, as shown in Models 8 to 10. In Model 11, I also conduct a dynamic panel regression model in the online market to provide a stronger causality explanation. Specifically, I estimate the Arellano-Bond dynamic panel model using the two-step estimation with corrected errors and orthogonal deviations (Arellano and Bond, 1991; Roodman, 2009). Given the dynamic nature of the model, I exclude the interaction term and focus on the effect of interactivity on the change in performance. The result indicates that interactivity is negatively and significantly related to the change in online readership. In Models 12 and 13, I change the five-year interactivity variable to the three-year and two-year interactivity respectively and find that the new results strengthen the initial results.

DISCUSSION AND CONCLUSION

This study focuses on the effects on adoption performance of the ways in which incumbents respond to discontinuous technological change. Specifically, I examined whether or not co-option at the product-feature level enhances incumbents' adoption performance with respect to discontinuous change over time. I theorized that by de-emphasizing the distinctive product features of technological change, incumbents tend to be more favored by stakeholders and as a result, can exploit their current set of resources more effectively in the new market. Therefore, I argued that through co-option, incumbents are likely to have better adoption performance with respect to discontinuous change than other incumbents, which can ultimately help them shape an *ex ante* discontinuous technological change into an *ex post* less discontinuous

one. The empirical results of this study provide supports for my arguments in the context of U.S. daily newspapers after the emergence of a discontinuous technological change, digital media. Newspapers that least frequently allowed readers to participate in news-producing activities had the better online readership, and the effect of co-option on online readership and net-combined readership increased as the newspapers spent more time on the web.

This paper makes several important contributions to research on technology. First, my paper contributes to technological change literature. I studied how organizations attempt to change their adoption performance with respect to discontinuous technological change by emphasizing different aspects of the change during the implementation process. Previous literature, especially in technology innovation, has examined how incumbents can have better (or worse) adoption performance when facing a new opportunity, such as the emergence of discontinuous change (Gilbert, 2006; Haveman, 1992; Mitchell, 1989; Rothaermel and Hill, 2005). Haveman (1992) showed, for example, that organizations with established competences tend to perform best when entering into a new market. My study takes this line of argument further, theorizing that some incumbent organizations will emphasize the similar aspects of technological change in order to more directly exploit these established competences. Similarly, Gilbert (2006) argued that the perception of technological change as a threat tends to increase routine rigidity, which is identified as one of the main reasons that incumbent firms often fail to respond to technological change. I argue differently that some organizations might appropriate this “routine rigidity” in order to be more acceptable to external audiences and to more directly exploit their established competences. In turn, these firms could have better adoption performance in the long run by means of routine rigidity, or more specifically through co-option.

Second, my paper also contributes to research on the social construction of technology perspective (Barley, 1986; Bijker, Hughes, and Pinch, 1987). Social constructivist thinking enriches our understanding of the construction process of different technologies, but, this line of research also confronts its own shortcomings (Russell, 1986). By focusing on the “thick description” of the social context in which the technology has been constructed, the social constructivist perspective tends to suffer from the lack of generalizable theory. By concentrating on co-option, that is, product-feature similarity between existing and new technologies, I derived more generalizable hypotheses about adoption performance with respect to discontinuous change. Furthermore, I examined the archived websites of newspapers, without sampling data based on the outcomes: I was technically able to study not only successful implementations of digital media, but also potentially unsuccessful ones (Barley, 1986).

Although the results largely support my theory and hypotheses, this paper has some limitations that must be addressed in future research. A first potential limitation of this study is that by focusing on performance, this study does not address why various incumbents respond differently to discontinuous change. Exploring the relationship of why incumbents may differ from one another is important for understanding a technological advance and how this process affects the nature of the technological change. In addition, by focusing on incumbent firms, I left the differences between incumbents’ and new entrants’ responses to discontinuous technological change unexplored. Theoretically and empirically, I examined how co-option helps incumbent improve their adoption performance compared to other incumbents. However, in order to shape discontinuous change in a beneficial way, incumbents that focus on co-option need to have better performance compared not only to other incumbents but also to new entrants. Future empirical research should examine the differences between incumbents and new entrants in greater detail

to shed light on the effects of incumbents' co-option on the overall social system and on the nature of technological change itself. Finally, since the U.S. daily newspaper industry is right in the middle of its process of transformation, unexpected events could still affect the adoption process of digital media. Keen examination of the industry for a greater number of years will help increase the significance of my findings.

In conclusion, my paper may suggest some practical implications for the U.S. daily newspaper industry, which has been undergoing a dramatic change. There exists an industry-wide fear that the newspaper industry, which is a reliable source of information and an important watchdog of government and business, may collapse (Meyer, 2009; McChesney and Nichols, 2010). My paper suggests differently that newspapers in print could successfully transfer into the new field created by discontinuous change. According to my arguments, newspapers that have developed 'print-media-like' digital media are likely to survive this transformation process, which means that it is not "urgently" necessary to subsidize newspapers (Schizer, 2011). Indeed, my paper suggests that newspapers can have better performance if they concentrate on what they are good at: successful newspapers tend to publish their news on the web as they publish news in print and put their new wine in their old wine bottles.

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TABLE 1
Summary Statistics and Bivariate Correlations

	Mean	STD	1)	2)	3)	4)	5)	6)	7)	8)	9)	10)	11)	12)	13)
1) Five-Year Interactivity	15.97	6.77	1.00												
2) Interaction [Interactivity*Length]	239	119	0.96	1.00											
3) Web Presence Length	15	2	0.40	0.61	1.00										
4) Paywall	0.08	0.27	0.05	0.11	0.26	1.00									
5) Lagged Print Circulation [ln]	11.99	0.65	0.00	0.00	-0.03	0.01	1.00								
6) Positive Previous Circulation	0.05	0.22	0.03	0.06	0.17	0.29	0.08	1.00							
7) Issue Price	0.86	0.21	0.41	0.48	0.50	0.26	0.01	0.08	1.00						
8) Pulitzer [ln]	1.47	1.08	0.13	0.14	0.10	-0.02	0.67	0.07	0.18	1.00					
9) Media Conglomerate	0.86	0.35	0.06	0.04	-0.07	-0.02	-0.04	-0.05	0.06	0.10	1.00				
10) Public Company	0.33	0.47	0.19	0.16	-0.05	0.04	-0.01	-0.06	0.03	0.11	0.28	1.00			
11) County Population [ln]	13.62	0.86	-0.04	-0.01	0.05	0.06	0.60	0.08	0.09	0.44	-0.10	-0.02	1.00		
12) County Young Generation Rate	0.24	0.04	0.14	0.20	0.26	0.04	0.23	0.04	0.33	0.18	-0.01	0.11	0.11	1.00	
13) County High Education Rate	0.31	0.07	-0.05	-0.01	0.07	0.00	0.23	0.03	0.14	0.27	-0.20	-0.20	0.12	0.31	1.00

TABLE 2
Fixed-Effects Panel Regression Model on Performance

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
	Online Readership			Print Readership		Combined Readership	
Five-Year Interactivity		-0.003† (0.002)	0.032** (0.012)	-0.001 (0.002)	-0.012 (0.010)	-0.002* (0.001)	0.009* (0.005)
Interaction [Interactivity*Length]			-0.002*** (0.001)		0.001 (0.001)		-0.001* (0.000)
Web Presence Length	0.045*** (0.008)	0.050*** (0.008)	0.080*** (0.013)	-0.053*** (0.007)	-0.062*** (0.012)	-0.006 (0.005)	0.003 (0.007)
Paywall	0.012 (0.034)	0.003 (0.035)	0.009 (0.032)	0.071* (0.029)	0.070* (0.028)	-0.005 (0.015)	-0.003 (0.014)
Lagged Print Circulation [ln]	0.070 (0.086)	0.056 (0.085)	0.081 (0.083)			0.112* (0.047)	0.120** (0.044)
Significant Circulation Gains	0.041 (0.028)	0.042 (0.028)	0.037 (0.027)			0.016 (0.016)	0.015 (0.015)
Issue Price	0.166** (0.050)	0.173*** (0.051)	0.184*** (0.051)	-0.189** (0.057)	-0.192*** (0.055)	0.035 (0.025)	0.038 (0.025)
Pulitzer [ln]	0.237* (0.098)	0.256* (0.100)	0.257** (0.088)	-0.050 (0.117)	-0.050 (0.112)	0.079* (0.039)	0.079† (0.041)
Media Conglomerate	0.181*** (0.041)	0.187*** (0.038)	0.189*** (0.028)	0.026 (0.073)	0.025 (0.069)	0.041* (0.017)	0.042* (0.020)
Public Company	-0.064 (0.041)	-0.066 (0.043)	-0.083* (0.034)	-0.064 (0.146)	-0.058 (0.143)	-0.003 (0.028)	-0.009 (0.027)
County Population [ln]	0.055 (0.328)	0.043 (0.303)	0.069 (0.289)	-0.017 (0.168)	-0.026 (0.168)	0.228* (0.109)	0.237* (0.109)
County Young Generation Rate	-1.180* (0.495)	-1.068* (0.524)	-0.986† (0.528)	0.443 (0.655)	0.417 (0.637)	-0.177 (0.238)	-0.151 (0.233)
County High Education Rate	0.392 (0.653)	0.365 (0.655)	0.265 (0.625)	0.391 (0.645)	0.422 (0.644)	0.113 (0.292)	0.081 (0.293)
Constant	9.815* (4.658)	10.080* (4.320)	8.966* (4.100)	12.959*** (2.435)	13.208*** (2.433)	9.179*** (1.695)	8.833*** (1.621)
Observations	481	481	481	481	481	481	481
Year-fixed-effect	Significant	Significant	Significant	Significant	Significant	Non-Significant	Non-Significant
R-squared	0.58	0.58	0.60	0.71	0.71	0.26	0.28
Number of newspapers	87	87	87	87	87	87	87

Robust standard errors in parentheses *** p<0.001, ** p<0.01, * p<0.05, † p<0.10

TABLE 3
Robustness Checks - Fixed-Effects Panel Regression Model on Performance

Variable	Model 8	Model 9	Model 10	Model 11	Model 12	Model 13
	Online	Print	Combined	Online		
Five- Year Interactivity ^a	0.034*** (0.008)	-0.010† (0.006)	0.010** (0.004)	-0.003* (0.002)	0.076*** (0.020)	0.055*** (0.015)
Interaction [Interactivity*Length] ^a	-0.002*** (0.000)	0.001 (0.000)	-0.001*** (0.000)		-0.005*** (0.001)	-0.004*** (0.001)
Lagged Dependent Variable				0.789*** (0.053)		
Web Presence Length	0.089* (0.036)	0.065 (0.043)	0.063* (0.029)	0.016 (0.017)	0.076*** (0.011)	0.078*** (0.011)
Paywall	0.008 (0.026)	0.078*** (0.020)	0.001 (0.013)	-0.054* (0.026)	0.006 (0.029)	0.008 (0.030)
Lagged Print Circulation [ln]	0.270*** (0.056)		0.248*** (0.034)	0.052 (0.043)	0.083 (0.080)	0.084 (0.082)
Significant Circulation Gains	0.049† (0.026)		0.021 (0.013)		0.037 (0.026)	0.037 (0.026)
Issue Price	0.219*** (0.052)	-0.193*** (0.042)	0.054* (0.026)	0.158** (0.053)	0.199*** (0.049)	0.192*** (0.049)
Pulitzer [ln]	0.249*** (0.037)	0.170*** (0.039)	0.176*** (0.024)	0.028* (0.013)	0.253** (0.089)	0.242** (0.088)
Media Conglomerate	0.161** (0.060)	0.061 (0.053)	0.05 (0.033)	0.072 (0.050)	0.192*** (0.030)	0.189*** (0.028)
Public Company	-0.082† (0.048)	-0.035 (0.043)	-0.005 (0.026)		-0.089** (0.029)	-0.085* (0.033)
County Population [ln]	0.337*** (0.050)	0.305*** (0.053)	0.334*** (0.037)	0.087*** (0.026)	0.080 (0.291)	0.080 (0.292)
County Young Generation Rate	-0.480 (0.453)	0.611 (0.374)	-0.037 (0.229)	0.513† (0.295)	-0.976† (0.521)	-0.991† (0.525)
County High Education Rate	0.942* (0.393)	0.501 (0.369)	0.370 (0.233)	0.155 (0.137)	0.222 (0.635)	0.252 (0.630)
Constant	2.614** (0.872)	6.746*** (0.872)	4.947*** (0.618)	0.251 (0.314)	9.365* (4.250)	9.325* (4.334)
Observations	481	481	481	395	481	481
Statistic Model	RE Tobit	RE Tobit	RE Tobit	Arellano- Bond	FE Panel	FE Panel
Year-fixed-effect	Non-Significant	Significant	Significant	Significant	Significant	Significant
R-squared					0.59	0.60
Number of newspapers	87	87	87	85	87	87

^a In the Models 12 and 13, the two- and three-year interactivity and the consequent interaction term variables are used instead of the five-year variables, respectively

Robust standard errors in parentheses *** p<0.001, ** p<0.01, * p<0.05, † p<0.10

APPENDIX

Coding Scheme

1. Interactivity (9pts for each front page)
 - a. Comment visibility (1pts): Are comments on articles (if exist) visible from the front page - comments (##), most commented articles, or post a comment.
 - b. Forum (1pt): Does the front page have a direct link to a forum (e.g. discussion, debate, message boards) site?
 - c. Forum visibility (1pt): Are forum issues visible from the front page?
 - d. User generated article (1pt): Are user generated articles or sections (e.g. letters to the editors or news tip section) visible from the front page?
 - e. Picture sharing (1pt): Can readers share their pictures on the web? (e.g. send us your own photos, reader submitted photos...)
 - f. Chat (1pt): Does the front page have a direct link to a chat room?
 - g. Reader polls (1pt): Does the front page have a spot that allows a reader to vote for a certain question?
 - h. Reader publishing (2pts): Does the site have a section where readers can publish their own articles without the approval of newspaper staffs (e.g. reader blog, self-publishing section)?