Article

Integrating Time Into Family Business Research: Using Random Coefficient Modeling to Examine Temporal Influences on Family Firm Ambidexterity

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Abstract

Organizational ambidexterity refers to a firm's ability to pursue both exploitation and exploration orientations. Despite research that suggests ambidexterity is a critical phenomenon in family firms, few studies directly examine the role of ambidexterity over time in family business. This study examines how family firm ambidexterity changes over time as a result of temporal-, firm-, and industry-level factors. We find that family firm ambidexterity is stable over time, punctuated by dramatic changes. We also find that the level of innovation required to compete in an industry is a predictor of changes in exploration versus exploitation over time among family firms.

Keywords

family firms, time, ambidexterity, random coefficient modeling

Organizational ambidexterity describes the ability to balance opportunity exploration activities with opportunity exploitation activities (March, 1991). Exploration activities include search, experimentation, and discovery, whereas exploitation entails the refinement and implementation of discoveries (March, 1991). Ambidexterity research suggests that firms shift their focus between exploration and exploitation—and vice versa—over time (e.g., Lubatkin, Simsek, Ling, & Veiga, 2006; Raisch & Birkinshaw, 2008; Raisch, Birkinshaw, Probst, & Tushman, 2009). Empirical research has indicated that when firms strike a balance between exploration and exploitation activities, they tend to experience benefits in firm performance (e.g., Uotila, Maula, Keil, Zahra, 2009).

Research on ambidexterity in family businesses suggests that the unique attributes of family firms influence how they balance the need to exploit existing knowledge with the need to explore and develop new knowledge (Sharma & Salvato, 2011). For example, family firms frequently possess long-term orientations in their goals and investments (Le Breton-Miller & Miller, 2006), have leaders with long tenure (Sharma, 2004), enjoy low turnover (Chrisman, Chua, & Steier, 2005), and need to balance the interests of the family with the interests of the business (Tagiuri & Davis, 1992). Moreover, some firms are better able to balance exploration against exploitation, particularly when faced with environmental change (e.g., Bergfeld & Weber, 2011; Hatum & Pettigrew, 2006; Hoy & Sharma, 2010; Miller & Le Breton-Miller, 2005). While research has examined how ambidexterity emerges in family firms and how it affects performance, little is known about how family firms balance exploration against exploitation over time.

Lack of knowledge concerning how temporal factors influence ambidexterity in family firms creates a gap between what we know and what we would like to know about ambidexterity in family firms. This lack of knowledge is problematic because time has been found to play an important role in organizational culture, innovation, and intergenerational succession in family business

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(Craig & Dibrell, 2006; Craig & Moores, 2006), suggesting that the balance between exploration and exploitation may change over time. We examine this question in the context of the family business literature on innovation and research on organizational adaptation (e.g., De Massis, Frattini, & Lichtenthaler, 2012; Tushman & O'Reilly, 1996). These literatures suggest that ambidexterity in family firms may either change gradually over time or remain steady, punctuated by discontinuous change. We address this theoretical tension and provide a description of how the balance between exploration and exploitation changes in family firms over time. Second, we address a gap in what is known about the antecedents of change in ambidexterity over time. We focus on environmental predictors at the industry level, as prior work has suggested these are of particular importance to family firms (e.g., Sharma & Salvato, 2011).

Our study makes three key contributions to the literature. First, we resolve a theoretical tension in the family business literature concerning how managers and owners change organizational ambidexterity over time. Second, we develop theory on ambidexterity and its environmental antecedents over time. This responds to suggestions that family firm innovation is heavily influenced by environmental factors (e.g., Sharma & Salvato, 2011). This contribution also responds to calls for research to examine differences among family firms with regard to innovation (e.g., Sharma & Salvato, 2011). Third, this is the first multilevel study to examine ambidexterity over time, answering recent calls for more longitudinal studies of family businesses (De Massis, Sharma, Chua, & Chrisman, 2012). While earlier studies of ambidexterity have used multi-year panel data (e.g., Uotila et al., 2009) and other single-level techniques, this is the first study capable of discerning patterns of ambidexterity over time. Overall, our study helps illustrate the importance of time to understanding how ambidexterity changes in family firms (cf. Salvato, Sharma, & Reay, 2012).

Time and Ambidexterity in Family Businesses

Organizational ambidexterity refers to an organization's ability to balance exploration and exploitation activities (March, 1991). Exploration activities reflect the search for new opportunities, emphasizing innovation, risk taking, experimentation, and flexibility (March, 1991). By contrast, exploitation activities reflect the refinement of existing opportunities, emphasizing efficiency and execution (March, 1991). Firms that are able to manage both exploration and exploitation activities generally outperform those that do not (Gibson & Birkinshaw, 2004; Raisch & Birkinshaw, 2008). Theory suggests that this performance improvement is because creative activity is matched with commercial exploitation rather than exploration occurring for its own sake (Uotila et al., 2009). Yet balancing both activities is difficult because each relies on different strategies and structures (He & Wong, 2004; Tushman & O'Reilly, 1996).

Early research suggested that certain stable configurations of strategy and structure enable organizational ambidexterity (e.g., Tushman & O'Reilly, 1996). However, later work suggests that ambidexterity must be achieved by dynamic processes (cf. Ketchen, Thomas, & Snow, 1993). Ambidexterity is maintained over time by rebalancing exploration against exploitation in response to internal and external changes (e.g., Siggelkow, 2002). This rebalancing is an intentional management function—firm managers must make conscious resource allocation decisions over time to maintain ambidexterity (e.g., Raisch et al., 2009).

The importance of managers to the orchestration of ambidexterity can be clearly seen in family firms. In the family business literature, research on ambidexterity has explored how the attributes of family firms enable family firm managers to benefit from continuity by engaging in exploitation while still preserving the ability to reorient the firm via exploration (Le Breton-Miller & Miller, 2006). This ability to balance exploration and exploitation has been suggested to be key to strategic entrepreneurship among family firms (Webb, Ketchen, & Ireland, 2010). Research has shown that family influence increases ambidexterity (Lubatkin et al., 2006; Stubner, Blarr, Brands, & Wulf, 2012). Given its link to performance, ambidexterity may prove to be an important predictor of performance differences among family firms (e.g., Sharma & Salvato, 2011).

Nevertheless, there are some significant gaps in the literature regarding how ambidexterity changes in family firms over time. In a study of four family-controlled businesses, Salvato and Melin (2008) found that long-term value in family firms depends on the ability to dynamically recombine resources in order to balance exploration and exploitation. Their study suggested that family firms tend to engage in long periods of exploitation punctuated by radical strategic exploration (Salvato

& Melin, 2008). This research suggested that family-specific dimensions of social capital drive the ability to adapt to a dynamic environment and that renewal of the firm through exploration may be crucially driven by the controlling family (Salvato & Melin, 2008). Other research has suggested that family firms' balance of exploration and exploitation is cyclical and tied to generational change (Zellweger & Sieger, 2012).

These prior studies have made it clear that theory on the temporal dynamics of ambidexterity among family firms remains underdeveloped. One perspective suggests that some family firms engage in continuous innovation, and thus the balance of exploration and exploitation should be stable over time (e.g., Bergfeld & Weber, 2011). The other perspective suggests that family members take responsibility for radical innovations while delegating routine innovation to subordinates (e.g., Chua, Chrisman, & Sharma, 1999; Miller & Le Breton-Miller, 2005; Sharma & Salvato, 2011). These family-controlled radical innovations are likely to occur rarely, resulting in discontinuities in the balance of exploration and exploitation over time. Thus, it may be that the way family firms divide innovation responsibilities results in ambidexterity changing nonlinearly over time. We draw from the management literature and develop this theoretical tension in the context of research on organizational adaptation. Specifically, we draw from the contrasting perspectives of continuous change (e.g., Brown & Eisenhardt, 1997) and the punctuated equilibrium model (e.g., Gersick, 1991; Miller & Friesen, 1980, 1984; Romanelli & Tushman, 1994; Tushman & Romanelli, 1985).

Static Versus Dynamic Ambidexterity

Ambidexterity in family firms may be static or dynamic. The static perspective suggests that ambidexterity is the result of relatively fixed configurations of organizational structure and resources (e.g., Tushman & O'Reilly, 1996). In terms of ambidexterity among family firms, this perspective suggests that there will be little variance in the level of relative exploration versus exploitation over time. However, this perspective is in conflict with recent studies in the broader management literature that suggest ambidexterity is maintained by dynamic, manager-led processes (e.g., Raisch et al., 2009). In this view, ambidexterity cannot exist outside of the resource allocation abilities of family firm managers because of the constantly changing internal and external environment (e.g., Siggelkow, 2002). If this perspective is correct, we would expect significant variance in family firms' relative exploration orientation over time.

The literature on the goals of family firms suggests that family firms may actively manage their level of exploration and exploitation rather than retaining a static balance over time. Economic goals are of central importance to successful family firms (Tagiuri & Davis, 1992). A salient economic goal of family firms is to develop high-quality, innovative, saleable products that will help grow the firm (McKenny, Short, Zachary, & Payne, 2012; Tagiuri & Davis, 1992). This suggests that family firm managers will pursue both exploration activities to facilitate product development and exploitation activities to use these products to increase the sales and growth of the firm. However, the literature on ambidexterity suggests that the appropriate balance between exploration and exploitation is not easily determined by managers and is frequently a moving target (e.g., Raisch & Birkinshaw, 2008). This suggests that managers in family firms will attempt to achieve the appropriate balance by dynamically rebalancing exploration and exploitation, rather than allowing their relative focus to remain static. Changes in strategy over time are facilitated in family firms where managers have greater social capital with employees, facilitating faster buy-in among those who will implement these strategic changes (e.g., Salvato & Melin, 2008). Indeed, this characterization of strategic change in family firms is substantiated by a recent study that found family firm managers reallocate resources to shift relative emphasis between exploration and exploitation over time (e.g., Salvato & Melin, 2008). Thus, we expect to find support for the dynamic model of ambidexterity among family firms. Formally,

Hypothesis 1: There will be significant variance in the relative exploration orientation of family firms over time.

Continuous Change and Ambidexterity

In addition to the question of whether ambidexterity in family firms is static or dynamic, there is also a theoretical tension as to whether ambidexterity in family firms changes gradually or dramatically over time. Family business research suggests that distinctive features of family firms play a key role in enabling family firm

managers to balance exploitation against exploration (Le Breton-Miller & Miller, 2006). Among these traits are low levels of employee turnover and sociocognitive familial bonds among the firm's controlling family (e.g., Chrisman et al., 2005). Low levels of turnover and the presence of strong familial bonds suggest a managerial preference for change in ambidexterity over time that is gradual, continuous, and linear. First, low levels of employee turnover suggest higher levels of organizational inertia (cf. Baron, Hannan, & Burton, 2001). Second, although familial bonds may facilitate the sharing of knowledge structures that enable innovation (e.g., Patel & Fiet, 2011), family bonds may also cause managers to prefer less risky change trajectories. The value of this option is in preserving the firm for future generations, reducing the risk of loss of socioemotional wealth, while keeping free certain resources for family purposes (e.g., Gómez-Mejía, Núñez-Nickel, & Gutierrez, 2001). For family firm managers, gradual change provides a way to encourage innovation by disrupting organizational inertia resulting from low turnover, while reducing the risk to the survival of the firm (e.g., Brown & Eisenhardt, 1997). If these factors are most important to family firm managers, we would expect to see change in family firm ambidexterity over time be gradual and continuous, as with a linear trend. Formally,

Hypothesis 2: Family firms' relative exploration orientation will follow a linear trend over time.

Discontinuous Change and Ambidexterity

In contrast, the punctuated equilibrium model suggests that the balance between exploration and exploitation remains steady over relatively long periods of time, interrupted by brief but major shifts in emphasis (e.g., Tushman & O'Reilly, 1996). The long-term orientations of family firms suggest that this model may be appropriate. Family businesses' long-term orientations create stability and continuity (e.g., Lumpkin & Brigham, 2011). Firms with a short-term orientation tend to overemphasize exploitation activities resulting in strong short-term performance and long-term obsolescence (e.g., March, 1991). Firms with a long-term orientation avoid this myopic bias toward exploitation while also avoiding overemphasizing exploration (Tushman & O'Reilly, 1996). Since firms with a long-term orientation make decisions and stand by them over long periods of time, those decisions are revisited less frequently. This may in turn lead the firm to make larger adjustments when such decisions are reexamined. Thus, we would expect to see discontinuity—ambidexterity will remain steady over long periods of time, with rare and rapid changes initiated by top managers. Formally,

Hypothesis 3: Discontinuous models of change in relative exploration orientation will explain more variance than models of incremental change.

Technological Opportunity: Environmental Antecedent of Ambidexterity

The relative levels of exploration and exploitation activity in family firms is thought to vary from firm to firm (Sharma & Salvato, 2011). In particular, environmental factors are thought to have a significant influence on the balance struck between these two activities (e.g., Sharma & Salvato, 2011). One environmental factor that may influence this balance is technological opportunity. Technological opportunity can be defined as the cost and effort required to innovate in an industry (Jaffe, 1986). The level of technological opportunity in an industry is influenced by both intrinsic characteristics of the technologies in use and exogenous factors such as the sophistication of scientific knowledge with respect to these technologies (Jaffe, 1986). When firms are in an industry where technological opportunity is high, there is less competition for a given opportunity. This incents family businesses in that industry to adopt a more exploratory orientation to identify and seize new opportunities before their firm's already exploited opportunities become obsolete. When firms are in an industry where technological opportunity is low, exploration becomes more expensive as opportunities are fewer, increasing competition for each opportunity and subsequently increasing the cost of exploration. Accordingly, family businesses in these industries are incented to maintain a more exploitative orientation. Thus, we expect that firms in industries with high technological opportunity will focus more on exploration relative to those firms in industries with low technological opportunity. Stated formally:

Hypothesis 4: There is a positive relationship between technological opportunity and family firm relative exploration orientation over time.

Method

Sample and Data

To test our hypotheses in a sample of interest to family business scholars, we collected a purposive sample of the S&P 500. The S&P 500 is a valuable sampling frame for researchers investigating the strategic orientations of large, publicly-traded family businesses for several reasons. First, S&P 500 firms cumulatively represent approximately 75% of the United States' publicly-traded stock and consist of companies from a diverse range of industries (Standard & Poor's, 2012). Second, more than 33% of the S&P 500 is composed of family firms (Short, Payne, Brigham, Lumpkin, & Broberg, 2009). Finally, to test time-related hypotheses, we required a longitudinal sample for which ambidexterity data could be collected. Because the S&P 500 firms are all large, publicly-traded companies, financial information is readily available for these firms in secondary databases, and shareholder letters outlining the companies' activities are regularly produced and made publicly available (cf. Short, Broberg, Cogliser, & Brigham, 2010).

To analyze the effects of time on organizational ambidexterity from the most recent 10-year period available at the time the research began, we collected firm shareholder letters and financial data from the years 2001-2010. This 10-year span compares favorably to previous applications of random coefficient modeling to longitudinal analyses that have relied on shorter sampling frames (e.g., 7 years; Short, Ketchen, Bennett, & du Toit, 2006). To isolate a sample of family firms, we classified each company as a family firm if the founders, direct family members of the founders, or both were members of senior management and/or members of the firm's board of directors (cf. Short et al., 2009; Zachary, McKenny, Short, & Payne, 2011). Firms were grouped into industries by four-digit SIC codes (e.g., Short et al., 2006). The sample totaled 1,072 firm years from 149 family firms in 95 industries.

Measures

We used computer-aided text analysis to measure *relative exploration orientation*. Computer-aided text analysis is a form of content analysis where word lists associated with a construct are used to identify the presence of words associated with that construct in organizational narratives (Duriau, Reger, & Pfarrer, 2007). Computer-aided text analysis has been used in prior ambidexterity research (Uotila et al., 2009), prior family business research (McKenny, Short, et al., 2012), prior studies analyzing CEO–shareholder letters (e.g., Short & Palmer, 2003), as well as studies that drew purposive samples to examine specific types of firms (e.g., Allison, McKenny, & Short, 2013). Accordingly, computer-aided text analysis is well suited to our study design. As an example of how computer-aided text analysis functions, a word list to measure optimism might include the words "optimistic," "hopeful," and "reassuring" (e.g., McKenny, Short, & Payne, 2013). If this word list was used in a computer-aided text analysis, each occurrence of those three words in a document would increment the optimism score of that document by one. As a result, at the end of the analysis, each document analyzed would have an optimism score that reflected the number of times any of the words in the optimism word list was used.

Since relative exploration orientation is an organizational-level construct, we selected shareholder letters, an organizational-level narrative, to enable measurement of the construct directly at the organizational level (McKenny et al., 2013). By measuring relative exploration orientation directly at the organizational level using publicly available organizational narratives rather than using individual-response methods such as surveys, we avoid biases arising from nonresponse (cf. Bartholomew & Smith, 2006) and attempting to generalize from one or few respondents to the organization (cf. Lyon, Lumpkin, & Dess, 2000). Shareholder letters and other annual report narratives are among the most commonly used narratives in organizational research (Duriau et al., 2007) and have been used with computer-aided text analysis to measure similar strategic constructs such as entrepreneurial orientation and market orientation (e.g., Zachary, McKenny, Short, Davis, & Wu, 2011).

We operationalized relative exploration orientation using the exploration and exploitation word lists developed and validated by Uotila et al. (2009) in their study examining the relationship between relative exploration orientation and firm performance among S&P 500 firms. Table 1 lists the contents of the exploration and exploitation word lists and presents excerpts from our sample of shareholder letters that are representative of each construct. We have bolded words appearing in the exploration or exploitation dictionaries.

To calculate relative exploration orientation, we calculated the exploration and exploitation score for each

Table 1. Dictionaries and Representative Shareholder Letter Excerpts.

Dictionary	Uotila et al. (2009) specification	Excerpt
Exploratory action	explor*, search*, variation*, risk*, experiment*, play*, flexib*, discover*, innovat*	All companies talk about **innovation**. At Whirlpool Corporation, our people are always thinking about ways to deliver unique and relevant solutions for our customers' needs and wants. Our **innovation** process is a long-term strategic commitment we've made to consistently deliver the products and services that delight our customers and create unmatched levels of loyalty to our brands worldwide. Customer loyalty to our brands is the core of our strategy, and our embedded **innovation** capabilities drive the process. **Innovation** at Whirlpool is not a temporary project or separate corporate department. It is a capability that permeates all areas of the company . . . within our people, our products and our services. In a rapidly changing global marketplace, our customers are more knowledgeable and have more choices than ever before. And only by providing them with **innovative**, high-quality, competitively-produced products that deliver, and build upon, the positive reputation of our brands will we succeed in moving our strategy and performance to the next level. We are making significant progress, and we are seeing the results of our efforts in the marketplace.(Whirlpool Corporation, 2005)
Exploitative action	exploit*, refine*, choice*, production*, efficien*, select*, implement*, execut*	Nucor has achieved record sales and earnings as well as many other record performance levels. This outstanding performance trend reflects our focus on the disciplined **execution** of our strategic growth plan, combined with continued strong global demand for basic commodities. Our investments in existing operations together with greenfield projects and acquisitions have practically doubled our hot rolled steel **production** capacity from 13 million tons in 2000 to over 25 million tons today. In 2006, we continued our focus on strategic growth with the announcement of several major investment projects culminating in January 2007, when Nucor announced an agreement to acquire Harris Steel Group, Inc., for a cash purchase price of about $1.07 billion. Through these efforts, we are determined to deliver the continuing promise that Nucor's best years are still ahead of us. Nucor's utilization rate in 2006 was approximately 88% of **production** capacity (an average of all operating facilities), reflecting improved market conditions through most of 2006. This stable market combined with continued growth helped Nucor achieve new records in 2006 for steel **production**, total steel shipments and steel sales to outside customers. Steel **production** in 2006 increased 10% to 22,382,000 tons, compared with 20,332,000 tons in 2005. (Nucor Corp., 2006)

Note. Wildcard (*) can represent any letter or letters.

firm's annual shareholder letters (e.g., Uotila et al., 2009). These counts were standardized by dividing by the total number of words in each document to eliminate the potential bias of document length (e.g., Payne, Brigham, Broberg, Moss, & Short, 2011). Finally, relative exploration orientation was calculated by dividing the exploration metric by the sum of the exploration and exploitation metrics (Uotila et al., 2009).

For example, Mattel, Inc. had an exploration score of 7 and exploitation score of 1 in 2010. This indicates that 7 words in their 2010 shareholder letter were listed in Uotila et al.'s (2009) exploration word list and 1 word was listed in the exploitation word list. Since Mattel's 2010 shareholder letter had 1,285 total words, the standardized exploration score suggests that 0.54% of the words in the letter emphasized exploration and 0.08% of

the words emphasized exploitation. Finally, using Uotila et al.'s (2009) formula for relative exploration orientation, we arrived at a final value of 0.00545/ (0.00545 + 0.000778) = 0.875, reflecting a relative emphasis toward exploration over exploitation. This variable ranges from 0 to 1, with 1 indicating a total emphasis on exploration and 0 indicating a total emphasis on exploitation.

Technological opportunity was operationalized as the average R&D intensity divided by sales for each industry in the sample (e.g., Hitt, Hoskisson, Johnson, & Moesel, 1996; Short et al., 2006).

Control Variables. In addition to our isolation of year, firm, and industry effects, we also explicitly controlled for the firm-level variable *organizational slack*. Slack may be defined as the level of resources in an organization beyond the amount required to sustain current operations that enable adaptation to internal or external change forces (cf. Bourgeois, 1981). In the broader management literature, slack has been shown to influence exploration and exploitation activities (e.g., Voss, Sirdeshmukh, & Voss, 2008). In line with our definition of organizational slack as excess resources, we operationalized slack as the firm's current ratio (Bromiley, 1991). Slack is a level one variable that is measured annually over the course of our 10-year study.

Statistical Method and Hypothesis Testing

Random coefficient modeling (RCM) is a tool for assessing the effect of time on ambidexterity and other constructs of interest to family business researchers. RCM was developed in the education literature to enable scholars to create regression models that incorporate nested data (e.g., students nested within classes, classes nested within schools; Bryk & Raudenbush, 1992). By simultaneously estimating regression models at different levels of analysis, with higher level equations using the coefficients of the lower level equations as dependent variables, RCM alleviates problems arising from the independence of observations assumption in traditional regression-based analyses (Brush, Bromiley, & Hendrickx, 1999). For organizational research, this enables researchers to more accurately model the nested nature of organizational data (e.g., individuals nested within organizations, organizations nested within industries; Hitt, Beamish, Jackson, & Mathieu, 2007). However, by modeling time as a level nested within firms (i.e., years nested within firms, firms nested within industries) scholars can similarly model multilevel effects using longitudinal data (Short et al., 2006).

RCM thus provides an improvement over earlier approaches such as panel analysis/regression. Prior research that seeks to study family firms over time has occasionally used panel data with random effects. This accommodates unique variance at Level 2 (the individual or firm level) that affects observations over time (level one). However, this does not accommodate higher level effects (such as effects due to the industry at Level 3). If panel regression, even with random effects, is used with data where higher level causes (such as industry) are used to predict the dependent variable, the result will be inaccurate error estimates and thus, significance tests that are overly optimistic. A typical example of this problem is using industry-level predictors, such as research and development intensity in panel regressions.

We estimated our models using the HLM 7 package. The HLM program implements an algorithm to estimate RCM models through a series of nested regression analyses employing either maximum likelihood or restricted maximum likelihood estimation (Raudenbush & Bryk, 2002). Our models included three levels, so we used full maximum likelihood estimation. Unlike prior work that uses dummy variables as a strategy to control for time effects (e.g. Rumelt, 1991), RCM allows the researcher to explicitly specify how the model should account for change from time period to time period in the form of a trend. Because we use RCM, when we specify random coefficient estimates, we allow each firm to have an individualized trend over time (e.g. Short et al., 2006). RCM allows the researcher to estimate both constant (intercept) and time-varying (slope) parameters for each firm. These may be either categorical or continuous variables at any level of analysis (Raudenbush & Bryk, 2002). RCM is a simultaneous estimation technique and so uses fewer degrees of freedom than either analysis of variance or variance components analysis (Brush et al., 1999).

As our test of Hypothesis 1, we estimated a fully unconditional (null) model. This model includes no predictors at any level—all that is estimated is the intercepts and error term. Since we have three levels, we have three equations. This set of equations estimates the null model:

$$\text{Relative Exploration Orientation}_{ijk} = \pi_{0jk} + e_{ijk}$$

$$\pi_{0jk} = \beta_{00k} + r_{0jk}$$

$$\beta_{00k} = \gamma_{000} + u_{00k}.$$

In these equations, Relative Exploration Orientation$_{ijk}$ represents relative exploration orientation at time i for firm j in industry k. π_{0jk} is the mean relative exploration orientation of firm j from industry k, whereas β_{00k} is the mean relative exploration orientation in industry k. γ_{000} is the grand mean relative exploration orientation, e_{ijk} reflects the deviation of the ijk-th relative exploration orientation measurement—that is, the relative exploration orientation at time i for firm j from industry k—from the mean relative exploration orientation of firm j in industry k (in other words, from π_{0jk}). r_{0jk} is the deviation from the mean β_{00k} for firm j from industry k, whereas u_{00k} is the deviation of industry k's mean relative exploration orientation across all observations. This system of equations estimates the proportion of variance in relative exploration orientation that is attributable to within-firm (year-to-year changes), between-firm, and between-industry levels.

For Hypothesis 2, we test for a linear trend in the effect of time on a firm's relative exploration orientation. For this hypothesis, we specified that the relationship between time and relative exploration orientation was continuous across our sample of family firms. Accordingly, we model the linear time variable as a fixed effect; that is, we neither model a firm-level error term in the Level 2 equation nor do we include a Level 3 error term in the associated Level 3 equation.

$$\text{Relative Exploration Orientation}_{ijk} = \pi_{0jk} + \pi_{1jk}*(\text{LINEAR}_{ijk}) + e_{ijk}$$

$$\pi_{0jk} = \beta_{00k} + r_{0jk}$$

$$\pi_{1jk} = \beta_{10k}$$

$$\beta_{00k} = \gamma_{000} + u_{00k}$$

$$\beta_{10k} = \gamma_{100}$$

LINEAR is a variable ranging from 0 to 9 to represent the 10 years in our sample. In this model, π_{0jk} is the mean relative exploration orientation, respectively, for firm j from industry k; however, γ_{000} now stands for mean relative exploration orientation in year zero (LINEAR = 0). Significance testing for changes in relative exploration orientation is accomplished using t tests for fixed effects along with χ^2 significance tests for variance components. A χ^2 significance test is also used to compare the fit of each model with the data with respect to the previous model using HLM's deviance statistics. If a given model fits better than the previous model and the t statistic for the LINEAR variable is significant, this suggests that there may be a linear change in relative exploration orientation over time among family firms.

Hypothesis 3 asks whether the change in family firms' relative exploration orientation over time is better modeled as reflecting discontinuous change. By entering each year separately, this model enables the regression coefficients to vary drastically from year to year, whereas the single linear trend variable from Hypothesis 2 assumes that the effect of each passing year to have a uniform relationship with relative exploration orientation. If the χ^2 significance test indicates that the discontinuous model fits the data better than the incremental model, this would suggest that changes in relative exploration orientation are best modeled as being discontinuous. Although a null finding in a significance test cannot be interpreted as conclusive evidence that changes in relative exploration orientation tend to be incremental, it does suggest the incremental variance explained by the discontinuous model does not fit significantly better than the more parsimonious incremental model. The discontinuous model is specified as:

$$\text{Relative Exploration Orientation}_{ijk} = \pi_{0jk} + \pi_{1jk}*(Y2002_{ijk}) + \pi_{2jk}*(Y2003_{ijk}) + \pi_{3jk}*(Y2004_{ijk}) + \pi_{4jk}*(Y2005_{ijk}) + \pi_{5jk}*(Y2006_{ijk}) + \pi_{6jk}*(Y2007_{ijk}) + \pi_{7jk}*(Y2008_{ijk}) + \pi_{8jk}*(Y2009_{ijk}) + \pi_{9jk}*(Y2010_{ijk}) + e_{ijk}$$

$$\pi_{0jk} = \beta_{00k} + r_{0jk}$$

$$\pi_{1jk} = \beta_{10k}$$

$$\pi_{2jk} = \beta_{20k}$$

$$\pi_{3jk} = \beta_{30k}$$

$$\pi_{4jk} = \beta_{40k}$$

$$\pi_{5jk} = \beta_{50k}$$

$$\pi_{6jk} = \beta_{60k}$$

$$\pi_{7jk} = \beta_{70k}$$

$$\pi_{8jk} = \beta_{80k}$$

$$\pi_{9jk} = \beta_{90k}$$

Table 2. Linear Change Model (Fixed Linear Effects at All Levels).

Fixed effect	Coefficient	*SE*	*t*
Average relative exploration orientation, γ_{000}	4.18×10^{-1}**	1.59×10^{-2}	2.64×10^{1}
Average relative exploration orientation linear change rate, γ_{100}	1.08×10^{-2}**	2.58×10^{-3}	4.20×10^{0}
Random effect	**Variance Component**	***df***	χ^2
Level 1 temporal variation, e_{tij}	5.19×10^{-2}		
Level 2 firm variation, r_{0ij}	1.32×10^{-2}**	54	148.35
Level 3 industry variation, u_{00j}	8.00×10^{-3}**	94	148

* $p < .05$. **$p < .01$.

$$\beta_{00k} = \gamma_{000} + u_{00k}$$
$$\beta_{10k} = \gamma_{100}$$
$$\beta_{20k} = \gamma_{200}$$
$$\beta_{30k} = \gamma_{300}$$
$$\beta_{40k} = \gamma_{400}$$
$$\beta_{50k} = \gamma_{500}$$
$$\beta_{60k} = \gamma_{600}$$
$$\beta_{70k} = \gamma_{700}$$
$$\beta_{80k} = \gamma_{800}$$
$$\beta_{90k} = \gamma_{900}$$

Hypothesis 4 tests whether industry R&D intensity (technological opportunity) influences the relative exploration orientation of the firms in that industry over time while controlling for slack resources per-year per-firm at Level 1. Because this hypothesis posits a direct effect on relative exploration orientation, industry R&D intensity is entered into the Level 3 equation associated with the Level 2 equation that modifies the Level 1 intercept (i.e., it is entered into the Level 3 equation that predicts β_{00j}). Equations follow:

$$\text{Relative Exploration Orientation}_{tij} = \pi_{0ij} + \pi_{1ij}*(\text{Current Ratio}_{tij}) + \pi_{2ij}*(\text{LINEAR}_{tij}) + e_{tij}$$
$$\pi_{0ij} = \beta_{00j} + r_{0ij}$$
$$\pi_{1ij} = \beta_{10j}$$
$$\pi_{2ij} = \beta_{20j} + r_{2ij}$$
$$\beta_{00j} = \gamma_{000} + \gamma_{001}(\textit{Industry R\&D Intensity}_j) + u_{00j}$$
$$\beta_{10j} = \gamma_{100}$$
$$\beta_{20j} = \gamma_{200} + u_{20j}$$

Results

Descriptive statistics at the firm-year level are as follows. Relative exploration orientation had a mean of 0.42 with a standard deviation of 0.27 and ranged from 0 to 1. Current ratio had a mean value of 1.95, 1.41 standard deviation and ranged from 0.22 to 19.84. Relative exploration orientation and current ratio were not significantly correlated. In the first model (Model 1), we estimated a fully unconditional model to estimate what percentage of variance is due to effects at each level (cf. Short et al., 2006). In all, 70.87% of variance in relative exploration orientation is due to firm-year effects, 19% of variance is due to firm-level effects ($\chi^2_{54} = 154.86$, $p < .01$), and 10.13% of variance is due to industry effects ($\chi^2_{94} = 142.27$, $p < .01$). We find support for Hypothesis 1: There is firm-year variability in relative exploration orientation.

The model for Hypothesis 2 (Model 2) added a linear trend predictor for relative exploration orientation. Overall, Model 2 was a significantly better fit than Model 1 ($\Delta\chi^2_1 = 17.46$, $p < .01$) and the linear trend predictor was significant and positive ($t = 4.20$, $p < .01$). Table 2 shows these results. This suggests that a gradual and continuous model of change in ambidexterity over time fits the behavior of family firms, supporting Hypothesis 2.

We tested Hypothesis 3 by comparing the fit of the discontinuous model (Model 3) against the linear model (Model 2). Overall, Model 3 was a significantly better

Table 3. Dummy Variables Model (Fixed Effects at All Levels).

Fixed effect	Coefficient	*SE*	*t*
Average, γ_{000}	3.76×10^{-1}**	2.58×10^{-2}	1.46×10^{1}
Average (2002 vs. 2001), γ_{100}	-1.18×10^{-2}	3.14×10^{-2}	-3.76×10^{-1}
Average (2003 vs. 2001), γ_{200}	4.30×10^{-2}	3.04×10^{-2}	1.41×10^{0}
Average (2004 vs. 2001), γ_{300}	2.26×10^{-2}	3.02×10^{-2}	7.49×10^{-1}
Average (2005 vs. 2001), γ_{400}	5.45×10^{-2}	2.97×10^{-2}	1.83×10^{0}
Average (2006 vs. 2001), γ_{500}	5.84×10^{-2}	3.11×10^{-2}	1.88×10^{0}
Average (2007 vs. 2001), γ_{600}	-1.64×10^{-2}	3.10×10^{-2}	-5.29×10^{-1}
Average (2008 vs. 2001), γ_{700}	4.66×10^{-2}	3.10×10^{-2}	1.51×10^{0}
Average (2009 vs. 2001), γ_{800}	1.18×10^{-1}**	3.62×10^{-2}	3.62×10^{0}
Average (2010 vs. 2001), γ_{900}	1.17×10^{-1}**	3.69×10^{-2}	3.69×10^{0}
Random effect	**Variance component**	***df***	χ^2
Level 1 temporal variation, e_{tij}	5.09×10^{-2}		
Level 2 firm initial, r_{0ij}	1.34×10^{-2}**	54	150.73
Level 3 industry mean, u_{00j}	7.74×10^{-3}**	94	146.26

* $p < .05$. ** $p < .01$.

fit than Model 2 ($\Delta\chi^2_8 = 19.15$, $p < .05$), finding that in 2009 ($t = 3.62$, $p < .01$) and 2010 ($t = 3.69$, $p < .01$) family firms significantly changed their relative exploration orientation compared with 2001. Table 3 shows these results. Although incremental change models do an adequate job in describing changes in relative exploration orientation, a model of discontinuous change better reflects the relationship present in our data, supporting Hypothesis 3.

Finally, the model for Hypothesis 4 (Model 4) incorporates industry R&D intensity as a Level 3 predictor of relative exploration orientation. We compare the fit of this model with the model, including slack with random effects and a linear trend. Overall, Model 4 was a significantly better fit than the linear trend model ($\Delta\chi^2_1 = 5.69$, $p < .05$) and the industry R&D intensity predictor was significant and positive ($t = 2.46$, $p < .05$). Table 4 shows these results. These results suggest that industry R&D intensity is positively associated with change in relative exploration orientation over time, thus Hypothesis 4 was supported.

Discussion

Organizational ambidexterity comprises a valuable ability to balance exploration activities and exploitation activities (March, 1991). In balancing these forces, both family and nonfamily firms have been found to achieve superior performance (e.g., Stubner et al., 2012; Uotila et al., 2009). Prior work on ambidexterity in family firms so far has spanned a variety of research streams, from performance and governance (Le Breton-Miller & Miller, 2006) to strategic entrepreneurship (Webb et al., 2010). Of the two prior studies to focus specifically on ambidexterity among family firms, both found a positive relationship between family firm status and ambidexterity and a positive relationship between ambidexterity and performance (i.e., Lubatkin et al., 2006; Stubner et al., 2012). While this suggests that ambidexterity may contribute to observations that family firms outperform nonfamily firms, research so far has been lacking in understanding differences in ambidexterity among family firms over time (cf. Sharma & Salvato, 2011).

In this study, we make three contributions to the family business literature. First, we address and resolve a theoretical tension in family business research as to how organizational ambidexterity changes over time. We find evidence that most strongly supports the discontinuous change model. While both conceptualizations of change in ambidexterity over time fit our data, the discontinuous change model offered the best explanation of the behavior of family firms in balancing exploration versus exploitation over time. This provides initial evidence that theories of discontinuous change may provide the strongest foundation on which to build future

Table 4. Linear Change Model (Random Effects at Level 2 With Level 3 Main Effects).

Fixed effect	Coefficient	*SE*	*t*
Average relative exploration orientation, γ_{000}	4.21×10^{-1}**	1.47×10^{-2}	2.87×10^{1}
Average relative exploration orientation linear change rate, γ_{200}	1.13×10^{-2}**	3.07×10^{-3}	3.70×10^{0}
Industry R&D intensity, γ_{001}	4.96×10^{1}*	2.02×10^{1}	2.46×10^{0}
Current ratio, γ_{100}	8.15×10^{-3}	7.24×10^{-3}	1.13×10^{0}
Random effect	**Variance Component**	***df***	χ^2
Level 1			
Temporal variation, e	4.90×10^{-2}		
Level 2			
Firm initial relative exploration orientation, r_0	1.53×10^{-2}**	48	119.58
Firm linear change rate, r_2	2.90×10^{-4}**	48	82.34
Level 3			
Industry mean relative exploration orientation, u_{00}	3.87×10^{-3}*	91	119.57
Industry linear change rate, u_{20}	4.00×10^{-5}	92	91.64

* $p < .05$. ** $p < .01$.

theory on how family firms change their ambidexterity focus over time. Future research may examine how firm and environmental antecedents of ambidexterity influence whether change occurs discontinuously or incrementally.

Second, we develop theory on how family firm managers direct change in ambidexterity over time in response to firm needs and constraints. We suggest that since long-term oriented firms make decisions in advance and revisit them infrequently, such firms will make relatively larger shifts in the balance of exploration versus exploitation when such decisions are reviewed. This in turn suggests that change in ambidexterity among family firms will be largely discontinuous. We also show that technological opportunity is an environmental determinant of organizational ambidexterity among family firms (cf. Sharma & Salvato, 2011). Our findings indicate that the level of technology development required to compete in an industry constrains a firm's ability to balance exploration with exploitation.

Third, ours is the first multilevel study to examine ambidexterity over time. We provide the first study that tests whether ambidexterity in family firms is dynamic or static in a large and diverse population. We are the first to assess whether change in ambidexterity is discontinuous or gradual in a large sample of family firms. Our study found that there is significant variance in relative exploration orientation to be explained at the within-firm (time variant), between-firm, and between-industry levels. In particular, approximately 70% of the variance was explained by within-firm factors, suggesting that family firms change their relative exploration intensity significantly over time. We found that both linear and discontinuous change predictors help to explain some of the within-firm variance. However, significant within-firm variance remains to be explained, suggesting that future researchers might emphasize the search for situational or time-varying antecedents of family firm ambidexterity. We also found that despite a trend toward increased exploration over time, there was significant heterogeneity among family firms. This is consistent with prior research that has suggested that family firms are heterogeneous (Carney, 2005; García-Álvarez & López-Sintas, 2001) and presents an opportunity for researchers to identify what factors influence this heterogeneity in ambidexterity.

The contributions of this study are best viewed in light of the trade-offs involved in its design. First, this study uses a sample of large publicly traded family businesses. This decision was made to facilitate the collection of longitudinal data for a large number of firms. However, this also limits the study's generalizability to

smaller privately held family businesses where attainment of ambidexterity may be significantly more difficult than in large corporations (e.g., Lubatkin et al., 2006). To identify the extent to which the findings of this study extend to the smaller privately held family business context, future researchers could replicate our study using a privately held family business sample by measuring the presence of language consistent with ambidexterity in press releases (cf. McKenny, Payne, Zachary, & Short, 2012).

A second limitation concerns the constraints of random coefficient modeling (RCM). Other multivariate approaches, such as structural equation modeling (SEM) allow for more freedom in specifying the relationships among variables. However, these methods typically require balanced and time-structured data at each level analyzed (Raudenbush & Bryk, 2002). This implies that time points must be the same and equal for each firm—in contrast, RCM allows unequal time points and can yield larger sample size with data sets that include considerable missing data. As software for SEM advances, this limitation may change (e.g., Short et al., 2006). Future research might use SEM to model the antecedents and outcomes of organizational ambidexterity in family firms (cf. Lubatkin et al., 2006).

Finally, while computer-aided text analysis is a valuable method for measuring ambidexterity (e.g., Uotila et al., 2009), other methods—such as financial data, patent citation data, and surveys—have been used in the broader management literature (e.g., Lubatkin et al., 2006). Financial data provide a proxy measure of exploration (R&D expenses) and exploitation (advertising expenses). However, such data are frequently missing or inconsistently reported in data sets. Patent data are another alternative (e.g., Gupta, Smith, & Shalley, 2006). By examining each patent's ratio of citations to past work, patents can be used to infer the extent to which a firm's R&D efforts focus on exploration versus exploitation. However, as other authors have noted, in some industries, the use of patents is relatively infrequent and thus patents may be a problematic way to assess exploration versus exploitation (e.g., He & Wong, 2004). Finally, while surveys present the opportunity to ask targeted questions, they present problems of nonresponse. Thus, we chose to employ computer-aided text analysis because it allows large-scale evaluation of data with near-perfect reliability (Duriau et al., 2007). In a small family firm context, future research may combine the advantages of our approach—longitudinal observation—with those of surveys—multiple item measures and the ability to use confirmatory factor analysis—to create a study that that exploits the strengths of both approaches. Thus, the limitations of this study represent opportunities for future research.

In this study, we used a definition of ambidexterity where both exploration and exploitation activities are pursued and balanced simultaneously (e.g., Raisch & Birkinshaw, 2008; Uotila et al., 2009). However, other conceptualizations of ambidexterity suggest that firms go through phases of emphasis on exploration and exploitation rather than pursuing them at the same time (e.g., Puranam, Singh, & Zollo, 2006). This sequential form of ambidexterity highlights a conceptualization of time not modeled in this study—time as cycles (e.g., George & Jones, 2000). Future research might investigate whether the ambidexterity pursued by family businesses is better characterized as sequential or simultaneous and identify the performance consequences of each strategy. For example, do firms that are highly exploratory in one year and highly exploitative in the next perform better than simultaneously ambidextrous firms?

In this study, we focused on the environmental antecedent technological opportunity. Prior research has suggested that the attributes of the external environment of family firms are particularly important in determining the balance between exploration and exploitation and how this changes over time (e.g., Sharma & Salvato, 2011). Prior ambidexterity research indicates that another important set of antecedents of ambidexterity lie at the firm level. In particular, organizational slack has been noted in the wider management literature to influence exploration and exploitation activities (e.g., Voss et al., 2008). Slack may be defined as the level of resources in an organization beyond the amount required to sustain current operations that enable adaptation to internal or external change forces (cf. Bourgeois, 1981). Future family business research may explore how organizational slack determines ambidexterity through its relationship to how family firms balance economic versus noneconomic goals (McKenny, Payne, et al., 2012; Tagiuri & Davis, 1992). When levels of slack are low, family businesses are unlikely to draw on the family business resources unless absolutely necessary, because doing so would threaten the long-run survival of the firm. However, when slack becomes excessive, rather than investing in poor innovation projects, family firms may employ some of these resources in the pursuit of noneconomic goals.

Our findings suggest implications for the wider management literature. While the antecedents of ambidexterity have been examined in several studies (e.g., Gibson & Birkinshaw, 2004; Raisch & Birkinshaw, 2008), research in management has not yet examined how ambidexterity changes over time in large samples. We draw from research on organizational adaptation to suggest how ambidexterity will change over time (e.g., Brown & Eisenhardt, 1997; Miller & Friesen, 1984). Given the importance of ambidexterity to firm performance, understanding how ambidexterity changes over time can help scholars develop better theory. Future research may examine how well-established antecedents of ambidexterity affect the balance between exploration and exploitation over time (e.g., Raisch & Birkinshaw, 2008).

Conclusion

Time is one of the most important constructs in organizational research because of its many and varied influences on organizational phenomena. Given mounting evidence of the performance implications of ambidexterity along with the unique abilities of family firms to balance exploration with exploitation, ambidexterity represents a promising organizational construct with which to better understand the differences between family firms (Lubatkin et al., 2006; Stubner et al., 2012). Our examination of change in ambidexterity over time in family firms also highlights the importance of time to organization studies (George & Jones, 2000) and family business research in particular (Salvato et al., 2012).

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