
Game Theory and Family Business Succession: An Introduction

Family Business Review
26(1) 51–67
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sagepub.com/journalsPermissions.nav
DOI: 10.1177/0894486512447811
fbr.sagepub.com


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Abstract

One of the most significant challenges to enduring family businesses is the process of passing the leadership of a firm from one generation to another. This article introduces game theory as a model for examining succession as a set of rational but interdependent choices made by individuals about a firm's leadership. Its primary contribution is demonstrating the application of game theory to understanding the decisions and outcomes of succession events.

Keywords

family business, management succession, game theory

One of the most significant challenges to enduring family businesses is the process of passing the management and ownership of a firm from one generation to another. Scholars have noted a range of factors that are important to successful succession events and have dedicated a great deal of effort to understanding their inherent challenges (e.g., Chrisman, Chua, & Sharma, 1998; Dunn, 1999; Ibrahim, Soufani, & Lam, 2001; Le Breton-Miller, Miller, & Steier, 2004; Shepherd & Zacharakis, 2000), yet this literature is still developing. To this point, the literature on succession has examined characteristics of successors and founders, succession processes, and the influence of other family members on succession. But each of these elements, important in their own way, are largely treated individually, in the absence of other factors that influence the success of succession events. This article describes how game theory can be used as a foundation for addressing important questions in family business succession.

Game theory is a tool for analyzing interactions among two or more entities (see Osbourne, 2003, for an overview). Its greatest power comes from simultaneous consideration of actions by multiple actors, in the form of individuals, groups, or organization, and the interrelationships of the outcomes of those moves. Although game theory is based in mathematics, one of its earliest applications was in analyzing political situations, especially interactions among adversarial countries during the

Cold War. The 2005 Nobel Prize for economic sciences was awarded to two game theorists, one of whom (Thomas C. Schelling) is regarded as a social scientist rather than a mathematician. Over time, its use has expanded to social and managerial settings as well, including general business activities (Papayouanou, 2010), strategic management (Dixit & Nalebuff, 1993; Grant, 2009), and career management (Bennett & Miles, 2011).

The capacity for taking into account the feelings, decisions, and behaviors of multiple actors at the same time creates potential for a significant step forward in the study of family business succession. Specifically, we explore the following research question: How can game theory contribute to understanding family business management succession events?

Game theory is an attractive option for understanding family business management succession because it effectively analyzes decisions, and the factors underlying them, when the outcome of the decision processes depend directly on choices made by more than one decision

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maker. That is, game theory accounts for situations in which the choices made by the different actors are interdependent, or when one person's best choices are influenced by the actions/decisions of others. Under such conditions, game theory allows for a more sophisticated and insightful analysis since the decisions of individuals are properly analyzed as interdependent choices, as opposed to choices made in isolation. As such, this tool fits perfectly with management succession, in which founders/CEOs, potential successors, and the people that surround them all might have an influence on how things work out. Additionally, once succession events are formally modeled as games, it is possible to empirically test these models (Davis & Holt, 1993; Kagel & Roth, 1995; Chakravarty et al., 2011).

In addressing this topic, we divide the article between introducing game theory and making elementary applications of its tools to basic concerns in succession events. We begin with an introduction to game theory. The succeeding sections of the article illustrate how game theory might be applied to the study of family business succession. The article closes with comments on the framework provided by game theory for both theoretical and empirical advances in the study of this important dynamic in family businesses.

Introduction to Game Theory

Game theory provides a framework for theoretically and empirically examining issues in family business succession. Game theory was established as a theoretical tool by von Neumann and Morgenstern (1944). The principle use of game theory is to model decisions and predict outcomes in interactions between actors, each of which is considered to have independent sets of preferred outcomes from the interactions, in order to develop insights about the choices those actors are likely to make.

All games involve (a) a clearly stated problem or situation involving (b) interactions among multiple actors, (c) conditions that stipulate the form of the interactions, (d) payoffs that result from the actors' choices, and (e) predictions as to what actors will decide.

Games are framed by a problem or situation statement. This statement identifies the nature of the interaction in question. For example, the problem statement in family business management succession event would focus on the interactions among a founder and potential successors

in a family-owned business. Actors comprise the unit of analysis in game theory. Actors may take the form of individuals or groups. Once a game has been specified, the actors in that game do not change. Theoretically, there is no limit to the number of actors in a game, although the complexity of a game increases exponentially with the addition of each incremental actor.

Games are played under specified conditions, including the structure of the game and the possible strategies the actors may select. These are the "rules of the game."

A game's structure dictates the order in which actors make decisions and how many rounds of decisions are involved. There are three basic game structures. The simplest game structure is a normal game (also called a *strategic game*), which involves independent and simultaneous choices among the game's actors in only one round of play. Repeated games typically are normal games played again and again with allowances for actors to learn from prior iterations of the game. Extensive games involve multiple rounds of play in which actors make sequential choices with complete information about the decisions made by all actors in preceding rounds. That is, decisions made at earlier points in time affect the possible strategies in later rounds of the game; "if-then" statements are often used in describing the alternatives in extensive games. The outcomes of these games are the culmination of multiple decision points. Extensive games are often reported as game trees.

The possible choices that an actor can make in a game situation are called strategies. Although the term *strategy* has many definitions, in game theory it refers to any course of action available to an actor. Many games are constructed as either/or situations: an actor can choose between one strategy and another. Theoretically, there is no limit to the number of strategies that might be available to an actor in a game. All actors in a game are assumed to be aware of the strategies available to all other actors; that is, although the outcomes of a game will vary with the choices made by actors, there are no strategic surprises in game theory.

For every actor in a game, each course of action is associated with expected payoffs (sometimes called preferences). In cases in which the results of a game would involve psychological or social benefits (such as happiness, social status, or removal of pain), expected payoffs in game theory are normally presented in the form of ordinal numbers. Ordinal numbers convey an actor's *ranking* of payoffs but not the distance between them. Alternatively,

		Actor 2	
		Stgy. 1	Stgy. 2
Actor 1	Strategy 1	A_{11}, B_{11}	A_{12}, B_{12}
	Strategy 2	A_{21}, B_{21}	A_{22}, B_{22}

Figure 1. Generic strategic form.

interval metrics may be used in situations in which scale matters, such as numbers of dollars lost or gained. For instance, the comparison of the pair of expected payoffs of $A = 2$ versus $B = 1$ and $A = 10$ versus $B = 1$ yields the exact same interpretation in a game of ordinal payoffs (A is preferred to B), but a different interpretation in a game of interval payoffs (A is a little better than B in the former and much better than B in the latter).

The ordering of expected outcomes is presented in the form of payoff (or utility) functions. For instance, an actor presented with two alternatives, A and B , of which A is valued more than B , would have a utility function of $u(A) > u(B)$, where $u(X)$ indicates the utility function of player X . Notice that the difference between ordinal and interval games is minimized when the payoffs are presented in the form of a utility function.

To aid the analysis of actors' decisions, all possible combinations of strategies are presented in a matrix called a strategic form. Each cell of the strategic form provides the expected payoff for each player from a particular combination of chosen strategies. For example, a game in which there are two actors and two possible strategies would take the strategic form of a 2×2 matrix (see Figure 1). This is an example of a normal game. Each cell in the matrix provides information on one set of expected payoffs, presented as (A, B) , with A and B representing the expected payoffs for each of the two actors, respectively, in that cell. Actors are assumed to be rational, in that they will always choose the strategy from the subset of options available to them that delivers the highest expected payoff; actors will be indifferent among strategies that offer equal payouts.

Two foundational concepts for analyzing expected decisions in game situations are dominant strategies and

Nash equilibria. A dominant strategy exists for an actor in a game when that actor would always choose one strategy over all others. That is, the payoff for the dominant strategy always exceeds the payoffs of all other possible strategies, regardless of the actions of the other actors in the game. A Nash equilibrium exists at a position in a game in which no single actor would choose an alternative strategy, given the strategy choice of the other actors in the game. Nash equilibria are used to identify steady-state outcomes of games that are played repeatedly by informed actors. A game may have zero, one, or multiple Nash equilibria.

To summarize, games involve specified situations in which actors choose among possible courses of actions, which result in predictable outcomes. The power of game theory rests in its ability to analyze situations in which the choices and actions of multiple players are interactive and mutually dependent: The outcomes experienced by one actor are influenced by the choices made by the other actor(s) in the game.

Repeated and Extensive Games

Repeated and extensive games are particularly well suited to issues in family business succession. The structure of repeated games is no different than that of normal games. The primary difference between them resides in the number of times the actors play the game. Normal games are typically thought of in terms of single-shot games: the actors are assumed to play the game once. Repeated games, alternatively, consider situations in which the actors play the same game multiple times. Actors have the opportunity to learn in repeated games.

Importantly, repeated games provide a methodology for managing the difficulties arising from variance and moderating factors, both noted above, in estimating actors' payoffs and utility functions. In essence, both variance and moderators challenge assumptions of perfect knowledge and rationality in game theory. These challenges are especially important if the actors in an interaction only engage with one another one time. However, a repeated game provides opportunities for the actors in a game to learn about the choices that the other actors are likely to make.

In this respect, repeated games allow for interventions. That is, interactions modeled initially as leading to conflict or indecision may be changed in some way over time as to avoid those difficulties. Game theory

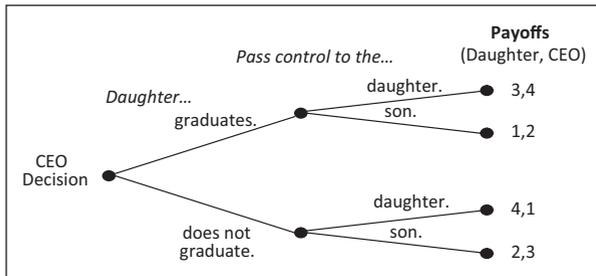


Figure 2. Extensive game.

analysis has the potential to identify the underlying causes of difficulties in succession events and possible paths to avert them.

Extensive games are those in which actors move in succession, allowing for consideration of various scenarios through what-if and if-then statements. Unlike strategic and repeated games, extensive games allow for variations in the conditions in which an actor's decisions are made. As the game progresses through levels of actors' decisions, the basis for future decisions changes. Extensive games are often modeled as decision trees.

An example will help explain extensive games. A simple extensive game might describe a situation in which the CEO of a family business has a daughter and a son, and values education. The daughter, at 27 years old, has shown the most interest in the firm but has only made partial progress toward college degree even though she is capable of doing the work; the son has shown less interest in the firm but has graduated from a good university and would join the firm if his father pressed him. The CEO would be happy to pass the firm to his daughter and would be most pleased to give the job to a person who really wants it. However, he feels responsible for the future of the firm and will ask his son to take the position, even if he does not prefer it, to promote the firm's success. See Figure 2 for a graphic on this game.

In this case, the CEO's payoffs might be structured as dependent on the successors' actions through a game tree model of an extensive game. The payoffs are presented as the numerical outcomes for the daughter and CEO, respectively, associated with each path. An additional game tree could be developed for the interaction between the CEO and his son.

Notice that the founder's basis for decisions changes as time passes and the children make their own decisions. In some respects, the founder has greater

information on which to base decisions; on knowing whether or not the daughter is successfully completing her education, his future decisions will be more certain. The degree to which clear paths arise from the game trees indicates the degree to which such situations would involve conflict or indecision.

Describing Family Business Management Succession in Terms of Game Theory

One of the most compelling subjects in the study of family businesses is the succession of firm leadership and ownership from one generation to another. Ownership succession involves distributing shares or other measures of ownership (i.e., partnership units) from a senior generation to junior generations, often taking place around retirement and estate-planning events. Leadership succession involves transferring responsibility for the ongoing management of a family firm from members of a senior generation to members of junior generations, especially the replacing a retiring CEO with a younger family member.

A significant part of the family business literature is dedicated to understanding why succession problems exist and how to alleviate them. Scholars have addressed succession from the perspective of succession processes (Cabrera-Suarez, De Saa-Perez, & Garcia-Almeida, 2001; Garcia-Alvarez, Lopez-Sintas, & Gonzalvo, 2002; Sharma, Chrisman, & Chua, 2003), characteristics of founders (Ibrahim, Soufani, & Lam, 2001) and successors (Chrisman et al., 1998), the impact of organizational climate on succession (Davis & Harveston, 1998; Dunn, 1999; Morris, Williams, Jeffrey, & Avila, 1997; Sharma, Chrisman, Pablo, & Chua, 2001; Shepherd & Zacharakis, 2000), environmental conditions for succession (Bjuggren & Sund, 2001), and postsuccession performance (Miller, Steier, & Le Breton-Miller, 2003); see Brockhaus (2004) for a review of the succession literature. Succession processes may include changes in management (Alcorn, 1982) and ownership level (Barry, 1975). This article concentrates on management succession, although we are conscious that the two processes often occur simultaneously (Barach & Ganitsky, 1995).

Succession in family businesses is a process that occurs over a long period of time punctuated by decision points (Churchill & Hatten, 1987; Handler, 1990, Le

Breton-Miller et al., 2004). Le Breton-Miller et al. (2004) viewed the management succession process as a sequence of four main stages: (a) establishing ground rules, (b) nurturing and developing the pool of potential successors, (c) selection, and (d) the final hand-off to the chosen successor. The vast majority of studies on family business succession focus on the first stages (Barach & Ganitsky, 1995; Barach, Gantisky, Carson, & Doochin, 1988; Cabrera-Suarez et al., 2005; Dyck, Mauws, Starke, & Mischke, 2002; Handler, 1992; Morris et al., 1997), whereas others focus on the postselection period (Mazzola, Marchisio, & Astrachan, 2008; Mitchell, Hart, Valcea, & Townsend, 2009). In particular, literature on the first stages of succession includes several studies that focus on incumbent/successor relationship (Le Breton-Miller et al., 2004); the motivations, personalities, and needs of incumbents (Barach & Ganitsky, 1995; Cabrera-Suarez et al., 2001; Dyer, 1986; Handler, 1990; Lansberg, 1988); and the commitment, development, and attributes of successors (Barach & Ganitsky, 1995; Dyer, 1986; Chrisman et al., 1998; Sharma & Irving, 2005; Ward, 1987).

Succession represents a period of survival risk to a family business (Royer, Simons, Boyd, & Rafferty, 2008; Shepherd & Zacharakis, 2000). One of the main reasons for the high failure rate among first- and second-generation family businesses is the inability to manage the emotional aspects of succession processes (Duh, Tominc, & Rebernik, 2009; Van der Merwe, Venter, & Ellis, 2009), especially in the presence of conflict or indecision. Interestingly, we did not find any studies that explore specific decision-making procedures for managing successions, which might include decisions by the incumbent to choose whether to stay or leave, to keep the company in the family's leadership or to appoint nonfamily leaders, and decisions by the successor on whether to work in the family business or to choose a different career.

Building on this stream of work, game theory views management succession as a set of rational choices made by individuals (e.g., founders/ CEOs and potential successors) about a firm's future leadership, with predictable information about their own outcomes resulting from those choices (e.g., choose a particular successor, choose not to be involved with the firm). By identifying the actors directly involved in a firm's succession, estimating their payoff functions, and identifying their

possible strategies, game theory provides a platform for understanding the intricacies of succession processes and events. Others have discussed the usefulness of game theory in the study of succession (e.g., Lee, Lim, & Lim, 2003). Game theory addresses two of the three major problems related to understanding management succession: that the actors have no (or limited) experience and that succession involves emotions as much as it does rational decisions (Duh et al., 2009).

In some instances, the transfer of management control is harmonious. In these cases, there is no discord among family members in planning or executing the success event. These successions go off just as planned without disagreement or conflict among family members about leadership or compensation decisions. For instance, a smooth succession could be described as a family in which only one of the siblings are interested in managing the business, that person has the support of his/her brothers and sisters, and that person is viewed as capable by the current CEO.

Given evidence of the difficulties and failure rates of succession events, we believe that harmonious successions are the exception. More often than not, consternation exists, to differing degrees and from differing sources. Game theory is useful to less-than-perfect successions in at least two ways. First, game theory acknowledges that successions involve decisions that are interdependent among actors that are highly interconnected. In these situations, it is typically not possible for any one actor to make his/her decisions independently. Consider two typical situations: (a) a founder wants to pass the firm's leadership to his son, but the son is not interested in the job; (b) two siblings want to be the next CEO, but there is only one job. These extremely simplistic descriptions highlight common cases in which the outcomes for any one actor depend on the decisions of other actors.

Second, game theory can help structure the factors and decisions that characterize a succession event. Succession decisions often involve a dizzying amount of information with many interconnections. More troubling, succession decisions typically require hard choices, especially when potential successors receive suboptimal outcomes: not everyone can be CEO. Accepting suboptimal outcomes is inherent in succession events, and that is never easy. Game theory cannot completely reduce the psychological and emotional hardships in succession, but it can help the decision makers clearly articulate the information on

which they are making choices. In doing so, CEOs might be more comfortable about their decisions, even if the decisions remain difficult.

Problem Statement

Management succession events result in the immediate or eventual transfer of management control of a family business. Please note that since we are concentrating on management succession, we are assuming the family, including the CEO, is committed to retaining ownership in the firm regardless of who is managing it. Relaxing this assumption is not problematic for game theory, but the complexities of doing so would distract us from the real purpose of this article: creating a foundation for the use of game theory for understanding management succession in family business.

Actors

Although family businesses are also composed of other important parties, such as spouses, nonsuccessor siblings and relatives, nonfamily managers, and a host of other stakeholders, the games described here are restricted just to CEOs and one or more potential successors. The influence of these other parties will be considered when constructing each actor's strategies, payoffs, and utility functions.

Conditions

The type of game being played (normal, repeated, or extensive) and the strategies available to each actor must be stipulated. To analyze conflict and indecision in a planned succession event on a cross-sectional basis, normal games likely will be the most appropriate structure. Analysis of succession events over time under the assumption that the characteristics of the actors do not change materially but that they do learn from one another would likely be structured as a repeated game. Successions that involve important changes over time, such as an increase in the education or experience of one of the potential successors, will likely be structured as extensive games.

Payoffs

As noted above, payoffs describe the outcomes of the game to an actor in the event of a particular set of

interactions and are captured in the form of a utility function. Each actor's utility function represents the series of values associated with each possible strategy available to that actor. There are at least three dynamics that are important in constructing an actor's utility function.

The first, and most obvious, involves capturing the factors that will influence each actor's utility. There are many elements that might influence the views of an actor, and the importance of those factors is likely to vary with each actor. The succession literature suggests that the following characteristics are likely to be important, although this list is not exhaustive:

- *Money*: The financial outcomes of the succession event for the CEO and the successor(s) (Churchill & Hatten, 1987).
- *CEO commitment to family business*: The degree to which the CEO wants to keep the business in the family (Kets de Vries, 1993).
- *CEO interest in retirement*: The degree to which the CEO is willing to exit the firm (Duh et al., 2009).
- *CEO motivations*: Other underlying motives for the decisions made by the CEO (Handler, 1990).
- *Successor training and capabilities*: The capacity of the successor(s) to ably run the company after the CEO retires (Le Breton-Miller et al., 2004).
- *Successor career aspirations*: A judgment of what the successor(s) wants to do with his/her working life (Mitchell et al., 2009).
- *Successor career alternatives*: The options open to the successor(s) both within and outside of the family firm (Handler, 1990).
- *Successor commitment*: The degree and nature of the successor(s) commitment to the family business (Sharma & Irving, 2005).

Capturing all of these elements requires some broad thinking. Computing payoffs requires delving into human characteristics such as desires, emotions, and personal feelings that are very hard to quantify. Rather than considering a single preference score associated with one of an actor's available strategies, it is better to think of a score as the summary of a vector of scores across the factors listed above. Game theory is robust even when preference vectors are complicated. Although

enumerating the true payoffs of an actor in a succession event is unlikely, estimations of emotional preferences are evident in almost all management studies. Game theorists have addressed similar problems through the use of “fuzzy numbers,” or a small set of numbers that are related to a true value (Buckley, 1985). This actually helps assure that the game captures the nuances involved when people make important decisions.

Consider a simpler situation involving a major decision, such as shopping for a car. At the beginning of the process, the buyers face a dizzying array of options. They often narrow their choices down to a few models and colors through rational analysis and pragmatic factors, and then make a decision. When asked why they selected one car over another on the short list, the responses will typically have less to do with attributes than feelings. In the end, the purchasers internalized the myriad factors that could be important to buying a car and came up with a single preference. This is an analogous (albeit more complex) situation.

Second, there may be elements that act as moderators of the relationship between an actor’s utility function and his/her actual choice of strategies. A moderating factor is any element that affects the relationship or interaction among any two or more variables. In this case, a moderator would take the form of some sort of influence that changes the relationship between an actor’s maximization of his or her utility function and the choices that he or she makes in the succession event. Moderators may arise both from other actors within the game as well as from forces external to the game. For instance, an actor’s payoffs may be altered by his or her beliefs about the preferences of other actors in the game. For instance, consider a CEO who inwardly believes that a younger daughter would be the best choice to run the firm but publicly supports an elder son who is highly interested in taking over the firm.

Last, people who are not directly involved in the game may influence the game’s actors. That is, people who are important to actors may alter the true utility functions of an actor. For instance, a spouse or other family members may influence a CEO’s decisions. Important customers may force a CEO to alter the selection of a successor, or a bloc of strong nonfamily managers may persuade a CEO to select a member of their group to lead the firm even if the CEO’s preference is to pass the firm to an offspring. A CEO approaching or even past retirement age may acknowledge the need to appoint a successor, but may be internally reluctant to leaving the business.

Interestingly, the degree to which actors face troubles clearly identifying their payoffs is indicative of troubles in the succession process. Many problems in succession arise when actors really do not know what they want, or change their opinions over time. We expect that (a) the less certain or the more equivocal an actor’s payoff vector, or (b) the more an actor changes preferences (in repeated and extensive games), (i) the greater the degree of indecision that will exist throughout a succession process and (ii) the less successful a succession event will be.

Decisions

Analysis of the strategic form, which integrates the utility functions of the game’s actors in the form of a matrix or game tree, leads to indications of what the actors will do in the game.

At this point, game theory analysis turns to the search of dominant strategies and points of equilibrium. A dominant strategy, as noted above, always provides an actor with superior outcomes than any other available strategy. A Nash equilibrium exists at a position in a game in which no single actor would chose an alternative strategy, given the strategy choice of the other actors in the game.

Harmonious succession processes and events are easy to recognize in a game theory analysis. When each actor has a dominant strategy, and those dominant strategies match up to create an equilibrium outcome, there will be no doubt as to the right thing to do. For instance, if a CEO always prefers to pass the firm to his oldest child, and all of the CEO’s other children agree that the eldest is the best choice of a successor, everything will go smoothly.

Harmonious successions, we expect, are the exception rather than the norm. Things are rarely so easy. Consider a few possible scenarios that made result in indecision and conflict among family members (the actors):

- *Frozen-out but interested successor:* A daughter wants the top job but the founder prefers to appoint another sibling as the firm’s next leader.
- *Untalented successor:* A son wants the top job but the founder does not consider him capable of successfully running the firm.
- *Disinterested or rebellious successor:* The founder prefers to pass the leadership of the firm to a daughter, but she is uninterested in the position.

- *Founder indecision*: The founder is uncertain about the firm's succession, even though a particular son clearly wants to be named the firm's next leader.
- *Successor indecision*: The founder would like to pass leadership of the firm to a daughter, but she does not have a clear commitment to the firm over other career options.
- *Horse race or blood feud*: Two different potential successors both want to be the firm's next leader and the founder is undecided about which one to select.

Each of these situations shares commonalities. Because these games are likely to end with an option that is not optimal for one of the players (perhaps all of them), conflict and indecision are likely to result. Conflict among actors will come up because succession processes and events involve highly personal, emotional, and professional decisions. They are so important to some actors as to have lifelong impacts on their relationships with other family members and even the business itself. If things do not go as an actor wants or expects, internal feelings of disappointment and external reactions of conflict should be expected. Faced with the potential for conflict, and knowledge that is likely to arise if certain decisions are made, actors may be indecisive in selecting strategies. That is, it is perfectly reasonable for a CEO (father/mother) or a sibling to feel empathy when they prefer an option that they know is not in alignment with the wishes of other family members, and to feel conflicted about those situations. Indecisiveness is sure to follow.

In more formal terms, we expect that the degree of conflict among actors will be lowest when there is only a single Nash equilibrium in the strategic form and significantly increase when there are no Nash equilibrium or multiple Nash equilibriums.

Total Family/Firm Welfare

Game theory typically focuses on the outcomes of interactions among players from the perspective of each individual actor: the results are framed in terms of the payoffs to each individual. In the case of family business succession, we must also consider a more holistic view of the payoffs. That is, we are interested not just in maximizing the payoffs of any given actor but also in maximizing the outcomes for the firm. Successful successions result in a strong future for the family business,

regardless of whether a particular player is happy with the outcome or not.

An Example

We now turn to specific examples in order to illustrate how family business succession issues can be analyzed using the tools of game theory. Although the equations may seem a bit complicated, the real idea is to understand the outcomes of the analysis.

Game Structure

Consider a situation in which a founder of a business (denoted F) desires to pass control of a family business over to one of his two offspring, either his son (denoted S) or his daughter (denoted D). Recall that we are concentrating on management succession, for purposes of simplicity, eliminating from our analysis the option of selling the firm.

The two candidates for succession ($i = \{S, D\}$) are each characterized by a level of talent for running the business (denoted $t_i \geq 0$) and a level of desire for running the business (denoted $d_i \geq 0$). The founder places a positive value on both the level of talent and level of desire of the chosen successor.

Choosing to pursue the CEO position at the family business constitutes an opportunity cost to that candidate. Someone talented enough to be considered for the top position at a family business is likely to be capable enough to get a very good job at some other firm. Suppose that S and D simultaneously choose to either "pursue" or "abandon" the position of CEO. After these choices are made, F then chooses a successor from among those offspring that pursued the position.

If both S and D chose "pursue," then F could choose either one to be the successor. If one chose "pursue" while the other chose "abandon," then the one who chose "pursue" will be named the successor. If neither chose "pursue," then F will appoint an outside (i.e., non-family member) successor. These latter assumptions on the choice by F can be justified by supposing that this "outside option" is always available, but the preference for appointing one of the offspring as the successor is so strong that the outside option will only ever be used in a situation in which neither offspring chooses to pursue the position.

This situation naturally can be modeled as a three-player game. The three players are S , D , and F . The strategies available to the players and the timing of the

decisions have already been alluded to above. First, S and D each simultaneously choose to either “pursue” or “abandon.” Second, after observing these choices, F then chooses a successor from among those individuals who chose to pursue the position.

Each of these three players has a payoff function. The payoff function for F can be written as $\pi_F = Ld_i + Vt_i$ from appointing an offspring with desire of d_i and talent of t_i as the successor. The parameter $L \geq 0$ captures the degree to which F values naming a successor with a greater desire for running the business (i.e., think of this parameter as capturing the degree to which the founder views the family business as a legacy to be passed on to the individual who really wants to run the business). The parameter $V \geq 0$ captures the degree to which F values naming a competent successor who can fully realize the firm’s performance. For instance, a founder who cares primarily about the legacy value of passing control to an interested successor and only slightly about maximizing the future value of the firm would have a relatively large value of L and a relatively small value of V . Finally, suppose that naming an outside successor would give F a payoff of $\pi_F = 0$, which follows with our assertion that a family CEO will always prefer to pass the business to an offspring if there is an option to do so.

Turning attention to the payoff of candidate i ($i = \{S, D\}$), suppose that the value the individual places on being the successor is directly measured by d_i . Further suppose that the individual must incur a cost of $c > 0$ in order to “pursue” the position. That is, choosing “pursue” and being named the successor results in a payoff of $\pi_i = d_i - c$; choosing “pursue” but not being named the successor results in a payoff of $\pi_i = -c$; and choosing “abandon” results in a payoff of $\pi_i = 0$. We will focus on situations in which each candidate has $d_i > c$, so that choosing “pursue” may possibly be best for the candidate. This assumption eliminates the uncomfortable situations in which a successor pursues the top job only because s/he has nothing better to do.

Perfect Information

Begin by considering a situation of perfect information, in which all three players know the exact values of d_i and t_i for both $i = \{S, D\}$ and all of the values of all of the parameters in the payoff functions of each of the three players.¹ Interestingly, even in this somewhat basic situation, qualitatively different equilibria can result.

To identify equilibrium strategies for this game, we use simple backward induction. That is, optimal behavior must first be determined starting in the terminal node of the game (i.e., the point at which F must choose a successor from among those offspring that expressed an interest in the position). If neither the son or daughter expressed an interest in the position, then F ’s only choice is to name an outside successor and realize a payoff of $\pi_F = 0$. If offspring i chose “pursue” while offspring j chose “abandon,” then F will appoint i and realize a payoff of $\pi_F = Ld_i + Vt_i$. Finally, if both S and D chose “pursue,” then F will choose to name the successor that makes his own realized payoff larger, based on the actual levels of talent and desire of the two candidates, along with the relative value that he places on these two attributes. In terms of the equations specified thus far, F would name D as the successor if and only if²

$$Ld_D + Vt_D \geq Ld_S + Vt_S \Leftrightarrow L(d_D - d_S) \geq V(t_S - t_D).$$

From this inequality, the choice of F is rather trivial if either (a) $t_D \geq t_S$ and $d_D \geq d_S$ or (b) $t_S \geq t_D$ and $d_S \geq d_D$. In the former case, F would clearly choose to appoint D over S , since the daughter is both more talented than and has a greater desire than the son. Similarly, in the latter case, F would clearly choose to appoint S over D , since the son is both more talented than and has a greater desire than the daughter. This is the definition of a harmonious succession.

The more interesting situations are those in which either (c) $t_D \geq t_S$ but $d_S \geq d_D$ or (d) $t_S \geq t_D$ and $d_D \geq d_S$. In these cases, the choice by F depends on the relative degree to which he values “desire” vis-à-vis “talent” of the successor (i.e., the values of the parameters L and V) and the differences in the levels of these attributes between the two candidates, that is, $(t_D - t_S)$ and $(d_S - d_D)$.

However, with perfect information not only can F easily make this comparison and choose the preferred successor if both candidates choose “pursue,” but both D and S can make the comparison in the inequality above and infer who will be named the successor if both choose “pursue.” Thus, in the initial stage during which D and S simultaneously choose to either “pursue” or “abandon,” one of two simultaneous move games is relevant.

If $L(d_D - d_S) \geq V(t_S - t_D)$, then D and S are essentially playing the simultaneous move game depicted in Figure 3. The payoffs in this matrix reflect the fact that if

		Son	
		Pursue	Abandon
Daughter	Pursue	$d_D - c, -c$	$d_D - c, 0$
	Abandon	$0, d_S - c$	$0, 0$

Figure 3. Simultaneous move game: Founder values desire more than competency.

both candidates choose “pursue” when $L(d_D - d_S) \geq V(t_S - t_D)$, F would name D as the successor. To fully understand this inequality, consider a case in which $d_D \geq d_S$ and $t_S \geq t_D$ (i.e., the daughter has greater “desire” while the son has greater “talent”). In light of these differences in attribute levels, the founder will prefer to appoint the daughter as the successor, so long as he cares sufficiently enough about the legacy value of passing control to an interested successor and only slightly about maximizing the future value of the firm (recall, a founder with such preferences has a relatively large value of L and a relatively small value of V). The inequality $L(d_D - d_S) \geq V(t_S - t_D)$ simply provides a precise condition (in terms of the parameters of the founder’s payoff function and candidate attribute levels) for when this is the case.

Focusing on the payoff matrix in Figure 3, recall, we are assuming that $d_D > c > 0$ and $d_S > c > 0$, or that the successors both have costs of pursuing the job that are greater than zero and their desire to take the job exceeds these costs. Thus, Figure 3 reveals that S does not have a dominant strategy (if D chooses “pursue,” then the best reply for S is “abandon,” whereas if D chooses “abandon,” then the best reply for S is “pursue”). However, for D , “pursue” is a dominant strategy: it is the best reply for D for each of the two strategies available to S . As such, this game has a unique Pure Strategy Nash Equilibrium, characterized by D choosing “pursue” and S choosing “abandon” followed by F selecting D to be the successor.

If, instead, $L(d_D - d_S) < V(t_S - t_D)$, then D and S are essentially playing the simultaneous move game depicted in Figure 4. The payoffs in this matrix reflect the fact that if both candidates choose “pursue” when $L(d_D - d_S) < V(t_S - t_D)$, F would name S as the successor. To gain insight into this condition, again consider a case in which $d_D \geq d_S$ and $t_S \geq t_D$ (i.e., the daughter has greater “desire” while the son has greater “talent”).

		Son	
		Pursue	Abandon
Daughter	Pursue	$-c, d_S - c$	$d_D - c, 0$
	Abandon	$0, d_S - c$	$0, 0$

Figure 4. Simultaneous move game: Founder values competency more than desire.

Faced with such differences in attributes, the founder will prefer to appoint the son as the successor, so long as he cares sufficiently enough about maximizing the future value of the firm and only slightly about the legacy value of succession (recognize, a founder with such preferences would have a relatively large value of V and a relatively small value of L). The inequality $L(d_D - d_S) < V(t_S - t_D)$ simply provides a precise condition (again, in terms of the parameters of the founder’s payoff function and candidate attribute levels) for when this is true.

When $L(d_D - d_S) < V(t_S - t_D)$, D does not have a dominant strategy: if S chooses “pursue,” then the best reply for D is “abandon,” whereas if S chooses “abandon,” then the best reply for D is “pursue.” However, for S , “pursue” is a dominant strategy, as “pursue” is the best reply for S for each of the two strategies available to D . As such, this game has a unique Pure Strategy Nash Equilibrium, characterized by S choosing “pursue” and D choosing “abandon” (followed by F selecting S to be the successor). That is, the game depicted in Figure 4 and the resulting equilibrium is essentially the mirror image of that depicted in Figure 3.

At this point, we can begin to see the powerful insights that can be obtained by formally modeling this situation with the tools of game theory. Under perfect information, the equilibrium is such that one and only one of the offspring pursue the position and the chosen successor is the individual which makes the payoff of F as large as possible. Game theory allows each decision maker to precisely see how the situation will unfold. In this simple example, this ultimately allows S and D to essentially coordinate their actions (i.e., one chooses “pursue,” while the other chooses “abandon”), resulting in a more harmonious outcome.

Furthermore, by parameterizing the payoffs of each player and formally solving for the unique equilibrium, we can gain insight into how the outcome of the

succession process would potentially change if the priorities of the various players were to take on different values. For example, again focus on a situation in which $d_D \geq d_S$ and $t_S \geq t_D$, and recall that in equilibrium the daughter will be chosen as the successor if and only if $L(d_D - d_S) \geq V(t_S - t_D)$. From here we can directly see how the realized outcome depends critically on the relative degree to which the founder values talent vis-à-vis desire. If, all other factors fixed, the founder values talent to a greater degree (i.e., has a larger value of V), then this condition is less likely to hold, implying that the son (in this case, the more talented candidate) is more likely to ultimately be appointed. If instead, all other factors fixed, the founder values desire to a greater degree (i.e., has a larger value of L), then this condition is more likely to hold, implying that the daughter (in this case, the candidate who wants the position more) is more likely to ultimately be appointed.

Similarly, we can easily see how varying the attributes of the candidates would impact the equilibrium outcome.³ If, all other factors fixed, the degree to which the daughter desires the position were increased (i.e., if d_D were larger), then the condition above is more likely to hold, implying that she is more likely to be named the successor. Similarly, if, all other factors fixed, the degree to which the son desires the position were increased (i.e., if d_S were larger), then the condition above is less likely to hold, implying that he is more likely to be named the successor.

If, all other factors fixed, the talent of the daughter were increased (i.e., if t_D were larger), then the condition above is more likely to hold, implying that she is more likely to be named the successor. Similarly, if, all other factors fixed, the talent of the son were increased (i.e., if t_S were larger), then the condition above is less likely to hold, implying that he is more likely to be named the successor.

These insights on how the equilibrium depends on talent levels are of tremendous importance for at least two reasons. First, individuals often have actions that they could take (e.g., pursuing an MBA), which would directly increase their talent for managing the business. Thus, it would seem reasonable to suspect that, at least to a degree, a portion of talent is under the control of the individual.⁴ Second, in terms of ultimately using a theoretical model as the basis for an empirical study, proxies for talent (e.g., level of education or within-industry work experience) can be measured and observed.

Finally, recognize that even though the unique equilibrium results in the appointment of the successor that makes the payoff of F as large as possible, this outcome may not maximize “Total Family/Firm Welfare” (i.e., the sum of payoffs across all players in the game). To see this, consider a situation in which $t_D < t_S$ and $d_D > d_S$. With perfect information, a prerequisite for maximizing Total Family/Firm Welfare is that only one of the two offspring should pursue the position (since only one individual will be named successor, having both choose “pursue” would simply result in additional costs of c , relative to an outcome in which the individual not named successor instead chooses “abandon”). With this in mind, the efficient outcome can be determined by comparing Total Family/Firm Welfare from realizing “ D pursue, S abandon, D chosen” to Total Family/Firm Welfare from realizing “ D abandon, S pursue, S chosen.” For the former outcome, F realizes a payoff of $Ld_D + Vt_D$, D is named the successor and realizes a payoff of $d_D - c$, and S chooses “abandon” and realizes a payoff of 0. This results in Total Family/Firm Welfare of

$$(Ld_D + Vt_D) + (d_D - c) + (0) = (1 + L)d_D + Vt_D - c.$$

For the latter outcome, F realizes a payoff of $Ld_S + Vt_S$, D chooses “abandon” and realizes a payoff of 0, and S is named the successor and realizes a payoff of $d_S - c$. This results in Total Family/Firm Welfare of

$$(Ld_S + Vt_S) + (0) + (d_S - c) = (1 + L)d_S + Vt_S - c.$$

Comparing these two expressions, Total Family/Firm Welfare is maximized by “ D pursue, S abandon, D chosen” if and only if

$$(1 + L)(d_D - d_S) \geq V(t_S - t_D).$$

Recall, the equilibrium outcome is “ D pursue, S abandon, D chosen” so long as

$$L(d_D - d_S) \geq V(t_S - t_D).$$

For $d_D > d_S$ it follows that $(1 + L)(d_D - d_S) > L(d_D - d_S)$. Thus, three outcomes are possible. If $V(t_S - t_D) \leq L(d_D - d_S)$, then the equilibrium outcome of “ D pursue, S abandon, D chosen” maximizes Total Family/Firm Welfare. If instead $V(t_S - t_D) > (1 + L)(d_D - d_S)$, then the equilibrium outcome of “ D abandon, S pursue, S chosen” maximizes Total Family/Firm Welfare.

sue, *S chosen*” maximizes Total Family/Firm Welfare. However, if

$$L(d_D - d_S) < V(t_S - t_D) \leq (1+L)(d_D - d_S),$$

then the equilibrium outcome is “*D abandon, S pursue, S chosen*,” while the outcome that would maximize Total Family/Firm Welfare is “*D pursue, S abandon, D chosen*.” When the equilibrium outcome is inefficient, feelings of indecision and conflict are more likely to come out of the succession process.

Recognize that these conditions for inefficiency can be expressed as

$$0 < V(t_S - t_D) - L(d_D - d_S) \leq (d_D - d_S).$$

The term $V(t_S - t_D) - L(d_D - d_S)$ is simply the net gain for *F* from having *S* be the successor instead of *D*. The first inequality in the condition above (i.e., the condition that this term is positive) is simply a direct reflection of the fact that *F* would choose *S* as the successor over *D* in the situations being considered. This comparison is based solely on the different possible realizations of *F*'s payoff.

However, Total Family/Firm Welfare depends not only on the payoff of *F* but also on the realized payoffs of *S* and *D*. For “*D pursue, S abandon, D chosen*” the sum of the payoffs of the two candidates is $d_D - c$, while for “*D abandon, S pursue, S chosen*” the sum of the payoffs of the two candidates is $d_S - c$. Thus, the net gain in welfare for the candidates collectively from realizing “*D pursue, S abandon, D chosen*” instead of “*D abandon, S pursue, S chosen*” is $d_D - d_S$, which is the final term in the conditions above.

As such, the conditions identifying when the equilibrium will be inefficient intuitively reveal why the equilibrium outcome fails to maximize Total Family/Firm Welfare. When $V(t_S - t_D) - L(d_D - d_S) > 0$, the founder maximizes his own payoff by choosing *S* over *D* and the equilibrium outcome is “*D abandon, S pursue, S chosen*.” But Total Family/Firm Welfare is instead maximized by “*D pursue, S abandon, D chosen*” precisely when the net increase in the joint welfare of the candidates from realizing this latter outcome (i.e., $d_D - d_S$) exceeds the net gain for the founder from realizing the former outcome, that is, $V(t_S - t_D) - L(d_D - d_S)$.

Imperfect Information

In this section, we consider a generalization of the game discussed above by considering the impact of imperfect information. By extending the model in this direction, we will ultimately see how altering a basic assumption can drastically change the qualitative nature of the equilibrium. More precisely, in this more general framework the game no longer has a unique equilibrium in which the son and daughter are able to essentially coordinate their actions. This discussion directly reveals the value of formally modeling and analyzing the situation with the tools of game theory, since the important role that information can potentially play is only seen by such an analysis.

Consider a situation in which there is imperfect information, in that none of the players know the true values of t_S and t_D at the start of the game. The values of d_S and d_D are still observed by all players at the start of the game, as are the values of L , V , and c . However, the “true value” of t_i is only revealed if candidate i chooses “pursue.”

For instance, suppose *D* and *S* each work at the family business as young adults. During this time they each come to learn, and reveal to others, their desire to run the family business in the future. However, these young adults will not be able to fully demonstrate their ability to be the next CEO. Later, likely when the founder initiates a succession process and the candidates must firmly decide whether or not to “pursue” the top job, each candidate may then have opportunities to take on a more serious role in the business, including more significant and substantial duties. As a result of having to perform these more important functions they learn, and it is revealed to others, their potential for actually running the business.

If neither offspring chooses “pursue” or if only one offspring chooses “pursue,” then the choice of *D* at the terminal node of the game is still trivial. Thus, for each candidate i , the best reply to a choice of “abandon” by the other candidate ($-i$) is a choice of “pursue.”

If both offspring choose “pursue,” then the true values of t_S and t_D are revealed, and *F* can easily choose which candidate to appoint as CEO (naming *D* the successor if and only if $L(d_D - d_S) \geq V(t_S - t_D)$, which is the same condition that was previously derived). But, when faced with the choice of “pursue” or “abandon,” each

candidate i is unaware of both their own talents and those of the other sibling (denoted t_i and t_{-i}). This is a common occurrence, as the time, responsibility, and dedication required of a family business CEO are significant, and may raise feelings of doubt or insecurity within the candidates.

As a result, when considering the outcome when both candidates choose “pursue,” each candidate can at best determine a value for his expected payoff incorporating the probability with which he expects to be chosen as the successor if both he and his sibling choose “pursue.” To formulate such a probability and expected payoff, a candidate must have some beliefs over the distribution from which the values of t_i and t_{-i} are determined. To simplify the analysis, suppose that each t_i is determined as an independent realization of a random variable distributed according to the cumulative distribution function $F(t) = t$ (i.e., each talent level is an independent draw from a $U[0,1]$ distribution).

The condition specifying when D will be chosen as the successor (if both D and S choose “pursue”) can be expressed as $t_s \leq t_D + \frac{1}{\nu}(d_D - d_S)$. Without loss of generality, suppose $d_D \geq d_S$. The choice by F of who to select as CEO when both choose “pursue” as a function of the realized values of t_D and t_S is illustrated in Figure 5. Under the assumption that t_D and t_S are independent draws from a $U[0,1]$ distribution, each point in the unit square is equally likely. Thus, from the perspective of the offspring when making their initial choices of “pursue” or “abandon,” the probability that D will be selected is

$$P(D) = 1 - \frac{1}{2} \left[1 - \frac{1}{\nu}(d_D - d_S) \right]^2$$

and the probability that S will be selected is

$$P(S) = \frac{1}{2} \left[1 - \frac{1}{\nu}(d_D - d_S) \right]^2.$$

From here, it follows that if both choose “pursue,” then the expected payoff of D is

$$\pi_D^{p,p} = d_D \left(1 - \frac{1}{2} \left[1 - \frac{1}{\nu}(d_D - d_S) \right]^2 \right) - c$$

and the expected payoff of S is

$$\pi_S^{p,p} = d_S \left(\frac{1}{2} \left[1 - \frac{1}{\nu}(d_D - d_S) \right]^2 \right) - c.$$

To ease the discussion, restrict attention to a situation of imperfect information in which D and S have equal

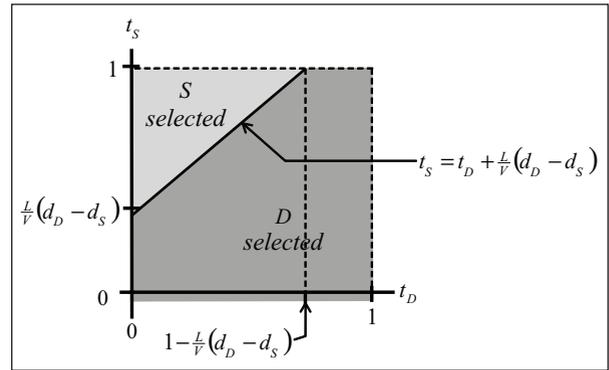


Figure 5. Founder decision structure under conditions of imperfect information.

desires to be named as the successor: $d_D = d_S = d > c$.⁵ In such a situation, if both “pursue,” then the offspring with the larger realized value of t will be named the successor, so that $P(D) = \frac{1}{2}$, $P(S) = \frac{1}{2}$, $\pi_D^{p,p} = \frac{1}{2}d - c$, and $\pi_S^{p,p} = \frac{1}{2}d - c$. It follows that when making the initial decisions of “pursue” versus “abandon,” it is now as if the offspring are playing the simultaneous move game illustrated in Figure 6. For this game, it is still true (by the assumption of $d > c$) that for each player choosing “pursue” is a best reply to a choice of “abandon” by the other player. Thus, there are essentially two qualitatively different cases of interest.

First, consider $\frac{1}{2}d - c > 0$ (or equivalently $d > 2c$). In this case, the desire of each offspring to run the business is sufficiently high so that choosing “pursue” is a dominant strategy for each individual. The unique Nash Equilibrium is characterized by both D and S choosing this dominant strategy of “pursue.” After these choices, the true values of both t_D and t_S are revealed, and the individual with the larger value of t_i (i.e., the higher level of talent) is chosen to be the successor. This outcome is desirable in that we never realize an ex post inefficiency similar to that described above. This is because for $d_D = d_S = d$, either D or S would realize the same benefit from being named the successor. So, total welfare from the succession decision are maximized by always appointing the individual that is strictly preferred by F , who after all is the one making the decision.

However, at this equilibrium we always have both offspring incurring the costs of $c > 0$ associated with pursuing the position. If it turns out that t_D and t_S are similar in value (so that $|t_D - t_S|$ is relatively small), then

		Son	
		<i>Pursue</i>	<i>Abandon</i>
Daughter	<i>Pursue</i>	$\frac{1}{2}d - c, \frac{1}{2}d - c$	$d - c, 0$
	<i>Abandon</i>	$0, d - c$	$0, 0$

Figure 6. Game under conditions of imperfect information.

the gain from appointing the offspring of higher talent might not necessarily outweigh the additional expense of having both individuals pursue the position.

Finally, note that in this case there will always be an offspring who actively pursued the position but was ultimately not chosen. This can be thought of as a situation in which there is a “Frozen-Out Successor,” in that the founder has identified one of the two siblings as the choice to be the next CEO of the firm, and the chosen sibling is interested in the job but the other sibling disagrees with the selection and also wants the job. Subsequent conflicts would likely arise between the rejected sibling and both the founder and the chosen sibling.

Second, consider $\frac{1}{2}d - c < 0$ (or equivalently $d < 2c$). In this case, the desire by each offspring to run the business is sufficiently low so that choosing “pursue” is not a best reply to a choice of “pursue” by his sibling. That is, the value of being the chosen successor is not large enough to warrant incurring a cost of $c > 0$ with certainty if there is only a $\frac{1}{2}$ probability of ultimately being named the successor. Neither player has a dominant strategy. The game has two Nash Equilibria in Pure Strategies (one in which D chooses “pursue” and S chooses “abandon,” and a second in which S chooses “pursue” and D chooses “abandon”), along with a third Nash Equilibrium in Mixed Strategies. This Mixed Strategy Nash Equilibrium involves each player randomizing between the available pure strategies, with each offspring choosing “pursue” with probability $2(d - c)/d$ and “abandon” with $(2c - d)/d$.⁶

Focusing first on the two Pure Strategy Equilibria, in these situations only one of the two offspring chooses to pursue the position. This does have the advantage of reducing the total costs of pursuit (since the costs of $c > 0$ are only ever incurred by one of the two individuals). However, the probability that the individual ultimately appointed to be the successor is the one with the higher

actual, true value of t_i is only $\frac{1}{2}$. That is, in this case, the ideal candidate (i.e., the one whose appointment would maximize the payoff of F , and since $d_D = d_S = d$, would also maximize the sum of benefits over all players) is only appointed half of the time.

Switching attention to the Mixed Strategy Equilibrium, observe that under this pair of strategies, each of the four possible outcomes (of “ D pursues while S abandons,” “ S pursues while D abandons,” “both pursue,” and “both abandon”) is realized with positive probability. If both “pursue” or if one chooses “pursue” while the other chooses “abandon,” the outcome is qualitatively similar to the respective discussions above. However, for this Mixed Strategy Equilibrium an outcome in which both D and S choose “abandon” also occurs with positive probability. This can be viewed as a situation in which (based on the chosen actions of the offspring) there are “Disinterested Successors,” in that the founder prefers to pass leadership to one of his offspring, but no such individual has expressed an interest and taken the necessary actions to pursue the position. This is clearly an undesirable outcome from the perspective of the founder.

As illustrated by this analysis, with imperfect information, the equilibria of the game (with either $\frac{1}{2}d - c > 0$ or $\frac{1}{2}d - c < 0$) differ drastically from what arose in the setting of perfect information.⁷ This result again illustrates the benefit of using game theory to examine this decision making environment. The important role that a factor such as differences in information can play in influencing the outcomes of the family business succession process can only be clearly seen by modeling and analyzing the situation through the lens of game theory.

Conclusion

Management succession in family businesses is a vitally important yet complex phenomenon in most family businesses. The many different forms and types of phenomena involved in family business succession reduce the likelihood that a singular theory for understanding succession might be developed. However, there is a great deal of value that might be gained from modeling the various aspects of succession.

This article outlines how game theory provides a solid foundation on which to observe, explain, and make predictions about succession in family businesses. Game theory offers a means of observing actors through an integrated model that can account for interdependencies

among them and the ramifications of one actor's decisions on the decisions of others. The construction of utility functions forces a complete assessment of what is important to each actor. And game theory is a rigorous tool for developing models and hypotheses in conjunction with existing managerial theories that then may be subjected to empirical testing. As such, it fulfills the criteria for advancing the study of family businesses set out by Zahra and Sharma (2004) by improving both the theoretical and empirical bases of family business research.

Furthermore, game theory can be used in conjunction with other organizational or managerial theories, such as agency theory, stakeholder theory, and the resource-based view of the firm, among others. Although these perspectives on succession have yielded interesting insights into succession, they were designed to explain other phenomena and have not resulted in conclusive theoretical explanations or seminal empirical conclusions about the success or failure of family business succession events. However, the modeling techniques, logical frameworks, and methodologies of game theory may lead analysts to new ways of approaching succession even while drawing on existing and helpful managerial theories.

Our hope is that this article initiates a new stream of empirical work on management succession. It has provided only a starting point: Its purpose is to introduce family business scholars to game theory in the context of management succession. Inherently, it is a very general article. Our hope is that future efforts apply game theory to succession on a more granular level.

This granularity can happen through at least two types of research efforts. Theoretically, researchers could develop models based in game theory that are likely to explain specific types of successions. For instance, each of the different situations described earlier in this article could warrant its own model describing how the likely positions of the actors, the strategies they might adopt, the likely outcomes of the game (for each of the actors as well as the total family/firm welfare), and any interventions supported by theory that may improve the outcomes of the game.

Second, game theory can guide empirical studies of succession. Primary data, in a variety of forms (including interviews, surveys, and role plays), gathered from family members involved in management succession would help validate models. The data could be used to

test whether or not theoretical models perform as predicted.

Furthermore, our examples, although seemingly complex, only explain elementary situations. Game theory is agile enough to consider other dynamics, such as nonfamily members, more than two potential successors, multiple CEOs (consider a firm led by brothers), and other complicating factors. Naturally, game theory could also extend into ownership succession as well.

The most significant challenges involved in the application of game theory to succession events reside in the measurements it requires, including quantifications of emotional constructs such as desires, feelings, and hopes. These challenges are most obvious in the need for numerical estimations of each actor's payoff functions. Such hurdles inherent in game theory are important and must be acknowledged. However, similar difficulties arise in almost any empirical study of social or personal phenomena, and proper measurement techniques may be able to allow analysts to have faith in the conclusions they draw from studies based on game theory models.

We have only scratched the very surface of game theory in this article; its purpose was only to introduce game theory as a tool rather than to aptly apply it. The real benefits of game theory will be realized when its mathematical and empirical tools are used to address defined problems within family business succession.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Notes

1. After gaining insight into this scenario, a similar analysis will be conducted for a situation of imperfect information, in which none of the players know the true values of t_i at the start of the game (with the value of t_i only being revealed if i chooses to pursue the position).
2. To simplify the discussion, suppose that if F is indifferent, he will choose D as the successor.

3. In the interest of brevity, suppose that $d_D \geq d_S$ and $t_S \geq t_D$, both before and after any such changes in candidate attributes.
4. As an avenue for future research, an even richer theoretical model could formally allow for a choice of costly investment in talent during an initial stage of a game similar to the one considered here.
5. If instead $d_D \neq d_S$, then the analysis would proceed in a very similar manner. However, the algebraic expression along the way would be more complicated, while the results and insights ultimately obtained would be qualitatively very similar.
6. At this mixed strategy equilibrium, each player must have the same expected payoff (given the randomization between “pursue” and “abandon” chose by his rival) from choosing “pursue” and “abandon.” Suppose S is choosing “pursue” with probability q and abandon with probability $1 - q$. If D chooses “abandon,” she realizes a payoff of 0 for certain. If she chooses “pursue,” her expected payoff is $q(\frac{1}{2}d - c) + (1-q)(d-c)$, which can be simplified to $d - c - \frac{1}{2}dq$. Equating this expected payoff from choosing “pursue” to the certain payoff from choosing “abandon” and solving for q yields $q^* = [2(d-c)]/d$. That is, D is willing to randomize between “pursue” and “abandon” if and only if S is choosing “pursue” with probability $q^* = [2(d-c)]/d$.
7. As noted, if $d_D \neq d_S$, the analysis would have proceeded in a very similar manner. In terms of the qualitative nature of the equilibria, the only substantive difference is that (in addition to the two cases just discussed) there would have also been a third possible case that could arise. This third case is characterized by the candidate with the higher level of desire having a dominant strategy of “pursue” (while the other candidate does not have a dominant strategy). As a result, when the parameter values are such that this third case arises, there is a unique equilibrium in which the candidate with the higher level of desire chooses “pursue,” while the candidate with the lower level of desire chooses “abandon” (the best choice for this candidate to a choice of “pursue” by his sibling).

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