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MANAGERIAL HUMAN CAPITAL AND ORGANIZATIONAL PERFORMANCE

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by

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(Under the Direction of J. Edward Kellough)

ABSTRACT

This dissertation focuses on the relationship between the human capital qualities of frontline managers and organizational performance. I draw upon human capital concepts developed in the fields of economics, management, and human resource management to clarify the relationships between human capital and organizational performance for public organizations. I develop a theoretical framework to facilitate a more effective use of human capital concepts for public administration scholars and empirically evaluate several aspects of this framework by assessing the influence of frontline manager human capital on organizational performance.

The organizational setting I use to examine this relationship is New York City (NYC) public schools in grades 3-8 (elementary-middle schools) and grades 9-12 (high schools). I focus on principals as the frontline managers in these organizations and examine the influence of a principal's human capital on organizational performance using structural equation modeling and random effects regression. The most significant results of the model, both statistically and substantively, are a positive association between a principal's tenure and internal management skills and school performance. The relationship between tenure and school performance is quadratic, however, with the positive effects of tenure diminishing more quickly for high school principals than elementary/middle school principals. The effects of six principal human capital skills in the model differ by contextual factors such as the type of school, the characteristics of the student body, and the interactive effects of these skills.

INDEX WORDS: Human Capital, Organizational Performance, Policy Implementation, Public Management

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DEDICATION

I dedicate this dissertation to my wife, Heather Robinson, for all of your love and support. Thank you for your patience as my proofreader and keeping everyone moving in the right direction during all these hours in the home office or the coffee shop. I promise not to ask you for any one-sentence summaries for at least a few weeks.

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CHAPTER 1

INTRODUCTION

This dissertation focuses on the relationship between the human capital qualities of frontline managers and organizational performance. Human capital is a term used in a variety of fields to describe the quality of a workforce. Summarizing the research on human capital, Blair (2011) defines the concept as the "name for the skills, knowledge, and capabilities of the workforce of a firm…as well as the organizational arrangements and networks of relationships those people have formed that enable them to be more innovative and productive" (p. 49). The theoretical development of human capital is primarily in the field of economics. The economics literature describes some hypotheses that specify productivity gains from investments in human capital but also discusses several challenges in assessing these hypotheses. Consultants (Michaels, Handfield-Jones, & Axelrod, 2001) and management scholars (Crook, Todd, Combs, Woehr, & Detchen Jr., 2011) also stress the positive relationship that exists between an organization's human capital and its performance.   Human capital is also frequently used by public administration scholars and practitioners, but the theoretical development of human capital is primarily in other disciplines. In the field of public administration, there are many unanswered questions regarding the application of human capital theory to the study of public organizations.

In this dissertation, I draw upon human capital concepts developed in the fields of economics, management, and strategic human resource management to clarify the relationships between human capital and organizational performance for public organizations. To do so, I discuss the prospects and challenges of advancing human capital theory by incorporating the scholarship from other fields with key ideas from public administration. Based on this literature, I develop a theoretical framework to facilitate a more effective use of human capital concepts for public administration scholars. I empirically evaluate several aspects of this framework by assessing the influence of frontline manager human capital on organizational performance.

The organizational setting I use to examine this relationship is New York City (NYC) public schools in grades 3-8 (elementary-middle schools) and grades 9-12 (high schools). I focus on principals as the frontline managers in these organizations and examine the influence of a principal's human capital on organizational performance. My main testable prediction is that greater levels of managerial human capital are associated with higher levels of organizational performance. I first assess this assumed relationship without specifying the mechanisms through which a manager's human capital influences organizational performance. Since managers can play a key role in the implementation of programs that may also influence performance (Bardach, 1977; Mazmanian & Sabatier, 1989; O'Toole Jr, 2011), I also assess the effects through such a program.

In summary, I assess the effects of managerial human capital on organizational performance through two different paths, unspecified means and program implementation. I evaluate these effects separately for elementary-middle schools and high schools to account for the different leadership practices required in these two settings (Leithwood, Louis, Anderson, & Wahlstrom, 2004). Recognizing that the multi-dimensional nature of performance makes the task of assessing performance especially difficult in public organizations (Talbot, 2010), I use two different aspects of performance for each group of schools. By assessing both the influence of human capital on organizational performance across two different groups of schools, using two different measures of performance for each group, and through two different mechanisms, I provide a range of empirical assessments to evaluate my theoretical framework connecting human capital and organizational performance. Through the development and assessment of a model connecting principal human capital with school performance, this dissertation aims to improve upon human capital theory as applied to public organizations, and in doing so, inform human capital management for public administration practitioners.

Human Capital and Organizational Performance

Assessing the influence of human capital on organizational performance is an important undertaking since the concept of human capital is central to recent efforts to improve the quality of the public sector workforce. These efforts gained momentum amidst New Public Management (NPM) reforms as many governments decentralized human resource management to varying degrees to ostensibly improve the performance of public sector organizations (Kettl, 2005; OECD, 2008; Pollitt & Bouckaert, 2011). In the U.S., public organizations refer to reforms focused on improving workforce quality as “human capital management” (Selden, 2009) while internationally the term “strategic human resource management” is more common (Farazmand, 2007). Both perspectives emphasize measuring the skills of an organization’s workforce to align with desired employee qualities as specified in the organization’s strategic plan. By detecting and addressing skill gaps, defined as a variance between the size and requisite skills of a workforce and what an organization forecasts it will need to achieve its goals, these reforms advocate that human capital plays a vital role in organizational performance (D. B. Lynn, 2001; U.S. Government Accountability Office, 2017).

The extent to which countries embrace NPM reforms to decentralize human resource management varies (OECD, 2008; Pollitt & Bouckaert, 2011), but the use of frameworks that require the measurement of employee competencies is a “clear trend” in OECD countries (OECD, 2017, p. 56). Notable reforms in the U.S. federal government include a 2002 law that established a Chief Human Capital Officer in the 27 largest federal agencies ("Chief Human Capital Officers Act of 2002," 2002; Dodaro, 2012) and the establishment of a Human Capital Assessment and Accountability Framework by the Office of Personnel Management (OPM) in 2006 that provided systems, standards, and metrics to assist federal agencies in their management of human capital. Many U.S. states also initiated civil service reforms to provide additional flexibility for public employers to hire and retain highly skilled workers (Kellough & Nigro, 2006; Selden & Jacobson, 2009).

While practitioners point to these reforms as examples of improvements in human capital management, public administration scholars have had surprisingly little to say regarding whether these reforms will improve organizational performance. Human capital frameworks developed by reformers are based in part on assumptions that organizations can identify the human capital qualities of prospective employees and match them with their position requirements. Despite the proliferation of such frameworks, there is little empirical evidence that public sector organizations can employ human capital frameworks successfully and routinely, or that human capital qualities are reliable predictors of performance.

Part of the challenge for public sector organizations is that despite the existence of human capital theory for several decades, there is still much work to be done to apply human capital concepts to the study of public organizations. There is a robust literature on human capital in other fields, especially economics, that describes human capital theory (Becker, 1993; Mincer, 1974; Schultz, 1981). While this literature provides several well-developed hypotheses, other scholars note some of the shortcomings of this concept, especially in measuring a person's human capital (Blair, 2011; McGregor, 1988). There are also questions regarding the applicability of human capital concepts to different sectors of the economy (Dickens & Lang, 1988).

While public administration scholars refer to human capital, the field should do much more to improve upon the theoretical development of human capital concepts, especially as they apply to the study of public organizations. The review by Fernandez, Resh, Moldogaziev, and Oberfield (2015) on the use of the Federal Employee Viewpoint Survey (FEVS), formerly known as the Federal Human Capital Survey, illustrates this point. Of the 42 articles the authors review, only two examine the association of human capital qualities and organizational performance. As I discuss in Chapter 2, a broader assessment of studies of human capital in the field's leading journals supports the need for more empirical evidence on the association of human capital qualities and organizational performance. There are especially few empirical studies that assess the influence of skills such as a human capital quality on performance. Empirical studies of human capital skills mostly focus on character skills such as the trustworthiness of a manager (Cho & Ringquist, 2011). Since other dimensions of a person's personality such as public service motivation (G. A. Brewer, 2012; Perry & Wise, 1990) and emotional intelligence (Goleman, 1998) may influence performance, public administration scholars should improve upon prior human capital scholarship by broadening the definition of human capital skills that may influence performance.

As this research indicates, there is a significant gap between theory and practice in the application of human capital theory to public organizations. While public organizations pursue reforms to improve human capital management, public administration scholarship lacks a strong theoretical foundation to inform these efforts. The field borrows concepts of human capital from other disciplines, but there is no shared understanding in the field of how these concepts from other disciplines apply to the study of public organizations. This dissertation addresses this shortcoming in public administration literature by clarifying the theory connecting human capital management policies, levels of human capital, and organizational performance and empirically evaluating the association between the human capital of public managers and organizational performance.

Research Questions

Studies in public administration support a positive association between managerial quality and organizational performance (Meier & O'Toole Jr, 2002, 2007; Petrovsky, 2010; Rainey & Steinbauer, 1999), but empirical evidence of the effects of managerial human capital qualities on organizational performance is less developed (Teodoro & Switzer, 2016). Intuitively managerial human capital should matter for the performance of public organizations, therefore a human capital approach that considers a person’s knowledge, skills, and abilities in comparison to their position requirements should lead to better informed hiring, promotion, and retention decisions than approaches that do not consider such data. At a fundamental level, effective human capital management centers on two main propositions: first, organizations can identify the human capital qualities of current or prospective employees and match them with their position requirements, and second, that human capital qualities are reliable predictors of performance. This dissertation addresses these propositions through the following research questions:

What aspects and levels of human capital are positively associated with organizational performance?

Does the strength of these associations differ based on the characteristics of the organization?

In this dissertation I assess the association between levels of human capital and their influence on organizational performance, using literature from other fields to identify the human capital qualities that should relate to organizational performance. The processes that organizations use to inform their evaluation of the human capital needed to accomplish their mission is an important area for research. The nature of the research questions and the data prevent an examination of the activities that should influence the levels of human capital in an organization, but I can examine the levels of human capital in organizations and their associated impacts on performance. I draw upon the public management and educational leadership literature to identify the human capital qualities that should relate to organizational performance. By observing the variation of these human capital qualities and organizational performance, I assess the viability of the human capital approach to public sector organizational performance.

These research questions have both scholarly and practical value for the field of public administration. By developing a theoretical framework connecting human capital management, levels of human capital, and organizational performance, this dissertation seeks to provide a more solid theoretical foundation for scholars to employ human capital concepts in public organizations. Since I focus on public managers, this study also contributes to one of the central topics of public management literature that managers make a difference in the performance of public organizations (L. E. Lynn, 1996). It also has important practical implications as public organizations pursue reforms that measure employee human capital to improve performance.

Dissertation Structure and Organization

The focus of my dissertation is to provide a framework to guide public administration scholarship to better inform human capital in theory and practice and evaluate its utility using panel data on public school principals in NYC. To meet these objectives, in Chapter 2 I describe and apply the key hypotheses and assumptions of human capital theory from other disciplines to public administration. This chapter culminates in a theoretical framework to explain the association of human capital with organizational performance in public sector organizations. This theoretical framework informs my hypotheses that evaluate the human capital of school principals on organizational performance that I discuss in Chapter 3. The remainder of the dissertation empirically evaluates these hypotheses to inform an assessment of the theoretical framework as a tool for public administration scholars and practitioners.

Chapter 2 draws upon human capital theory as developed in economics, management, and strategic human resource management to summarize the challenges of applying human capital concepts to public organizations. I focus specifically on the work of economists from the University of Chicago that formalized the concept of human capital, including Becker (1993), Mincer (1974), and Schultz (1981). This literature provides insights into the central hypotheses of human capital theory, some of the important assumptions underlying these hypotheses, and the key measurement challenges inherent in a human capital approach. I also draw upon literature from management, strategic human resource management, and labor economists that point to important shortcomings of human capital theory to include accounting for the influence of individual human capital at the organizational level, controlling for the influence of a person's background on other human capital qualities, controlling for the influence of organizational culture on human capital, and assessing the applicability of human capital in lower wage occupations.

Based on this understanding of human capital theory as developed in other fields, I assess the empirical evidence in the field of public administration on the association between human capital and performance. Although this scholarship provides important insights, the field has not addressed the shortcomings of human capital scholarship from other disciplines to advance human capital as a theory and adapt it to the unique context of public organizations. The literature in this chapter informs a theoretical framework that integrates prior scholarship in economics, management, strategic human resource management, and public administration to articulate a theoretical framework of testable assertions that certain activities and subobjectives of a human capital approach should lead to improved organizational performance. I conclude this chapter with a discussion of my research questions which evaluate several components of this framework.

In Chapter 3 I describe the units of analysis to assess the theoretical framework and my research questions. Some important qualities of the units of analysis are variation in the human capital qualities of front-line managers, reasonably objective measures of organizational performance, and accountability between the front-line manager and these measures of performance. I draw upon descriptive data on NYC school principals to demonstrate that principals change frequently and thus vary in terms of the human capital quality of experience. I also discuss a shortcoming in the public administration literature that few studies assess the influence of human capital skills on organizational performance. I identify the principal human capital skills likely to influence school performance from the educational leadership literature.

Few studies use subordinate evaluations to measure human capital skills, but I explain how they offer a means to assess principal human capital skills in NYC public schools.

Although measuring organizational performance presents many theoretical and empirical challenges (Talbot, 2010; Walker, Boyne, & Brewer, 2012), I explain the performance measurement system employed by NYC schools that uses several tools to make their published assessments of school performance as comprehensive as possible. Although all measures of performance are somewhat subjective (G. A. Brewer, 2006), I explain how the NYC school performance metrics are salient to the organization and to parents or guardians of NYC public school students and assess several different aspects of organizational performance. Lastly, insights from educational leadership literature and processes used by NYC public schools inform my premise that there is accountability between principals as front-line managers and the measures of performance I use in this dissertation.

In addition to the effects of a principal's human capital skills on school performance through unspecified mechanisms, a principal may also influence school performance through program implementation. In the case of NYC schools, I explain how the Contract for Excellence (C4E) program consists of several different policies that may have an effect on school performance. Assessing the implementation of these programs is difficult due to the ambiguity of program goals (Matland, 1995) and lack of measurable outputs for most of the policies within the C4E program. One component of the C4E program that does provide clear goals is class size reduction. I discuss the empirical evidence that class size reduction should lead to improved school performance and why principals are the key actors in the implementation of this program. A principal's human capital may therefore have an effect on the extent to which he or she implements the class size reduction program, and in turn, school performance. Since this is a non-experimental research design, I discuss other variables that influence school performance which I control for to reduce the possibility of a spurious association between a principal's human capital and school performance. This chapter concludes with a summary of the hypotheses that I will use to assess the influence of principal human capital on school performance.

Chapter 4 focuses on the research methods I use to assess the influence of principal human capital on school performance. As noted earlier, managerial human capital may effect organizational performance through unspecified means or exercise an effect through program implementation to improve organizational performance (Mazmanian & Sabatier, 1989). Accounting for effects through program implementation is especially important in the field of public education since principals frequently spend time managing resources (Hess & Kelly, 2007). I describe how structural equation modeling is an appropriate method to assess these effects based on the variables of interest I describe in Chapter 3. I also describe my use of confirmatory factor analysis to measure five out of the six principal human capital skills in my model. I discuss why a pooled structural equation model is an appropriate modeling strategy in comparison to other alternatives. I conclude this chapter with a discussion of the limitations of some of my measures and some strategies I employ to mitigate the effects of these limitations.

In chapter 5 I examine the effects of principal human capital on school performance through unspecified means, both for all schools over the course of the panel and for the smaller subset of schools implementing the class size reduction program. Chapter 6 consists of the analysis of the effects of principal human capital on school performance through implementation of the class size reduction program for the smaller set of schools that receive funds for this program. In each chapter, I also discuss the results using some alternative measures for several of the human capital skills in my model and compare the results from the pooled structural equation model with a random effects regression.

Chapter 7 concludes the dissertation with an assessment of the theoretical framework discussed in Chapter 2 to guide research in the field of public administration. I examine the combined effects of the influence of principal human capital on school performance through unspecified means and program implementation. I compare these effects to other variables in the model that influence school performance to place the influence of principal human capital into perspective. However, because the influence of a manager may work though many causal pathways, distilling the overall effect of managerial human capital on performance is difficult. This is especially true in public organizations in which managers implement programs that often have vague goals. While a principal's human capital may or may not have some effect on performance through the implementation of the class size reduction program, there is no guarantee that the same result holds true for other programs. Furthermore, it is difficult for researchers to quantify the effects of other programs due to the challenge of vague goals and subsequent difficulty in measuring the outputs of these programs. I therefore discuss how the framework used in this dissertation is useful to guide assessments of human capital in public organizations, but assessing the effects of human capital through unspecified means will likely prove much easier than accounting for the effects of human capital through program implementation.

I conclude with a discussion of the contributions this dissertation makes in applying the concepts of human capital developed in other fields to the study of public organizations. First, this dissertation integrates concepts of human capital developed in economics with key ideas in public administration with a framework to assess the effects of human capital on the performance of public organizations. Second, I assess the effectiveness of subordinate evaluations as a measure of a manager's human capital. Lastly, I empirically assess some key portions of the human capital framework I propose that has important implications for both theory and practice since many public organizations seek to quantify the human capital in their organizations to improve organizational performance.

CHAPTER 2

HUMAN CAPITAL: CONTEXTUAL AND HISTORICAL PERSPECTIVE

This chapter provides an overview of human capital concepts as developed in other disciplines and applied to public administration scholarship and practice. This summary informs an assessment of the challenges that confront public administration scholars in integrating human capital concepts to the study of public organizations and why confronting these challenges is important for the field of practice. I first outline the key ideas in human capital scholarship, primarily from the field of economics, and some of the major criticisms of this scholarship that impact its application to the study of public organizations. Next, I describe public administration scholarship on human capital and note the work that remains to improve upon human capital concepts from other fields. I then discuss how human capital is currently integrated into the field of practice and why further theoretical development and empirical assessments of human capital theory is important for scholars to inform the field of practice. I then make the case that there are some unique characteristics of acquiring and managing human capital that distinguish this process in the public sector compared to the private sector. I conclude by offering a framework to organize existing research on human capital, clarify the concepts and relationships regarding human capital and organizational performance in the public sector, and guide a consistent application of human capital concepts to public administration theory and practice.

What is Human Capital?

Before considering whether human capital is an appropriate research focus for the field, some definitional clarity is in order. What do we mean by human capital, and is there a difference in human capital management and human resource management (HRM)? Human capital is a term used in a variety of fields to describe the quality of a workforce. Summarizing the research on human capital, Blair (2011) defines the concept as the "name for the skills, knowledge, and capabilities of the workforce of a firm…as well as the organizational arrangements and networks of relationships those people have formed that enable them to be more innovative and productive" (p. 49).

In the field of practice, human capital is frequently at the center of reform efforts to improve the quality of the public sector workforce. New Public Management (NPM) reforms in many governments focused on measuring and improving the performance of public sector organizations to adapt to economic challenges and other changes shaped by globalization (Kettl, 2005; Ridder, Bruns, & Spier, 2005). NPM reforms generally favored decentralized decision-making and greater discretion for public managers to enable the planning and recruitment of a more highly productive workforce (Daley, 2012; Farazmand, 2007; McGregor, 1988).

Human capital is an integral part of these reforms as public organizations emphasized measuring the skills within their workforce and how well they aligned with desired employee qualities (Selden, 2009). By detecting and addressing skill gaps, defined as a variance between the size and requisite skills of a workforce and what an organization forecasts it will need to achieve its goals, the assumption is that human capital plays a vital role in improving the performance of public organizations (D. B. Lynn, 2001). Advocates of a human capital approach contend that traditional human resource management practices in the public sector result in excessive protections for employees and place undue limits on public managers that affect their ability to shape their workforce to meet future challenges (G. A. Brewer & Kellough, 2016).

Across the European Union, most member states pursued reforms to decentralize human resource responsibilities, integrate them more closely with management, and permit greater flexibility in recruitment and career management (Demmke & Moilanen, 2010). As noted in Chapter 1, the U.S. federal government instituted statutory provisions for human capital management, and the Office of Personnel Management (OPM) provides guidance to assist federal agencies in the management of human capital ("Chief Human Capital Officers Act of 2002," 2002).[1] U.S. states also initiated a variety of civil service reforms, many of which aimed to provide additional flexibility for public employers to hire and retain highly skilled workers (Kellough & Nigro, 2006).

One notable shortcoming of human capital frameworks employed by practitioners is that the causal connection between levels of human capital, processes that affect these levels of human capital, and organizational performance are not clear. Take for example the Human Capital Framework (HCF) developed by OPM for use by federal agencies in Figure 2.1. The HCF, codified in the Federal Register, contains four components: Performance Culture, Talent Management, Strategic Planning and Alignment, and Evaluation ("Personnel Management in Agencies," 2016). Performance Culture focuses on practices to retain existing talent within agencies while Talent Management focuses on the processes to identify and hire the workforce needed to accomplish an organization's mission. Strategic Planning and Alignment focuses on harmonizing an agency's human capital programs with its mission, goals, and objectives. Lastly,

[1] OPM issued a revised Human Capital Framework (HCF) in 2010 to comply with legislation mandating that OPM collaborate with agencies to integrate human capital strategies into their strategic plans ("Personnel Management in Agencies," 2016).

Evaluation ensures an agency's human capital processes continue to improve and remain consistent with merit system principles. While OPM acknowledges that each component is an open system, it is unclear from the framework what moderating variables organizations should consider that might impact each component of the framework. The framework also does not provide a common understanding of employee qualities that should be considered as important components of human capital.

While practitioners point to these reforms as examples of improvements in human capital management in the public sector, there are some important theoretical questions regarding human capital that are not addressed in public administration scholarship. For instance, what are the assumptions underpinning reforms aimed at increasing human capital in the public sector, and are these assumptions contingent on certain conditions? What human capital qualities are important for the performance of public organizations? How do we measure these human capital qualities, both at the individual and organizational level? To begin the process of providing answers to these questions, the next section briefly outlines the key ideas in human capital scholarship. This research demonstrates that applying human capital concepts to the study of public organizations presents some theoretically interesting challenges as quantifying an organization's human capital may be more complicated than it initially appears.

What is a Human Capital Framework?: An Assessment of Current Theory

Human capital is a concept used in a variety of disciplines for different purposes. Perhaps most pertinent to understanding how human capital may influence the performance of public organizations, economists tend to focus on the association of human capital and productivity, management scholars on the effects of human capital within different levels of an organization, and HRM scholars on the acquisition and management of human capital. When a concept is used in a variety of disciplines, addressing construct clarity is a concern since theories developed in one field may be used inappropriately in another (Ployhart, Nyberg, Reilly, & Maltarich, 2014). Construct clarity is the extent to which a definition that establishes boundaries for an abstract concept is "precise and scholars in a community agree upon it" (Molloy & Ployhart, 2012, p. 152). Since the formal development of human capital theory is primarily in economics and to a lesser extent management and HRM, public administration scholars borrow the conceptual definitions of human capital from these other fields. Understanding how these fields define and assess human capital is an essential first step to establish construct clarity for human capital theory in public administration.

Human Capital in Economics

Human capital traces its origins to the field of economics. Primarily led by Jacob Mincer, Gary Becker and Theodore Schultz, economists at the University of Chicago in the 1950s, the early work on human capital sought explanations for economic growth in countries beyond measures of physical capital such as factories or machines. Becker summarized this research in his influential 1964 work, *Human Capital*, which used the term to describe many forms of investment in individuals that increase their knowledge and skills, primarily focused on education and training (Becker, 1993). With this definition, Becker urged scholars to think about investments in human capital as they do investments in physical capital. Becker theorized that human capital investments entail costs, but these investments increase growth and productivity in future time periods. Later scholars applied human capital theory to explain measures of population quality and economic progress (Schultz, 1981) and return on investments in education and work experience (Mincer, 1974).

Taken together, the Chicago economists argue that organizations composed of employees with higher levels of education, skills, and abilities should outperform those with comparatively lower levels. Their research underscored the importance of effectively investing in human capital for individuals and organizations. These economists primarily focused on choices at the individual level through a cost-benefit perspective comparing the expected benefits of human capital investments to their costs. Becker (1993) argued that the insights derived from the micro focus on individuals could also inform group or macro level behavior. Scholars in other fields later criticized the method of aggregating individual human capital to assess human capital at the group level (Ployhart & Moliterno, 2011). However, aggregation is still a common method as evidenced by human capital models used by the United Nations (United Nations Task Force on Measuring Human Capital, 2016) and the World Bank (J. Y. Kim, 2018).

There are several commonly referenced hypotheses in the economics-based human capital scholarship. First, just as investments in physical resources add productivity in future time periods, investments in human capital such as more highly educated, trained, and skilled workers will likewise increase productivity. Since the human capital approach assumes wages are proportional to individual productivities, a person that invests in education and skill enhancement will generate higher wages in future time periods (Harrison & Sum, 1979).

Second, Becker differentiates human capital into two forms, firm specific and general human capital. General human capital, for example a master's degree in public administration, is more portable across organizations than firm specific capital such as training on organization-specific software (Becker, 1993; Foss, 2011). Becker theorized that since organizations cannot always realize the gains from investments in general human capital due to employee mobility, they are not incentivized to pay the costs of such investments. Individuals, however, have an incentive to pay the costs of investments in general human capital as increases in their knowledge, skills, and abilities will result in higher wages. The opposite is true for specific human capital. Individuals are not incentivized to bear the costs of specific training because if they lost their job, their investment in specific training would not increase their value to other employers. Organizations are hurt by the departure of employees with specific training since an equally profitable replacement cannot be found in the general labor pool, therefore they will pay these employees a higher wage than a comparative employee with only general training.

While the distinction between general and specific human capital is useful for explaining the incentive structures for investments in human capital, some scholars argue the assumptions underlying this distinction are incomplete (Burton-Jones & Spender, 2011). We do see organizations, both public and private, that provide incentives to employees for development of general human capital such as reimbursement in money or time for college classes. Further specification of firm specific (not portable), industry specific (not portable outside of an industry), and individual specific (generally portable across firms and industries) human capital would aid in the application of human capital to employer and employee behavior (Von Krogh & Wallin, 2011). Recent research demonstrates the distinction between general and specific human capital may not be a useful construct at all since both forms can benefit organizations and employees (Boon, Eckardt, Lepak, & Boselie, 2018; A. Nyberg, Reilly, Essman, & Rodrigues, 2018).

A final central hypothesis of human capital scholarship is that human capital cannot be transferred from one organization to another instantly (McGregor, 1988). While a person may be able to leverage some aspects of human capital soon after changing organizations, other aspects are not immediately transferable. For example, it takes time for an individual to understand a new organization's supporting capabilities, integrate with new teammates, and leverage formal and informal networks, especially in positions requiring complex decision-making (Boxall, 2011; Brymer, Hitt, & Burton-Jones, 2011; Groysberg, 2010).

This aspect of human capital is important to consider in light of current trends regarding worker mobility. Compared to workforce trends for much of the 20th century, in the age of the internet fewer managers remain with one organization for an entire career due in part to greater transparency regarding new job opportunities (Abramson, DeMesme, & Willenz Gardner, 2002). Within organizations, another driver of employee mobility is the perceived benefit to talent development from working across many different job functions (Berger, Gan, & Fritzler, 2016; Campion, Cheraskin, & Stevens, 1994).[2] These trends imply employees are increasingly mobile, so understanding the portion of an individual's human capital that is immediately transferable versus the aspects that will take longer to manifest is an important, but less developed, aspect of human capital theory as developed in economics.

Human Capital in Management

Scholars in the field of management recognized that the micro focus in the economics literature limited their ability to explain the effects of human capital at different levels of an

[2] This practice was encouraged recently in the U.S. federal workforce by an Executive Order aimed at increasing the rotation of members of the Senior Executive Service (SES) across different positions and agencies (*Executive Order 13714*, 2015). The original concept for the Senior Executive Service was a "government-wide, cohesive corps of individuals that encouraged mobility within and across government agencies" (M. P. Carey, 2012). However, job rotations were not viewed positively but instead seen as a mechanism to transfer unwanted personnel. OPM also delegated many of its supervisory tasks for the SES to individual agencies, thus making it difficult for a centralized agency to fulfill the original intent of frequent rotations among SES members.

organization. From their perspective, an organization's human capital may not simply be the sum of the human capital of the individuals in the organization. Some combinations of individual human capital may be more valuable for an organization than others. For instance, while the aggregate levels of human capital may be the same, would it be better for an organization to have average performers on a human capital characteristic or some low and some high performers? Drawing on work in psychology, organizational behavior, and strategy among other fields, scholars in management articulated three concepts to provide a better means of evaluating human capital effects at the organizational level: complementarities, emergence, and human capital resources.

Complementarities is a concept that examines resource combinations in which "the presence of one element increases the value of others" (Ennen & Richter, 2010, p. 210). Management scholars describe two main types of complementarities, interactive and causal. An interactive complementarity describes a combination of groups with different levels of human capital that may have an interactive impact that differs from what one would expect by simply examining the aggregate human capital within the groups. For instance, an organization may recognize higher performance if it has some employees with high levels of cognitive abilities to engage in problem solving and others with high levels of emotional intelligence to provide customer service. The interaction of these two units would produce different results for the organization than if they were used independently (Adegbesan, 2009). The second type, a causal complementarity, describes a generic human capital quality that shapes the development of a more unit specific quality. For example, high levels of cognitive ability within a group may positively influence the group's ability to learn a new job skill quickly (Campbell, Coff, & Kryscynski, 2012).

As opposed to complementarities which focus at the unit level, the concept of emergence uses a micro level perspective to explain how individual human capital qualities combine to create a unit-level resource (Ployhart et al., 2014). Emergence provides a theoretical explanation of the aggregation process through a bottom-up perspective that emphasizes the interaction process of individual level characteristics within a group (Kozlowski & Chao, 2012). Ployhart et al. (2014) describe emergence as either simple or complex. A simple form of emergence takes place when a task requires combining similar human capital qualities of group members such as in the case of a group lifting a heavy weight. In contrast, a complex form of emergence occurs when a task requires a combination of different human capital qualities such as a surgical team that brings together individuals with different forms of expertise. In such situations, the interdependencies, interactions, and relationships among the group members shape the emergence process.

Ployhart and Moliterno (2011) provide a framework to explain the emergence process and distinguish between simple and complex forms of emergence. They argue that task interdependence and relationships are important variables that shape the emergence process and determine the extent to which individual human capital contributes to higher levels of organizational human capital. When task interdependence is high, relationships among organizational members are especially important for the emergence process to take place. If personality characteristics of team members such as competitive ambition negatively affect cooperation within the organization, there may not be a positive relationship between the individual human capital qualities of the team members and the human capital at the organizational level. However, when task interdependence is high and there are high levels of coordination and cooperation among individuals in the team, there is a positive relationship between individual and organizational human capital.

Lastly, because of the complexity involved in the aggregation of individual human capital at the organizational level, some management scholars argue that human capital should remain an individual-level construct and the term human capital resources should distinguish human capital at the organizational level (A. J. Nyberg, Moliterno, Hale, & Lepak, 2014). This rigid distinction between the individual and organizational level quickly met resistance, however, because of the theoretical issues that such a distinction ignores. For example, upper echelon theory (Hambrick, 2007; Hambrick & Mason, 1984) articulates that the background characteristics of top-level executives affect their choices and in turn shape the organization. The literature that focuses on high-performance individuals, or "stars," also presents a challenge to a rigid distinction between human capital at the individual and organizational level since high-performers may have a disproportionate impact on organizational level outcomes (Rothaermel & Hess, 2007). Ployhart et al. (2014), therefore, offer the following distinction between human capital and human capital resources to account for the multi-level influence of individual human capital. They define human capital as an individual's knowledge, skills, abilities, or other characteristics that are relevant for achieving economic outcomes that accrue to the individual. A human capital resource is an individual or unit-level capacity that is accessible for unit-relevant purposes. Accessibility and relevance are therefore important factors that link individual human capital to human capital resources for an organization.

Human Capital in Human Resource Management

While scholars in economics and management focus on the effects of human capital on organizational performance, this literature does not provide much perspective on how organizations acquire and manage their human capital. The field of human resource management examines practices such as employee recruitment, selection, training, and development. Within this field, some scholars articulate a strategic human resource management perspective. This perspective differs from a traditional HRM approach in that it examines how human resource practices work together as a system toward goal achievement and performance at the organizational level (Boon et al., 2018). The premise that strategic human resource management practices have a positive influence on performance is well supported in the literature (Combs, Liu, Hall, & Ketchen, 2006), but strategic human resource management scholars seek a richer understanding of the mechanisms through which human resource practices affect performance (P. M. Wright & McMahan, 2011). Some strategic human resource management scholars point to human capital as a promising concept to describe these mechanisms (A. Nyberg et al., 2018).

In contrast to studies in economics and management that primarily use human capital as an independent variable to explain organizational performance, strategic human resource management scholars use human capital as a mediator variable to explain the relationship between strategic human resource management practices and organizational performance. A key puzzle for strategic human resource management scholars that the other two fields do not address is how strategic human resource management practices influence the acquisition and development of human capital. Recognizing that "many highly skilled employees can exhibit mediocre or even inferior performance," strategic human resource management scholars share the perspective of management scholars that individual human capital combines in complex ways at the organizational level (P. M. Wright & McMahan, 2011, p. 99). In turn, these scholars also place an emphasis on personality characteristics of employees and other contextual factors to explain how human capital at the individual and organizational level is shaped by strategic human resource management policies and subsequently influences organizational performance.

Measuring Human Capital

The research above demonstrates that there are contending perspectives on how to measure human capital at the organizational level. The common approach in economics is to measure the human capital among individuals in an organization and then aggregate them to determine organizational human capital, but this method assumes a positive, linear relationship between individual human capital and organizational human capital. If this assumption does not hold, this measure of organizational human capital is subject to substantial error variance as described by the emergence concept. Measuring human capital at the organizational level may also be problematic since the distribution of human capital at the individual level may have important implications for organizational outcomes.

A comprehensive way to measure organizational human capital would be to measure the individual human capital in an organization and assess the emergence process to account for the human capital at the group level. This method requires significant data collection as the researcher must “gather clear and specific human capital measures from each individual within the unit” and then assess characteristics of the environment and the people in it that contribute to the emergence of organizational human capital (P. M. Wright & McMahan, 2011, p. 101). The benefits and drawbacks of the different ways to measure organizational human capital underscore the importance of aligning the measurement strategy employed by a researcher with the nature of their research questions.

There are also several common challenges to measuring human capital whether at the individual or organizational level. Unlike physical capital, human capital is a difficult investment to quantify since it is much less tangible (Blair, 2011; McGregor, 1988; Schultz, 1981). For example, education is an important component of human capital, but it can be conceptualized in a variety of contexts to include formal schooling, self-education, apprenticeships, or vocational education (Sweetland, 1996). Another challenge involves isolating how much the gains in knowledge and skills from an educational program increased productivity as opposed to other investments in human capital such as on-the-job training and experience (Blaug, 1976). The quality of an educational program should also impact productivity, so the process of categorizing the quality of different institutions and programs adds further difficulty to quantifying human capital investments.

Other scholars contend that human capital scholarship does not account for the influence of a person's background on future earnings, thereby imparting an upward bias to the influence of schooling on earnings (Cain, 1976). The endogeneity problem of using education as an explanatory variable is further complicated by research that claims educational attainment functions as a screening device for employers to distinguish the ability, motivation, and trainability of potential workers (Blaug, 1976; Sweetland, 1996). In short, education may disguise a more fundamental correlation between attributes that characterize the trainability of a worker and wages instead of the correlation between schooling and wages.

Further complicating the effort to quantify investments in human capital is the effect of organizational culture on human capital. Frequently cited research on organizational culture defines the term as shared patterns of beliefs and common understandings among members of an organization (Dyer Jr., 1986; Khademian, 2002; Schein, 1992). An organization's culture may condition the influence of human capital investments on performance in an enduring way that is not accounted for through the concept of complex emergence discussed earlier.

Differences in labor markets for high and low skilled workers pose another challenge to measuring human capital investments. Scholars examining labor markets in the U.S. in the 1960s questioned the assumption that returns to human capital investments are the same for all individuals (Dickens & Lang, 1988). They found increases in schooling and training had almost no influence on employment and wages of many urban workers, leading them to conceptualize a dual labor market instead of a single labor market as articulated by human capital scholars (Cain, 1976). Human capital investments in high wage sectors reaped returns as expected, but in low wage sectors, human capital investments did not yield similar returns.

Summarizing a Human Capital Approach in the Context of Public Administration

In summary, human capital refers to the knowledge, skills, and abilities of an organization's employees and the relationships that enable them to be more effective. The key hypothesis is that production rises with investments in human capital, but the approach does not account for the influence of native ability and family background on either human capital investments or returns on these investments. Unlike physical capital, human capital cannot be transferred instantly as the integration of knowledge, skills, and abilities is a process that takes place over time. Human capital can take the form of general human capital which is more transferable across organizations and specific human capital which is applicable primarily to one organization. Measuring human capital is difficult since it is not a tangible good like physical capital. There are five primary measurement challenges: accounting for the influence of individual human capital at the organizational level, difficulties in quantifying the return of human capital investments, controlling for the influence of a person's background on other human capital qualities, controlling for the influence of organizational culture on human capital, and assessing the applicability of human capital in lower wage occupations.

In the context of public administration, scholars in the field recognize the focus on human capital among practitioners (Ingraham, Selden, & Moynihan, 2000; Lewis, 1991; Marshall, 1998). However, there is not a concerted effort to address the shortcomings of human capital theory identified above or assess how well human capital concepts from other fields apply to the study of public organizations. A. Nyberg et al. (2018) mention the contributions of scholars in psychology, organizational behavior, strategic human resource management, strategic management, and economics to the development of human capital theory but noticeably exclude public administration from this list.

Since public administration scholars draw on the theory of human capital as developed in other fields, I consulted the leading public administration journals to assess how scholars use the concept. Of the 33 articles that list human capital in the abstract, only seven had a dependent variable focused on organizational performance. While the difficulty of measuring performance in public organizations (Talbot, 2010) likely has a large influence on these results, a couple of issues stand out when examining the use of human capital in the field's leading journals in Table 2.1.[3]

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[3] An abstract search for the term human capital in the field's three leading journals according to Google Scholar, *Public Administration Review*, *Journal of Public Administration Research and Theory*, and *Public Management Review* yielded a total of 23 returns. I also consulted the top ranked personnel journal in public administration, *Review of Public Personnel Administration*, which yielded another 10 returns. While organizational performance was the most common dependent variable for articles that included human capital in the abstract, other common

First, scholars in the field follow in the tradition of economists by aggregating individual human capital skills to determine organizational level human capital. No articles from the field's leading journals discuss the emergence process or measure human capital skills at the organizational level through a concept such as human capital resources. Second, despite the proliferation of human capital frameworks in the field of practice, there are few empirical assessments in the field on the association between strategic human resource management policies and organizational performance or between levels of human capital in public organizations and organizational performance.

A similar trend emerges from the research conducted by Fernandez et al. (2015) on the use of the Federal Employee Viewpoint Survey (FEVS), formerly known as the Federal Human Capital Survey, administered by the U.S. Office of Personnel Management. Of the 42 articles the authors review that use data from this survey, only two, Choi and Rainey (2010) and Cho and Ringquist (2011), examine the association of human capital qualities and organizational performance. Most articles that use FEVS data focus on job satisfaction as a dependent variable and managerial practices as an independent variable instead of levels of human capital.[4] Perhaps most significantly, the field has not addressed the measurement challenges of human capital identified in prior work from other academic disciplines.

dependent variables were job satisfaction and turnover or turnover intention with five articles each. The remainder of the articles not included in Table 2.1 were descriptive studies of policies or data (5 articles), articles that used data from the U.S. Federal Human Capital Survey but did not assess performance (3 articles), an article that used human capital as control variables (1 article), a book review (1 article), and articles that assessed another dependent variable besides those previously listed (6 articles).

[4] The FEVS functions as a climate survey, so the focus of public administration research on managerial practices is not surprising. The survey's purpose is not aligned with some of the key concepts of human capital or strategic human resource management such as whether organizations are identifying and retaining employees with the appropriate skills and the resulting association between human capital and performance.

While governments press on with the development of human capital frameworks to improve performance by better managing their human capital, there is little consensus on a theoretical research agenda to enhance the effectiveness of concepts of human capital from other fields in public administration. As the next section details, there is sufficient evidence to suggest that there are unique aspects of public sector organizations that call for greater construct clarity for the use of human capital theory in public administration.

Human Capital and the Public Sector

There is a broad literature to draw on in the field of public administration that demonstrates integrating human capital concepts from other fields should account for some unique aspects of the public sector. In this section, I describe some characteristics of acquiring and managing human capital that distinguish this process in the public sector compared to the private sector. I also explain some human capital characteristics that may have unique impacts on performance in a public sector context. This literature informs a framework in the concluding section that describes a human capital approach for the field of public administration.

Acquiring and Managing Human Capital

Strategic human resource management scholars focus on the importance of aligning an organization's human capital to support the organization's goals, thus the organization's strategic plan informs decisions on what human capital qualities are needed in the organization. To answer the question "what do you need?" one must first know what the organization "is, what it does, and why" (Bryson, 2011, p. 8). In public organizations, a strategic plan is frequently influenced by external constraints as a result of the political process (Wilson, 1989), although circumstances do exist in which public agencies gain some measure of autonomy in formulating their strategy (Carpenter, 2001).

Research by Bryson (2011) explains the roles of top executives in strategic planning. In the public sector, top executives may be political appointees that come to their positions with a wide variety of previous experience. There is some debate regarding the human capital qualities, especially in regard to experience, required for top level managers. While top managers self-assess their skills as generalist in nature, studies demonstrate they underestimate the specificity of their knowledge and skills (Groysberg, 2010; Kotter, 1982). The varying demands among managers in different sectors make generalizations about the required level of specific versus general knowledge difficult to make, but the latest trends in research demonstrate that experience in a variety of functions is beneficial for promotion (Berger et al., 2016). Regardless, top executives are likely to have an influence on an organization's strategy, so understanding the effects of general and specific human capital among top managers is an important consideration that shapes strategic human resource management in public organizations.

Scholars that evaluate strategic planning also note that human resource management is a vital component of an effective strategic plan (Bryson, 2011; Mintzberg, 1979). A more explicit emphasis on human capital management that focuses specifically on building a skilled workforce may provide additional insights. Some empirical assessments of this proposition demonstrate the expected positive impacts of human capital management on performance (G. A. Brewer & Selden, 2000; O'Toole & Meier, 2009), but more research is needed to evaluate the impacts of human capital management in a variety of settings. Since public organizations often operate in environments shaped by partisan politics and legal constraints (Nigro & Kellough, 2014), the ability of public organizations to manage their human capital may be much different than that of comparable private sector organizations.

Human Capital Characteristics and Performance

The topic of measuring performance also underscores the unique application of human capital theory to the study of public organizations. There is a lack of agreement in the field on how to measure the performance of public organizations (Bouckaert & Halligan, 2008). Talbot (2010) highlights a couple of challenges to include specifying the unit of analysis since many public organizations function within a multi-level governance structure and developing measures for what are often unclear outputs and outcomes. Although measuring the performance of public organizations is a persistent challenge for public administration scholars, research indicates “a range of management practices and external constraints affect different dimensions of performance in different ways” (Walker et al., 2012, p. 8). As this section indicates, there is good reason to include human capital as a factor that influences the performance of public organizations.

The studies in Table 2.1 note a positive association between the traditional human capital qualities of education, experience, and skills and performance in the public sector. The influence of education and experience may decrease in the presence of environmental shocks as noted by Avellaneda (2009a, 2009b). Other studies indicate the significance of experience increases in highly political settings (Riccucci, 1995) or as task difficulty increases (Fernandez, 2005).

The nature of a person’s experience is also an important measure of human capital. The type, length, and recency of someone’s experience may influence the extent to which this aspect of a person’s human capital affects organizational performance. Understanding the influence of private sector experience for public sector organizations is especially important since many scholars expect the future government workforce to be characterized by employees that migrate between the public and private sectors (Abramson et al., 2002).

One study comparing private and public sector experience found positive outcomes for public sector managers with recent private sector experience to include a higher likelihood of promotion relative to their peers and a greater likelihood of supervising more employees (Bozeman & Ponomariov, 2009). However, this study also found private sector experience is not always positive as the foregoing positive outcomes diminished as the length of private sector experience increased. This research implies there may be an optimal time to switch careers from the private to the public sector, but further research should explore the effects of variables such as age and job type on this relationship as well as the effects of public to private sector transitions. Such research would also aid in assessing a general hypothesis in the literature that the higher the level of managerial responsibility, the greater the portability of a manager's talents (Simon, 1997; Yukl, 2013).

Similarly, many studies consider whether a new manager was hired from within the organization or recruited from outside as an important aspect of experience to consider (Boyne & Dahya, 2002; Karaevli, 2007; Kraatz & Moore, 2002; Petrovsky, James, & Boyne, 2015). In public organizations, hiring externally may involve a hire from another public organization or from the private sector. Proponents of hiring from within cite the benefits from a manager's established networks (Karaevli, 2007), the positive effects on performance from retaining members with high levels of organization specific human capital (Carmeli, 2004), and decreased risk since upper level managers are more familiar with an internal than an external hire (D. C. Carey & Ogden, 2004).

Other scholars contend external hires are more likely to innovate than internal hires, so hiring externally can be a method to change an organization's direction (Groysberg, 2010; Karaevli, 2007; Kotter, 1982; Teodoro, 2010). Hiring externally may also be an important method to draw upon sources of information previously unavailable to the organization (Beckman & Haunschild, 2002) or obtain new skills the organization currently lacks (Rainey, 2002). Since turnover introduces uncertainty as employees gauge the goals and expectations of the new manager (Petrovsky et al., 2015; Whitford, 2002), organizations should evaluate whether agency specific knowledge and important relationships can be gained quickly when deciding between internal and external hires (Kotter, 1982).

While these studies demonstrate the potential for the conventional human capital measures of education and experience to influence performance under certain conditions, public administration scholars should also consider broadening their definition of human capital characteristics to include dimensions of a person's personality. Three personality aspects seem especially relevant to the connection between human capital and public sector organizational performance: character skills, public service motivation, and emotional intelligence. Regarding character skills, scholarship in psychology demonstrates that traits such as grit, defined as perseverance and passion for long term goals, can predict individual performance in certain contexts more than traditional human capital characteristics focused on skills and abilities (Duckworth, Peterson, Matthews, & Kelly, 2007; Reeves, Venator, & Howard, 2014). Gould-Williams (2003) and Cho and Ringquist (2011) demonstrate the value of studying character skills in their examination of the effects of inter-personal trust and managerial trustworthiness respectively. Their findings demonstrate character skills may influence performance and underscore the need for scholars to establish more comprehensive measures of human capital.

Other research (Downs, 1967; Niskanen, 1971) considers that a person's motives to serve the public interest or a particular program may affect performance, codified formally by Perry (1996) as public service motivation (PSM). While some studies find a positive relationship between PSM and organizational performance (G. A. Brewer, Selden, & Facer II, 2000; Sangmook Kim, 2005; Ritz, 2009), a challenge is that PSM is a broad concept that may take different forms in different organizations or areas of service provision (Rainey, 1982). Another aspect of a person's personality that may influence performance, emotional intelligence, can be critiqued along similar lines (Goleman, 1998; Locke, 2005).

Despite these challenges, PSM is an important personality characteristic that deserves further study. It is difficult to apply the first two hypotheses of human capital theory from economics in the public sector since there are limitations to how much public agencies can use wage increases to retain employees with specific human capital. In turn, PSM may be an important quality that affects performance in public organizations that is not as applicable in other contexts.

Since a longstanding tenet of public administration is that managerial quality can make a difference in organizational performance (L. E. Lynn, 1996), many scholars tend to focus on managers. This is the case with studies of the influence of individual human capital skills on organizational performance noted in Table 2.1 as both of these studies examined the effects of managerial human capital skills on organizational performance. However, despite a variety of theories and approaches to studying leadership, scholars cannot point to a single leadership quality that is universally accepted within the field (Rainey, 2014; Rainey & Steinbauer, 1999). Leadership likely differs at the dyadic, group, and organizational levels, with different mediating variables influencing the actions of a leader at each level (Yukl, 2013). A more effective human capital focus would provide some structure to this vast literature through specifying the conditions under which a leader's human capital characteristics are likely to influence performance. In doing so, human capital has the potential to bridge public management literature that indicates leader quality makes a difference in organizational performance and leadership and organizational behavior literature that indicates leader characteristics influence performance (Hambrick, 2007; Hambrick & Mason, 1984). It is also likely that a leader's human capital has an effect on the emergence of the human capital of other employees in the organization, but public administration scholars have not addressed this concept in a meaningful way.

Ployhart and Moliterno (2011) provide a useful framework for public administration scholars to incorporate the concept of emergence to understand the variables that might shape the influence of a leader's human capital on organizational performance. They argue that task interdependence and relationships explain whether higher levels of individual human capital result in higher levels of organizational human capital. There are several concepts addressed by public administration scholars that could contribute to this framework and adapt it to the study of public organizations.

First, willingness to implement a policy may affect the emergence process in public organizations in addition to the factors mentioned by Ployhart and Moliterno (2011). Policy implementation is a valuable aspect of performance to study from a normative perspective since administrators are accountable to elected officials. While the implementation literature points to an administrator's disposition as an important variable that affects policy implementation (O'Toole, 1986), a human capital approach that accounts for personality aspects can help explain an administrator's motivations, and in turn, describe why an administrator may be more or less inclined to leverage their human capital to implement a policy.

Tummers, Steijn, and Bekkers (2012) describe a three-factor model that includes policy content, organizational context, and personality characteristics to explain the willingness of bureaucrats to implement policies. They characterize policy content in terms of societal meaninglessness (does the policy fail to deliver beneficial outcomes for society), client meaninglessness (are the policy instruments ineffective for its intended clients), and personal meaninglessness (does the administrator perceive implementation holds no value for him or her personally in terms of their income or job status). Important factors of the organization's context are whether professionals sense they have a say in how the organization crafts the policy and the attitudes of managers and other professional colleagues toward the policy. Finally, the personality characteristics of the administrator in terms of their rebelliousness (how individuals respond when their behavioral freedoms are restricted) and rule compliance (belief of an individual that people have to obey government regulations) will also affect their willingness to implement a policy. The work of Teodoro (2011) complements this model as he examined the conditions under which administrators are more likely to innovate. He also draws on psychology literature to articulate an important role for ambition, which has roots in achievement or power motivation for an individual, in determining the actions of administrators. When career opportunities exist in which an administrator can advance in another organization and he or she is ambitious, the administrator is more likely to draw upon the norms of their profession as opposed to rigidly following the directives of their superiors in an organization. These models highlight some conditions that shape the behavior of administrators, and in turn, can help explain the conditions under which they may or may not leverage some of their human capital qualities in their work environment.

Regarding the second factor in the framework offered by Ployhart and Moliterno (2011), relationships among employees, public administration scholarship points to positive associations between organizational justice (Kurland & Egan, 1999; E. V. Rubin, 2009; Yang & Kassekert, 2010), managerial trustworthiness (Ko & Hur, 2014), and support of career development (Soonhee Kim, 2002) with job satisfaction. In turn, these three variables are likely to influence the relationships among employees and contribute to the emergence process.

This scholarship demonstrates that dimensions of a person's personality should be considered alongside the traditional measures of human capital such as experience, education, and skills. Human capital would be an effective approach to integrate these studies to help scholars and practitioners understand how human capital broadly conceived as a person's education, experience, skills, and personality may affect organizational outcomes.

There are also conditions that affect the availability of human capital, both external and inside an organization, in the public sector. Starting with the supply of human capital external to the organization, few public administration scholars examine the influence that access to human capital based on available labor pools has on organizational performance. Some studies demonstrate the effects of human capital availability are especially pronounced when agencies are charged with the implementation of technically complex tasks (Teodoro & Switzer, 2016). Since labor pools differ across locations, scholars and practitioners should take the human capital qualities of these labor pools into account when assessing the availability of human capital. This approach deserves further research and should account for such factors as the mobility of employees in assessing human capital externally available to organizations.

Regarding the supply of human capital inside an organization, employee turnover may decrease the human capital within a workforce but can also be an opportunity to leverage hiring and promotion to acquire human capital to meet organizational needs (Hausknecht & Trevor, 2011; O'Toole & Meier, 2003). Some studies find that turnover intention is a function of an employee’s age and job tenure, workplace satisfaction, and organizational factors such as performance initiatives and relationships with coworkers or management (Pitts, Marvel, & Fernandez, 2011). Bertelli and Lewis (2013) demonstrate how a more effective focus on human capital can aid organizations in forecasting employee turnover. They found that greater agency specific human capital was associated with lower turnover intentions among U.S. federal employees. Their study demonstrates the utility of developing more precise measures of general versus specific human capital to understand the effects on turnover. Future studies would benefit from other measures of outside employment options instead of perceptual measures. Also, assessing turnover intention may lead to different findings than using actual turnover as a dependent variable.

Lastly, the extent that current employees invest in further developing their human capital also shapes the supply of human capital inside an organization. There are contending perspectives on what incentivizes a person to invest in skill development. Human capital theory holds that a person makes further investments in their human capital to increase their wages. Public sector organizations often cannot compete with their private sector counterparts on wages, especially for highly skilled employees. Gailmard and Patty (2013) argue that job tenure and discretion in shaping policy, not wages, incentivize public sector workers to further invest in their human capital.

These two perspectives highlight a tension between providing flexibility to acquire and retain human capital featured in some recent reforms and traditional civil service practices such as tenure. While freeing public organizations from traditional civil service practices may enable them to more flexibly pursue employees with the human capital characteristics the organization needs, a downside may be a disincentive for public employees to invest in agency specific human capital while on the job.

The research cited above highlights many notable contributions from public administration scholars that can inform the application of human capital concepts developed in other fields to the study of public organizations. Public administration, both as a field of scholarship and practice, needs a framework to integrate these ideas with scholarship from other disciplines that articulates how the acquisition and management of human capital can influence performance in the public sector. The concluding section offers a theoretical framework to organize and motivate research to more effectively apply human capital concepts to public organizations.

Human Capital: The Theoretical Research Agenda

As governments experiment with different approaches to human capital management, many unanswered questions remain to better integrate the concept of human capital into public administration research and practice. While human capital concepts from strategic human resource management, management, and economics provide some useful insights to inform human capital management in the public sector, there is good reason to believe that there are some unique aspects of public organizations that will affect the application of these concepts in public administration. A human capital framework for public administration should address the connection between the acquisition and management of human capital and the subsequent influence on organizational performance, account for the effects of individual human capital on performance as well as how individual human capital influences human capital at the organizational level, and account for the unique context of public sector organizations.

The problem that a human capital approach aims to solve is unsatisfactory, or at least less than optimal, organizational performance. The framework in Figure 2.2 thus starts with performance as the objective and articulates a program theory of testable assertions that certain activities and subobjectives of a human capital approach should lead to improved performance. In doing so, it aims for three broad goals: 1) urge public administration scholars to think about levels of human capital more broadly than traditional measures focused on education and experience, 2) inform how we measure levels of human capital, and 3) understand the influence of flows which are in essence levers, some controllable by public administrators and others not, that influence levels of human capital and subsequently organizational performance.

The focus of this framework is at the organizational level. The framework aims to inform research on the effects of human capital on organizational performance in public organizations. While the framework has broad applicability to different measures of organizational performance, it does not address matters such as the consequences of a human capital approach for other organizational outcomes like workforce diversity, the applicability of the framework to the full range of political systems worldwide, or assess means to influence the availability of human capital for managers. Although the majority of the strategic human resource management and human capital management literature focuses on western democracies, the framework below likely has applicability to public organizations in a variety of settings.

Consistent with strategic human resource management and human capital management approaches focused on reconciling skill gaps in a workforce, the left side of the framework focuses on an organization's strategic plan, and moving from left to right within the framework, how this strategic plan influences human resource management policies and decisions. Starting on the left side with the process of formulating an organization's strategic plan, the framework holds that leaders undertake a set of activities (1) to formulate the strategy for an organization that includes an overall strategic plan, the structure to accomplish the plan, and the human capital required to support the plan. Variables such as the organizational setting (Wilson, 1989), the initial stock of human capital in the organization, and the actions of senior leaders in the organization (Bryson, 2011) influence the process of strategy formulation. Organizations that are more effective in designing a strategic plan should be positively associated with outcome (a), identification of their human capital requirements.

Once an organization identifies its human capital requirements (a), the next activity is to incorporate these requirements into the organization's strategic human resource management policies (2). For example, if the organization desires to increase the amount of certain human capital characteristics in its workforce, it must design policies to recruit prospective employees with such qualities (Linos, 2018; Rodwell & Teo, 2004). The organizational setting will influence this activity as public organizations frequently operate within the context of civil service rules to ensure an equitable process for applicants (G. A. Brewer & Kellough, 2016; OECD, 2008).

Through the process of implementing strategic human resource management policies (2), organizations integrate the human capital requirements identified in the strategic plan (a) into the actual policies used to manage human resources (b). Measuring outcome (b), the integration of human capital requirements into human resource management, should involve assessing skill gaps which represent a shortfall between current or projected human capital in the organization compared to the levels of human capital identified in the organization’s strategic plan (Farazmand, 2007; D. B. Lynn, 2001; OECD, 2017).

Continuing to move from left to right in the framework, an organization addresses skill gaps (b) identified through the implementation of strategic human resource management policies (2) through the process of leader and employee human capital management (3). Personnel turnover, recruitment, retention, promotion, and employee development are all activities organizations can undertake to influence the level of human capital within the organization (c).

While some studies demonstrate a positive relationship between human capital management and performance (G. A. Brewer & Selden, 2000; Coggburn & Kearney, 2010; O'Toole & Meier, 2009), few studies examine the relationship between human capital management and levels of human capital in the organization. Personality traits such as character skills (Cho & Ringquist, 2011; Duckworth et al., 2007; Gould-Williams, 2003; Reeves et al., 2014), public service motivation (G. A. Brewer, 2012; Ritz, 2009), and emotional intelligence (Goleman, 1998) may be associated with higher levels of performance, so these personality traits should also be considered in addition to the traditional human capital measures of education, experience, and skills. Since leader quality (Meier & O'Toole Jr, 2002) and characteristics (Hambrick, 2007; Hambrick & Mason, 1984) may influence performance differently than human capital investments at lower levels of the organization (Cain, 1976; Dickens & Lang, 1988), the association between human capital management (3), levels of human capital in the organization (c), and organizational performance should be considered for both leaders and employees within the organization.

Recognizing that public and private organizations compete for leaders and employees with high levels of human capital (OECD, 2017), factors such as the location and type of work may affect the available labor pool for organizations and in turn influence the human capital qualities of leaders and employees within an organization (Teodoro & Switzer, 2016). Characteristics of the organizational setting may also influence human capital management. Wage conditions in the public labor market may constrain the ability of public organizations to attract leaders and employees with high levels of human capital (Donahue, 2008; OECD, 2017). Civil service protections also play a role in the acquisition of human capital as current employees may continue to invest in expertise under conditions of reasonable certainty regarding job tenure (Gailmard & Patty, 2013).

While the human capital of individuals (c) has an effect on the human capital resources (d) at the organizational level, human capital resources may not be simply the sum of the individual human capital in the organization (Ployhart et al., 2014). Scholars must therefore decide whether to assume a positive, linear relationship between individual and organizational human capital through the aggregation process or examine more complex interactions of individual human capital by using the concept of emergence. The emergence process may be influenced by task interdependence and relationships as explained by Ployhart and Moliterno (2011), but in public organizations, policy characteristics and the organizational setting may also play a role (Teodoro, 2011; Tummers et al., 2012). This framework also facilitates the assessment of complementarities between human capital variables (Ennen & Richter, 2010).

The network structure of an organization may also moderate the impact of human capital management. Public agencies seldom function as a unitary actor but instead frequently operate in conjunction with other agencies, both public and private (Meier & O’Toole, 2006; Provan &

Milward, 2001). In such environments, the human capital qualities of a workforce will likely influence the environment but also be influenced by it, thereby complicating efforts to isolate the effects of human capital qualities (c) on organizational performance. The framework offered by Provan and Milward (2001) may be instructive for human capital researchers to address this challenge by analyzing human capital at different levels of analysis within the network.

An organization's culture is also an important variable to consider when assessing human capital management. While leader and employee human capital qualities (c) may influence an organization's culture, the ability of an organization to recruit and retain leaders and employees with certain human capital qualities may also be influenced by an organization's existing culture (Khademian, 2000).

Lastly, while there is some evidence that human capital qualities are positively associated with organizational performance in the public sector as detailed in Table 2.1, the empirical evidence focuses mostly on the influence of experience and education. Addressing some of the key challenges identified from other fields—measurement challenges of human capital, the influences of general versus specific human capital, the effects of human capital investment in high wage and low wage occupations, and the portability of human capital—will aid public administration in advancing human capital theory to better explain the association between human capital and organizational performance. Since the organizational setting may condition the influence of human capital and performance (Avellaneda, 2009a, 2009b; Fernandez, 2005; Riccucci, 1995), scholars should examine these human capital qualities in a variety of contexts.

The outcomes of identification of human capital requirements (a), integration of these requirements into human resource management (b), and levels of human capital within an organization (c and d) and the associated activities with each therefore serve as a program theory to connect the concepts of human capital, strategic human resource management, and organizational performance. While there are many other variables that impact the outcomes depicted in this framework, the relationships depicted sacrifice additional complexity to focus on promising lines of research to understand how human capital may influence organizational performance.

This dissertation focuses on the right side of the human capital framework in Figure 2.2 that outlines a causal relationship between levels of individual human capital in an organization (c) and organizational performance while accounting for characteristics of the organizational setting. While my research questions do not directly address the key components of the left side of the human capital framework, they do enable me to assess the viability of the framework as a program theory. As I explain in Chapter 3, I draw upon literature in management and educational leadership to identify the human capital skills on the left side of the framework that should relate to organizational performance. By observing the variation of these human capital qualities and organizational performance, I will assess the viability of the human capital approach to organizational performance outlined in Figure 2.2.

Chapter Summary

This chapter explained that a human capital approach to personnel management is a part of the vernacular of human resource managers in federal and state governments in the U.S. and an integral component of strategic human resource management policies pursued in numerous countries worldwide. The opposite is the case in public administration literature which features references to human capital with no concerted effort to further develop human capital theory as it applies to public organizations. The field has immense potential to contribute to practice by improving upon the theory of human capital to support efforts of public organizations that seek to improve performance through human capital management. This chapter concluded with a theoretical framework to guide public administration scholarship to better inform human capital in theory and practice. The next chapter discusses the main variables of interest in this dissertation to address the research questions presented in the opening chapter informed by this theoretical framework.

Table 2.1

Human Capital in Leading Public Administration Journals

		Human Capital Concepts				
		Strategic HRM Policies	**Education**	**Experience**		**Skills**
				Tenure	**Sector**	
Level of Measurement	**Individual Human Capital**		Avellaneda (2009)		Avellaneda (2009)	Cho & Ringquist (2011)
	Organizational Human Capital (Aggregated Individual Measures)		Teodoro & Switzer (2016)	Choi & Rainey (2010) Kirkpatrick et al. (2017)	Kirkpatrick et al. (2017)	
	Organizational Human Capital (Organizational Level Measures)	Coggburn & Kearney (2010) Rodwell & Teo (2004)				

Figure 2.1

OPM Human Capital Framework

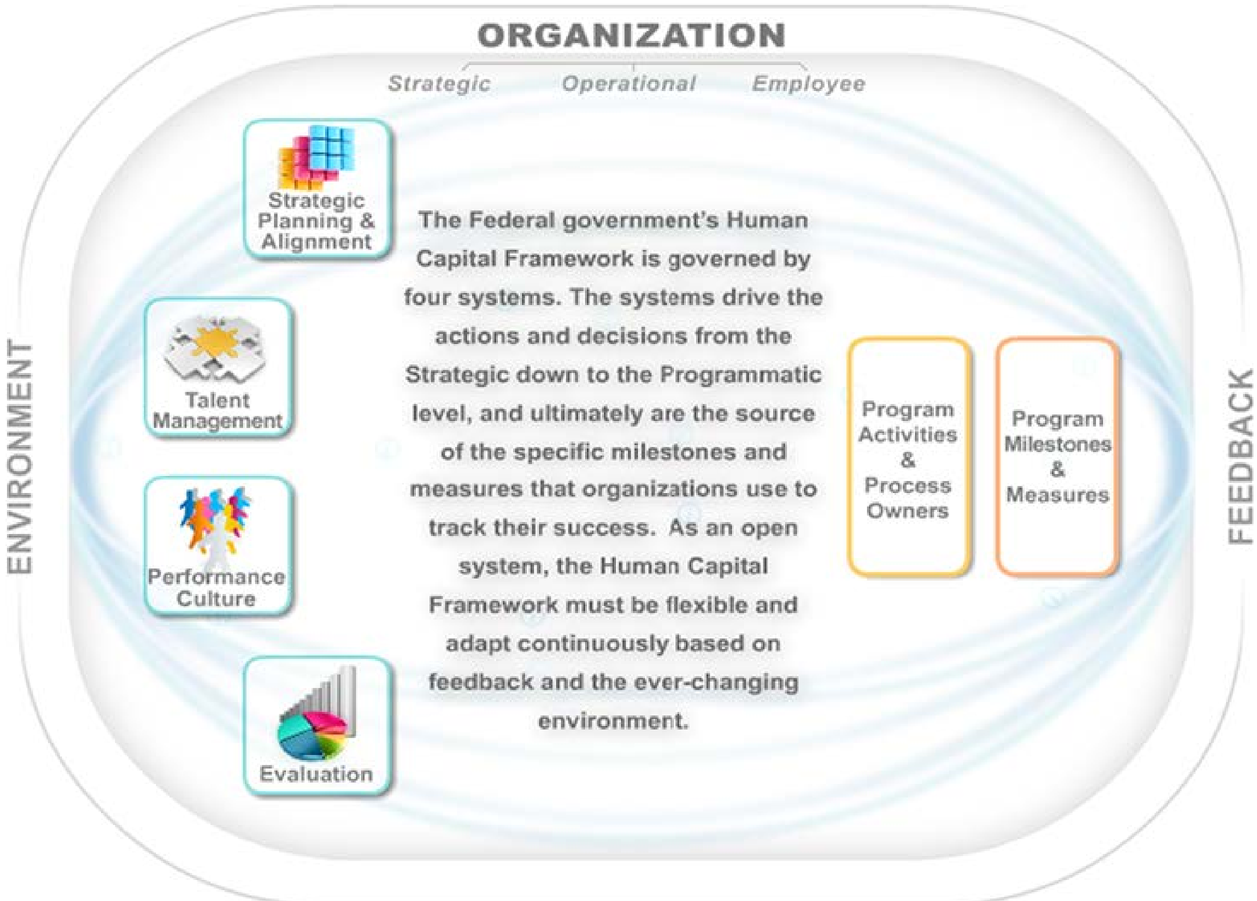
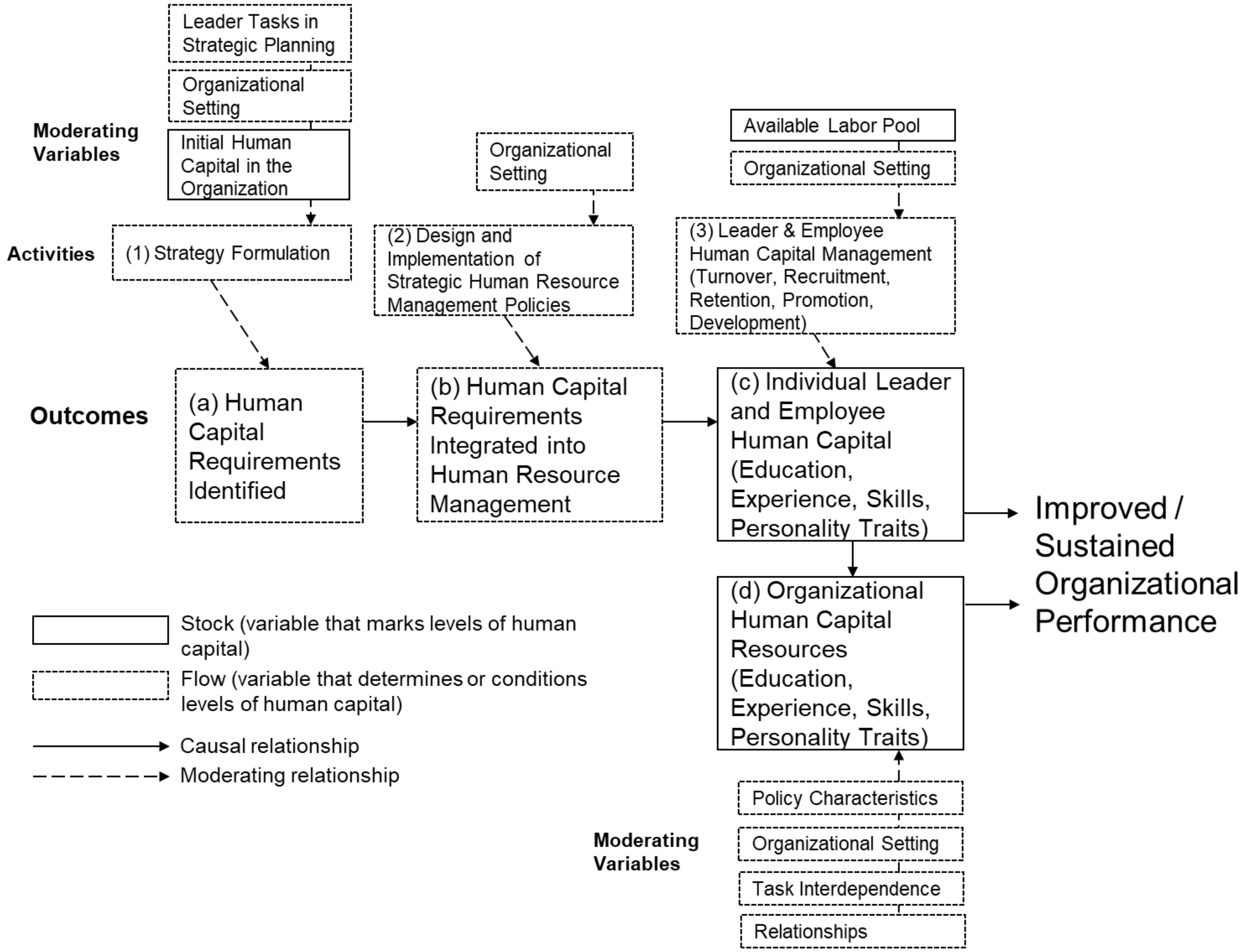


Figure 2.2

Concepts and Relationships within a Public Administration Human Capital Framework



CHAPTER 3

PRINCIPAL HUMAN CAPITAL AND SCHOOL PERFORMANCE

This chapter describes the units of analysis I use to examine the influence of a manager's human capital on organizational performance and specifies the hypotheses that relate to my research questions. I first explain why New York City (NYC) public schools are an appropriate unit of analysis for my research questions and describe the setting in which the school's front-line managers, school principals, operate. Next, I describe the dependent variables I use to measure school performance which come from an annual report issued by the NYC Department of Education (DOE) for each school. I draw upon public management and educational leadership literature to specify my independent variables of interest, principal human capital qualities, that should influence school performance. I also describe other independent variables that should influence school performance that I control for in this analysis. Since a manager's human capital may also influence the implementation of programs that affect organizational performance, I discuss a specific program implemented in a subset of NYC public schools that may have an effect on school performance. I explain how a principal's human capital may affect performance through unspecified means but also through the implementation of this program. This chapter concludes with a summary of the hypotheses I use to assess the influence of a manager's human capital on organizational performance.

Unit of Analysis Selection: NYC Public Schools

As described in Chapter 1, I evaluate two main research questions in this dissertation. First, what aspects and levels of a manager's human capital are positively associated with organizational performance? Second, does the strength of these associations differ based on the characteristics of the organization? I use three criteria to guide my unit of analysis selection to answer these research questions. A suitable set of organizations should feature variation in the human capital qualities of front-line managers, reasonably objective measures of organizational performance, and accountability between the front-line manager and these measures of performance. This section explains how NYC grade 3-12 public schools meet these criteria.

Regarding the first criterion of variation in the human capital qualities of front-line managers, principals in NYC vary according to the human capital qualities of experience and skills. Principals change frequently in NYC as between 2008 and 2013 over 9% of elementary/middle schools and 13% of high schools were led by principals in their first year as the top manager in the school as indicated in Table 3.1.[5] These statistics are consistent with other educational leadership studies that find principals change frequently and thus vary in terms of their tenure in a school (Fuller & Young, 2009; Gates et al., 2004; Miller, 2009; Ringel, Gates, Chung, Brown, & Ghosh-Dastidar, 2004). As I discuss in the subsequent section on hypotheses and measures, I use subordinate evaluations for the majority of the principal skills I assess in this model. As with experience, principals vary significantly in their ratings on these skills.

[5] A principal could be in their first year of tenure in a school because they replaced a different principal that led the school in the prior year or because the school is in its first year of existence. Over the course of the panel 39 new schools opened in 2007, 39 in 2008, 54 in 2009, 45 in 2010, 33 in 2011, 27 in 2012, and 30 in 2013 (Kranes, Mosher, Pappas, Smith, & Domanico, 2015).

Second, public schools also have reasonably objective measures of organizational performance. While studies frequently use standardized test scores and attendance rates to assess school performance (Hill, 2005; Meier & Hicklin, 2008), some scholars criticize these measures due to the difficulty in imputing how much the results are due to the influence of school employees (Wilson, 1989), because these tests focus on simple aspects of learning as opposed to more complicated problem-solving skills (Bird & Farewell, 2005; Favero & Meier, 2013), or because of cultural bias within standardized tests (Jencks & Phillips, 1998). The NYC DOE employs more comprehensive measures of school performance in its annual Progress Report for each school.[6] In addition to test scores from New York State (NYS) exams, the NYC Department of Education (DOE) also considers progress and performance in coursework, graduation rates, and measures of college and career readiness in assessments of school performance. Measures of performance from this report provide more holistic assessments of school performance that are salient to the organization and to parents or guardians of NYC public school students than traditional measures focused on single dimensions of performance such as test scores.

Lastly, there are two primary indicators of accountability between the front-line managers and the measures of organizational performance in this study. First, educational leadership scholarship emphasizes the importance of principal leadership on school performance (Austin & Reynolds, 1990; Louis, Leithwood, Wahlstrom, & Anderson, 2010; Portin & Shen, 1999). Second, the NYC DOE details specific procedures for removing or transferring principals for persistently poor school performance (New York City Department of Education, 2002). While it

[6] The NYC Department of Education (DOE) issued School Progress reports from the 2006-07 through 2012-13 school years. The School Quality Report replaced the Progress Report in the 2013-14 school year and included new measures of school performance.

is one of several tools used to evaluate schools by the NYC DOE,[7] the Progress Report is arguably the most salient for two reasons. First, it is published annually on the NYC DOE website to provide public accountability for school performance. Second, principals express high satisfaction rates regarding the quality of support they receive from the Progress Report as an accountability and assessment tool.[8]

In order to remain consistent with the measures of principal human capital and school performance in this study, the panel data encompass a six-year period in NYC Public Schools (Grades 3-12) from school year 2007-08 through 2012-13 (N≈1250 in each school year).[9] Subsequent references to school years use the last year of the school year to identify each year of the panel. For example, I refer to the 2007-08 school year as 2008. I draw upon this panel to assess the influence of principal human capital qualities on school performance for principals with one or greater years of tenure in a school. While it would be preferable to evaluate the human capital model on all principals, the exclusion of new principals speaks to the difficulty of measuring the human capital qualities of first-time managers. Despite this limitation of the data, new principals represent approximately 10% of the total principal population in a given year, so the results apply to the vast majority of principals.

Table 3.2 summarizes the distribution of schools from each year of the panel that received a Progress Report from the NYC DOE. Some schools, such as a K-12 school, serve

[7] The other primary tool is the Quality Review Score which is based on an in-person assessment by an experienced educator. The Quality Review is not incorporated into the scores published on the Progress Report but it is displayed on the first page of the Progress Report. Unlike the Progress Report, the Quality Review is not an annual assessment.
[8] On average, principals reported a satisfaction rate of 80% for the Progress Report between 2007 and 2013 in a bi-annual survey administered by the NYC DOE (New York City Department of Education, 2013).
[9] I exclude schools that only serve special populations such as special education, alternative, early childhood, transfer, and Young Adult Borough Centers to focus on general education schools. While some schools in the panel serve grades K, 1, and 2, the performance of the students in these grades do not contribute to the Progress Report scores that inform my measures of performance.

elementary, middle, and high school students. I draw upon categories defined by the NYC DOE to classify schools. The NYC DOE defines elementary schools as schools that serve grades K-4, K-5, and K-6. Middle schools serve grades 5-8, 6-8, and 6-12 (minus grades 9-12). High schools serve grades 9-12, K-12 (minus grades K-8), and 6-12 (minus grades 6-8). A school can therefore be classified in one, two, or three categories depending on the grades it serves. Over the course of the panel, some schools are also transitioning to serve new grades. For instance, a middle school may transition from a grade 6-8 school to a grade 9-12 school over the course of the panel. The decision rule I use for such schools is to classify a school into its new category when the NYC DOE begins reporting performance statistics for the school in the new category. Continuing with the example above, I would classify a school only as a middle school until the NYC DOE reports performance statistics for the school in both the middle school and high school categories.

Figures 3.1, 3.2, and 3.3 describe the distribution of schools for each district for elementary, middle, and high schools respectively. These figures indicate there is some variation in the quantity of each type of school per district with District 10 containing more schools than any other district. As these figures indicate, the distribution of schools differs slightly from year to year since some schools opened and closed over the course of the panel. It is reasonable to assume that principals of schools that opened and closed during this timeframe may face different challenges from principals that lead schools that remained open throughout the course of the panel. Schools do not receive Progress Reports during their first year in operation or if they are designated for closure. Including all schools in my analysis that receive Progress Reports therefore avoids the potential bias of including schools that just opened or are designated for closure.

Previous studies in public administration use data from NYC schools to examine the influence of school quality on parental and teacher assessments of the school (Favero & Meier, 2013), the effects of internal management practices on test score performance (Favero, Meier, & O'Toole, 2016), and the influence of performance management practices on test score performance (Sun & Van Ryzin, 2014).[10] These studies demonstrate the promise of this dataset to address important questions in the field of public administration. This dissertation expands upon these previous studies by incorporating measures of a principal's human capital qualities to assess their influence on school performance. Unlike previous public administration studies that use NYC DOE data, I incorporate more holistic measures of school performance as I explain in the subsequent discussion of my dependent variable.

A shortcoming of using NYC public schools as my unit of analysis is that scholars often find different effects when examining school leaders compared to other public sector managers. For example, in the representative bureaucracy literature, the demographics of school leaders do not seem to have an effect on the performance of different gender or racial groups, perhaps because teachers have significant autonomy in their classroom (Pitts & Jarry, 2007). Other scholars contend there are significant differences in the behaviors of managers in the field of education compared to other fields (Larson, Bussom, & Vicars, 1981; Martinko & Gardner, 1984; Morris, Crowson, Hurwitz, & Porter-Gehrie, 1981). This finding is not surprising since principals manage a diverse set of tasks and interact with various stakeholders to include students, parents, teachers, superintendents, school boards, and state officials. The limited lateral entry from other professions into service as a principal also distinguishes this form of

[10] Favero and Meier (2013) and Favero et al. (2016) examine a panel from 2007 through 2009 while Sun and Van Ryzin (2014) examine a cross-section in the 2009 school year. This dissertation expands the data to incorporate school years 2007 through 2013.

management from others. The effects of managerial human capital for principals may therefore be different than managerial human capital in other fields.

While the effects of principal human capital on performance may not be generalizable to other fields, I am more confident in the application of the findings to school systems in other locations and time periods. The education sector is the largest category of government employment in the U.S. with nearly half of the total federal, state, and local public workforce employed in the field of education (Willhide, 2014). The implications of this study are therefore relevant for a large portion of the public workforce. Although I assess the influence of principal human capital skills on school performance, my research also has broader applicability outside the field of education since I develop and evaluate a human capital framework as discussed in Chapter 2 for public organizations in general. While I focus on school principals in this study, the theoretical framework in Chapter 2 can be applied to organizations throughout the public sector.

Before discussing the specific measures in this study, it is instructive to understand the context in which school principals operate within the NYC DOE. The next section describes the organizational hierarchy that exists above the school principal and the labor market that shapes the hiring, assessment, and replacement of NYC school principals.

School Leadership in the NYC DOE

NYC public school principals operate in the largest school system in the United States. The NYC DOE serves over 1.1 million students with an annual budget that exceeds $32 billion.[11]

The Chancellor is appointed by the NYC Mayor and serves as the executive with overall responsibility for the school system. Unlike most school systems that are under the direction of an elected or appointed Board of Education, the NYC Mayor controls the NYC DOE. This arrangement is a result of a 2002 NYS law that transferred responsibility for NYC schools from a seven-person Board of Education to the Mayor which continues under the current administration of Mayor Bill de Blasio (Hernandez, 2009; McKinley & Foderaro, 2017).

As of the beginning of the 2018 school year, there are 1,616 schools in the NYC DOE organized into 32 separate districts spread across the five boroughs. The 227 charter schools in NYC are assigned to a separate district. In addition to the 32 public school districts and the charter school district (District 84), a separate district focuses on students with significant learning challenges (District 75) and students under 21 who experienced an interruption to their educational progress (District 79). Unless a student is eligible for enrollment in District 75 or 79 or is selected for a charter school in District 84, he or she will enroll in a school in District 1-32. Within District 1-32, some schools are zoned by specific geographical areas and others are non-zoned such that a student that lives anywhere in the district or borough can attend. A student can also apply to transfer to a different school for reasons such as unsafe conditions, academic or social concerns, or travel hardships by working with a NYC DOE enrollment counselor.

[11] The NYC DOE webpage provides an overview of demographic and budgetary data available at https://www.schools.nyc.gov/about-us/reports/doe-data-at-a-glance.

A superintendent leads each of the districts. There are also nine executive superintendents that oversee as many as seven district superintendents geographically organized across the five boroughs. Figure 3.4 depicts the hierarchical structure of the NYC DOE from the school principal to district superintendent to executive superintendent up to the Chancellor.[12] The primary responsibilities of the district superintendent are to implement NYC DOE policies, approve school budgets, and appoint, supervise, and evaluate school principals.[13] Community Education Councils (CEC) assist district superintendents that supervise K-8 schools. CECs consist of eleven voting members (nine elected parents, two members who either live in the district or own a business in the district appointed by the borough president, and one non-voting high school student) that serve two-year terms. The CECs hold monthly public meetings with the district superintendent and advise and comment on district policies.[14] For high schools and district 75 schools, there are four citywide councils that serve a similar function. Although the education councils inform the activities of the district superintendent, he or she still has the primary responsibility to select and supervise the principals within the district.

NYC DOE regulations and a contract between the NYC DOE and the union representing public school principals shape the dynamics of the labor market for school principals. Principals must meet minimum eligibility requirements to include seven years of prior pedagogic experience, possess a NYS administrative license, and a master's degree. Principals that meet the minimum requirements can apply for placement into a pool of candidates eligible for

[12] The NYC DOE organizational chart is available from https://www.schools.nyc.gov/docs/default-source/default-document-library/central-org-structure-accessible.
[13] Additional information on NYC superintendents is available from https://www.schools.nyc.gov/about-us/leadership/superintendents.
[14] Additional information on the composition and functions of education councils is available from https://www.schools.nyc.gov/school-life/get-involved/education-councils.

advertised positions. When a position becomes available, the district superintendent serves as the "hiring manager" and is the ultimate appointing authority to fill the principal vacancy. The district superintendent forms a "Level 1 Committee" composed of a supervisor from the school, two United Federation of Teachers members, one school support staff member, four to seven parents, and a chairperson designated by the district superintendent. The Level 1 Committee interviews the candidates that apply from the candidate pool and makes recommendations to the district superintendent.

NYC DOE regulations enable district superintendents to remove or transfer principals for "persistent educational failure" which is defined as "a pattern of poor or declining performance for two or more years on multiple performance indicators" (New York City Department of Education, 2002). The indicators that superintendents review include student achievement data, attendance rates, and school violence indicators.

As these procedures indicate, district superintendents have significant discretion in the hiring, evaluation, and termination of school principals. The principal is the person that he or she holds accountable for school performance. The human capital qualities of principals that are associated with higher performance are therefore of practical interest to these superintendents to guide hiring and retention decisions. The process used to measure human capital qualities of managers and their influence on organizational performance are also of scholarly interest as described in Chapter 2. The remainder of this chapter describes the measures for human capital qualities of principals and organizational performance and the hypotheses I employ to explain the association between these two concepts.

Principal Human Capital Qualities and School Performance

Dependent Variable: School Performance

I measure organizational performance in two different ways to assess whether the effects of principal human capital vary across different measures of performance. The NYC DOE Progress Report for each school consists of two different aspects of student achievement which the report terms Student Progress and Student Performance. Both are continuous variables in the form of as assessment assigned by the NYC DOE. Table 3.3 lists the criteria and maximum possible points for each measure. The scores for each criterion are summed to result in the Student Progress or Student Performance score. As Table 3.3 indicates, the metrics to calculate the Student Progress and Student Performance scores vary slightly for elementary and middle schools that serve grades K-4, K-5, or K-6 (elementary), grades 5-8 or 6-8 (middle), or K-7 or K-8 (K-8). Although I could examine elementary, middle, and K-8 schools separately, the demands confronting principals in these school are similar enough to consider them as a group which is consistent with other educational leadership research (Louis et al., 2010). The dependent variable of school performance therefore consists of four different indices: Student Progress Scores for elementary/middle schools, Student Progress Scores for high schools, Student Performance Scores for elementary/middle schools, and Student Performance Scores for high schools. To avoid confusion, I use the term "school performance" to refer to combinations of these measures and use the more specific terms of "Student Progress score" or "Student Performance score" when referencing these specific measures of performance.

The Student Progress and Student Performance scores are adjusted according to comparisons to other schools to isolate a school's contribution to student achievement rather than reflect the demographic characteristics of its students. Other factors such as a student's family background and innate abilities significantly contribute to student achievement (Eberts & Stone,

1988) but are difficult to accurately specify. By weighting performance scores based on comparison schools, the Progress Report scores assist with isolating aspects of school performance that flow from the influence of factors controllable by school administrators. The NYC DOE weights school performance by comparing a school's performance to that of a group of peer schools and to schools citywide. The process of establishing the group of peer schools is somewhat complex as detailed in Table 3.4. For each type of NYC school (Elementary, K-8, Middle, and High School), the point of the process is to establish a peer index value for each school to select a group of schools that are similar in terms of academic and demographic backgrounds.

For each criterion in Table 3.4, a school's performance is compared to the performance of its peer schools. These comparisons are expressed in terms of a percentage that are tied to a range based on how many standard deviations a school is above or below the average of the group of peer schools and all schools of the same type citywide according to the distribution outlined in Table 3.5. These comparisons are then weighted by 75% for the peer comparison and 25% for the citywide comparison to determine a school's score for each performance criterion.

Since this process is somewhat complex, the following example illustrates this process using a component of the Student Performance Score for high schools. A high school can earn a maximum of 5 points for the criterion of percentage of students that graduate within 4 years. Its peer comparison is 70% (meaning it scored slightly below one standard deviation above the average of its peer schools on this criterion) and its citywide comparison is 80% (meaning it scored slightly higher than one standard deviation above the citywide average). To determine the points this school will earn for this criterion, the percentage of peer range is weighted by 75% and added to the percentage of citywide range weighted by 25%, which is then multiplied by the total points possible for the criterion. For this example, the points earned for this school for the criterion of percentage of students that graduate within 4 years is [(0.70)x(0.75)+(0.80)x(0.25)]x5 which equals 3.63. Table 3.6 describes the distribution of progress and performance scores for each year of the panel.

Specification of Hypotheses

My main testable prediction is that greater levels of managerial human capital are associated with higher levels of organizational performance. Drawing on public management and educational leadership literature, I specify two forms of experience and five different skills that should be associated with school performance. Managerial human capital may influence organizational performance through unspecified means or exercise influence through specific activities such as implementing programs to improve organizational performance. If managerial human capital is an important determinant of organizational performance, we should see its effects in one or both of these dimensions. While I describe Structural Equation Models (SEM) in Chapter 4 that I use to assess the effects of managerial human capital on organizational performance, the path diagrams in Figures 3.5 and 3.6 explain the basic logic of my research design.

As Figure 3.5 indicates, principal human capital may influence school performance through unspecified means. However, because principals are also the key actors in implementing programs that may affect school performance, their human capital qualities may exert influence on school performance through their management of such programs. As I explain in this section, a principal’s human capital may have an influence on school performance through implementation of the Contract for Excellence (C4E) program as indicated in Figure 3.6.

I describe the hypotheses for each of these paths and evaluate them for each of the following groups in Chapters 5 and 6: Student Progress Scores for elementary/middle schools, Student Progress Scores for high schools, Student Progress Scores for all schools, Student Performance Scores for elementary/middle schools, Student Performance Scores for high schools, and Student Performance Scores for all schools.

Hypotheses Focused on Principal Experience (Path 1-Unspecified Means)

A central hypothesis of human capital scholarship is that greater experience should correlate with higher organizational performance (Becker, 1993; Blair, 2011; Grant & Hayton, 2011). Literature from the private sector supports the positive effects of the alignment of a leader's previous management experience and the requirements of his or her new organization (Boeker, 1997; Phillips, 2002). What type of experience is relevant, however, is likely to differ across fields. Petrovsky et al. (2015) focus on managerial experience as an aspect of managerial capability, using the term "public fitness" to describe the match between the requirements of the organization and the leader's previous management experience.

"Public fitness" for principals should be considered in terms of their tenure in their current school and prior experience as a principal in other schools. The shorter the tenure of a principal in his or her current school, the less likely he or she is to "fit" into the routines of the organization. When organizations change managers, both the organization (Whitford, 2002) and the manager (Campion et al., 1994) go through a process of adjusting to the new environment, resulting in a negative association between leadership turnover and organizational performance in the short term. As the tenure of a manager increases, several studies demonstrate a positive association with organizational performance (Hill, 2005; O'Toole & Meier, 2003). Over time, the organization adapts to the manager's style while the manager develops an understanding of the organization to influence performance. The relationship between tenure and performance is likely nonlinear, however, as greater experience in the organization may preclude a manager from seeking and implementing new ideas to make needed changes (Rutherford, 2017). Additionally, while a principal has a lot to learn about the organization in the first year, in each subsequent year there is simply less to learn, therefore additional years of tenure should be associated with smaller gains in performance.

Studies focused specifically on the association of principal tenure and school outcomes provide mixed results. Clark, Martorell, and Rockoff (2009) find a positive relationship between principal experience in the same school and school performance while several other studies failed to find a statistically significant relationship between principal experience and school performance (Ballou & Podgursky, 1995; D. J. Brewer, 1993). D. J. Brewer (1993) cautions experience has an effect on school performance through hiring quality teachers whose instruction matches the principal's vision for the school. I expect that tenure may have a small effect on performance as some impacts of tenure may moderate the influence of other human capital skills.

Since the vast majority of school principals are new to the principalship (Clark, Martorell, & Rockoff, 2009), the effects of prior principal experience in a different school may not be as significant as tenure in the current school. Given the definition for prior principal experience I discuss below, the value of this variable does not change from year to year over the course of the panel for most principals. In turn, the relationship between prior principal experience and school performance is likely linear instead of quadratic. The hypotheses below focus on the effects of principal tenure and experience through unspecified means. I discuss the effects of tenure on a principal's human capital skills at the conclusion of this section after I explain the other principal human capital skills that should influence performance. Table 3.7 describes the distribution of principal tenure and prior experience for each year of the panel.

H1a: There is a positive, quadratic relationship between principal tenure and school performance.
H1b: There is a positive relationship between prior experience as a principal and school performance.

Independent Variables:

Principal Tenure: I define tenure as the number of consecutive years that a manager serves as the principal at the same school. Principal experience is measured at the beginning (fall) of each school year, thus new principals in the fall have a tenure value of 0. If a principal changed mid-year, I round up if the tenure is recorded as .5 or higher by the NYC Independent Budget Office (IBO). I cross-referenced the principal tenure data published by the NYS DOE to ensure the reliability of the IBO data. In cases in which the IBO measures do not correspond with the NYS DOE rolls, I adjusted the data based on the NYS DOE rolls.

Principal Prior Experience: Prior experience is defined as the number of years that a principal served as the principal of a different school prior to beginning his or her tenure in their current school. It is measured as described in the principal tenure section above. This variable only accounts for prior experience as a principal in NYC schools. A limitation of the data is that prior principal experience in other school systems is not available. At worst, this shortcoming will impart a downward bias on the results and underestimate any effects prior experience has on performance.

Hypotheses Focused on Principal Skills (Path 1-Unspecified Means)

I focus on five principal skills informed by public management and educational leadership literature that should influence school performance: Goal Setting, Internal Management, Managing Family Involvement, Human Capital Management, and Instructional Leadership. I measure four out of five of these skills using an annual NYC DOE Survey administered to teachers and parents/guardians. Although quantifying a principal's skills is a difficult undertaking, the perceptions of a school's teachers provide a useful measure since the principal serves as their first line supervisor. Likewise, parents/guardians are well equipped to be a good judge of how well the school communicates with them. Responses to the survey questions are converted to a 10-point scale by the NYC DOE with each survey response assigned a value (e.g., strongly agree=10, agree=6.7, disagree=3.3, strongly disagree=0). The responses are then averaged at the school level. I use Cronbach's Alpha to initially assess the reliability of the survey question indicators used to measure each principal skill. Cronbach's Alpha provides a measure of internal consistency among indicators to assess how closely related the items are as a group. Since Cronbach's Alpha may under or overestimate scale reliability and does not assess whether the group of indicators is unidimensional (Brown, 2015), I derive the actual measures for these skills using confirmatory factor analysis as I discuss in more detail in Chapter 4.

Turning first to a principal's skills at Goal Setting, I expect this skill to have a positive influence on school performance since a tenet of leadership in organizations is that members perform at higher levels when given specific, measurable goals (Rainey & Jung, 2012; Yukl, 2013). Establishing well defined goals is also positively associated with work motivation (B. E. Wright, 2007). Many studies of principal effectiveness include measures of mission and goal development as predictors of successful leadership (D. J. Brewer, 1993; Favero et al., 2016;

Grissom & Loeb, 2011; Hallinger & Heck, 1998; Leithwood et al., 2004; Weber, 1989; Witziers, Bosker, & Krüger, 2003).

H1c: The higher a principal is rated by the school's teachers as a Goal Setter, the more positive the effects will be on school performance.

Principal Skills as a Goal Setter**:** I use the following questions from the NYC Teacher Survey to assess a principal's skills at setting and communicating goals for the organization[15] (Cronbach's Alpha .88): 1) School leaders communicate a clear vision for this school; 2) My school has clear measures of progress for student achievement throughout the year.

Next, models of a public manager's effects on performance include Internal Management which focuses on a manager's ability to stabilize the internal operations of the organization (O'Toole Jr & Meier, 1999). While skills such as Goal Setting could also be thought of as facets of internal management, Internal Management in this study relates to aspects of a principal's leadership that affect the overall school conditions as opposed to operations inside the classroom or networking outside of the school. Previous educational leadership studies note a positive association between Internal Management and school performance (Grissom & Loeb, 2011; Horng, Klasik, & Loeb, 2010; Owings, Kaplan, & Nunnery, 2005).

H1d: The higher a principal is rated by the school's teachers as an Internal Manager, the more positive the effects will be on school performance.

Principal Skills as an Internal Manager**:** Specific behaviors of a principal at Internal Management include keeping the school running smoothly through basic functions like safety

[15] The question ordering for these two questions changed slightly during the panel, moving from the middle of the survey to the beginning between 2007-08 and then a slight change from 2011-12. This change in ordering should have minimal effects on the results since the questions remained in the same content area from year to year. Question 2 was worded differently in 2012: "The principal at my school makes clear to the staff his or her expectations for meeting instructional goals." I compare the results with both questions to the results from only the first question which was worded consistently throughout the panel to ensure the change in wording does not affect the results.

and cleanliness as captured by the following questions on the NYC Teacher Survey[16] (Cronbach's Alpha .81): 1) The principal is an effective manager who makes the school run smoothly; 2) Order and discipline are maintained at my school; 3) My school is kept clean.

In addition to stabilizing the internal operations of a school, a principal must deal with several external stakeholders to include the superintendent, school board, community leaders, parents, and in some cases teacher associations. Previous studies point to positive gains from networking activities of superintendents (Meier & O'Toole Jr, 2003), so one would expect successful principals may also benefit in some degree from time spent influencing the school's external environment.

In a study of elementary school principals, Hallinger and Murphy (1986) found that the student body's socioeconomic status (SES) conditioned the principal's relationship with parents. Low SES schools featured limited parental involvement with principals acting as a buffer between the school and parents to avoid detrimental influences on the school's programs. In higher SES schools, principals reciprocated high levels of parental involvement by seeking efficient ways to involve volunteers interested in contributing resources to the school. A school's SES seems like an important moderating variable that shapes how much time a principal will spend communicating with parents and thus influences the extent that a principal's skills at Managing Family Involvement affects school performance.

H1e: As a school's SES increases, the higher a principal is rated by the school's parents as a Manager of Family Involvement, the more positive the effects will be on school performance.

[16] The question ordering for these four questions changed slightly during the panel, moving earlier in the survey from 2007-08 and then slightly later from 2011-12. This change in ordering should have minimal effects on the results since the questions remained in the same content area from year to year and the wording remained consistent.

I measure a school's SES by the percentage of students eligible for free lunch.

Principal Skills as a Manager of Family Involvement**:** The following questions from the NYC Parent/Guardian Survey measure a principal's skills at Managing Family Involvement[17] (Cronbach's Alpha .95): 1) I feel welcome at my child's school; 2) My child's school makes it easy for parents to attend meetings by holding them at different times of day, providing an interpreter, and in other ways; 3) The school keeps me informed about my child's academic progress; 4) How satisfied are you with how well your child's school communicates with you?

I use teacher evaluations of a principal's skills at managing family involvement as a robustness check to evaluate the effects of Managing Family Involvement on Student Progress and Performance scores using the following questions from the NYC Teacher Survey[18] (Cronbach's Alpha .92): 1) Obtaining information from parents about student learning needs is a priority at my school; 2) Teachers and administrators in my school use information from parents to improve instructional practices and meet student learning needs; 3) My school communicates effectively with parents when students misbehave.

Next, the principal skill of Instructional Leadership focuses on a principal's role in shaping the instructional environment inside classrooms. This skill is the most extensively researched among the five principal human capital skills but suffers from a lack of definitional clarity as the label "instructional leadership" can encompass nearly any activity a principal

[17] The question ordering for the third question changed over the course of the survey, moving slightly earlier from 2007-08 and 2009-10. This change in ordering should have minimal effects on the results since the questions remained in the same content area from year to year and the wording remained consistent.

[18] The question ordering for these three questions changed over the course of the survey, moving slightly earlier from 2007-08 and then slightly later from 2011-12. The change in ordering should have minimal effects on the results since the questions remained in the same content area from year to year. The wording of the last question changed slightly for the 2012 survey: "My school communicated effectively with parents regarding students' behavior." Since the change in wording is minimal, I do not anticipate that it will affect the results.

undertakes to improve classroom instruction (Grissom & Loeb, 2011; Murphy, 1988). The results from previous studies of Instructional Leadership are mixed with some finding a positive correlation between Instructional Leadership and school performance (Bartell, 1989; Eberts & Stone, 1988; Robinson, Lloyd, & Rowe, 2008) while others find no significant relationship (D. J. Brewer, 1993; Horng et al., 2010) or an effect contingent on other factors (Grissom & Loeb, 2011).

The most popular instrument for examining the influence of Instructional Leadership (Hallinger, 2005) is the Principal Instructional Management Rating Scale developed by Hallinger and Murphy (1985). This instrument employs a broad definition of Instructional Leadership that includes a principal's efforts to define a school's mission and promote a positive school climate. Recent scholarship criticizes this broad definition of Instructional Leadership and employs a more narrowly focused definition that concentrates on curriculum development and teacher coaching. Using this narrower definition, studies suggest that Instructional Leadership may have harmful effects on school performance by intruding on a teacher's professional autonomy (Eberts & Stone, 1988) or diverting a principal's focus away from other important managerial functions (Grissom, Loeb, & Master, 2013; H. May, Huff, & Goldring, 2012).

To separate the influence of Instructional Leadership from the other human capital skills in this study, I tailor the definition of Instructional Leadership created by Hallinger and Murphy (1985) to focus on a principal's actions in managing the instructional program and promoting quality teaching. Principals exert indirect influence on these dimensions through promoting professional development and communicating instructional priorities (Indirect Instructional

Leadership) or more direct methods such as teacher observation, coaching, and performance evaluation (Direct Instructional Leadership).[19]

Since the literature is unclear on whether Instructional Leadership has a positive influence on school performance, I do not specify a direction of influence in order to clarify this inconsistency. In addition to testing for the effects of Direct and Indirect Instructional Leadership on performance, I also assess the influence of a school's grade level and the socioeconomic status of the student body. Regarding grade level differences, there is a higher level of specification required for subject matter expertise in high schools than elementary/middle schools (Grissom et al., 2013). While a principal's expertise in the instructional program in an elementary/middle school may translate well to his or her Instructional Leadership practices, in high school teachers typically focus on specific subject areas. In turn, there is a greater likelihood that a principal lacks the expertise to develop and implement specific professional development activities to benefit high school teachers in comparison to elementary/middle school teachers. However, principals may also use Instructional Leadership to coach teachers in general classroom leadership techniques that are not subject specific. Principals in NYC may be particularly well suited to provide such instruction since there is a requirement for prior pedagogic experience to qualify as a NYC principal. Since a case could be made that grade level differences may or may not have an effect

[19] As this section indicates, I use four questions from the NYC teacher survey that assess a principal's Indirect Instructional Leadership skills and one question that assesses a principal's Direct Instructional Leadership skills. An argument could be made that there is not a meaningful difference between Indirect and Direct Instructional Leadership. The four indicators for Indirect Instructional Leadership combined with the indicator for Direct Instructional Leadership have the same Cronbach's Alpha value (.9383) as the results using the four indicators for Indirect Instructional Leadership. A confirmatory factor analysis of the five indicators also shows they load on a single factor, although the factor loading for the Direct Instructional Leadership indicator is the smallest (.77) of the five indicators. Although an argument could be made that there is not a meaningful distinction between Indirect and Direct Instructional Leadership, there is a theoretical basis that these are two different skills (Grissom et al., 2013), therefore I use indicators to establish separate latent variables for Direct and Indirect Instructional Leadership.

on the influence of Instructional Leadership on school performance, I test for its effects to reconcile these competing perspectives.

There is also some evidence that the socioeconomic status of the student population moderates the effects of Instructional Leadership. Prior studies contend there is a greater likelihood of alignment for high performance expectations between teachers and parents in less challenging schools compared to more challenging schools (Hallinger & Murphy, 1986). Similarly, there is a higher likelihood of quality teachers in a less challenging school than a more challenging school (Clotfelter, Glennie, Ladd, & Vigdor, 2008). Higher quality teachers likely need less supervision than lower quality teachers, thus a principal that exerts his or her skills in Instructional Leadership in a school with a large percentage of high quality teachers may be better off focusing on other aspects of school administration (H. May et al., 2012). In such environments, efforts by principals to directly control instruction likely lead to conflict with teachers who view these actions as an intrusion on their professional autonomy (Hallinger & Murphy, 1985). Conversely, in more challenging schools, there is some evidence that principals are more hands on with direct instructional leadership to raise expectations (Grissom et al., 2013; Hallinger & Murphy, 1986; H. May et al., 2012). One would therefore expect that as the poverty level of the student body increases, principals rated highly at Instructional Leadership would have more positive effects on school performance than those that are rated lower on this skill.

H1f: A principal's skills as an Indirect Instructional Leader have an effect on school performance.
H1g: A principal's skills as a Direct Instructional Leader have an effect on school performance.
H1h: The grade level of a school has an effect on the influence of Instructional Leadership on school performance.
H1i: As a school's socioeconomic status decreases, the higher a school's principal is rated as an Instructional Leader, the more positive the effects will be on school performance.

I measure the socioeconomic status of the student body as described in the previous section on family involvement.

Principal Skills as an Indirect Instructional Leader**:** The following questions from the NYC Teacher Survey measure a principal's skills as an Indirect Instructional Leader[20] (Cronbach's Alpha .94): 1) School leaders invite teachers to play a meaningful role in setting goals and making important decisions for this school; 2) This year, I received helpful training on the use of student achievement data to improve teaching and learning; 3) The professional development I received this year provided me with content support in my subject area; 4) The professional development I received this year provided me with teaching strategies to better meet the needs of my students.

Principal Skills as a Direct Instructional Leader: The following question from the NYC Teacher Survey measures a principal's skills as a Direct Instructional Leader:[21] 1) School leaders visit classrooms to observe the quality of teaching at this school.

Other scholars contend a principal's role in shaping the workforce may be more pronounced in his or her ability to recruit and retain quality teachers. Brewer's (1993) influential study cites the selection of teachers as a method by which principals exert a measurable effect on student outcomes. Other studies support this finding as teachers hired by the current principal

[20] The question ordering for these three questions changed over the course of the survey, moving slightly earlier from 2007-08. From 2011-12, question 1 moved slightly earlier while questions 2-4 moved slightly later. The change in ordering should have minimal effects on the results since the questions remained in the same content area from year to year. Question 1 was also worded slightly differently in 2007: "The principal invites teachers to play a meaningful role in setting goals and making important decisions for this school." Also, Question 2 was worded slightly differently in 2012: "I received helpful training on the use of student achievement data to improve teaching and learning this year." Since the changes in wording are minimal, I do not anticipate them to affect the results.

[21] The question ordering for this question changed slightly, moving earlier from 2007-08 and 2011-12. The change in ordering should have minimal effects on the results since the questions remained in the same content area from year to year. The wording of the last question changed slightly for the 2012 survey: "School leaders visit classrooms to observe the quality of teaching at my school." Since the change in wording is minimal, I do not anticipate that it will affect the results.

give much more favorable evaluations of the principal's leadership than teachers hired by a previous principal, suggesting the acquisition of human capital is a means employed by principals to shape classroom instruction (Ballou & Podgursky, 1995).

H1j: The greater a principal's abilities as a Human Capital Manager, the more positive the effects will be on school performance.

Principal Skills as a Human Capital Manager**:** A basic function of the principal as human capital manager includes retaining quality teachers and replacing poor performers with more capable instructors. At a minimum, one would expect principals that excel at Human Capital Management to increase the percentage of courses that are taught by high-quality teachers. The NYS DOE defines the requirements to be a high-quality teacher as possession of a bachelor's degree, certification to teach in the subject area, and demonstration of subject matter competency.[22] Human Capital Management is a difficult concept to measure as a favorable level of teacher attrition depends on whether a principal replaces outgoing teachers with more capable replacements. Principals may be constrained in their ability to force lower quality teachers out of a school due to contractual protections for teachers. A principal also has few tools to judge whether a novice teacher will be an effective educator. Despite these challenges, using percentage of courses taught by a high-quality teacher as a measure of Human Capital Management has face validity in terms of a principal's skills at meeting a baseline requirement of staffing classrooms with teachers that meet state requirements.

As a robustness check on this human capital skill, I compare the results from the measure above with results using teacher survey responses on the following questions from the NYC

[22] The NYS DOE provides some exceptions for teachers teaching outside their certification area as detailed at https://data.nysed.gov/glossary.php?report=reportcards.

School Survey. These questions poll teachers on the quality of their colleagues in terms of their instructional standards and teamwork[23] (Cronbach's Alpha .87). 1) Teachers in this school set high standards for student work in their classes; 2) To what extent do you feel supported by other teachers at your school; 3) Most teachers in my school work together to improve their instructional practice.

Lastly, I hypothesize that a principal's tenure will have a positive effect on the other human capital skills in the model. As a principal gains experience in the organization, their understanding of the organization improves which enables the principal to better leverage their skills to improve school performance. Modeling the effects of principal tenure through human capital skills also helps to account for the growth in a principal's human capital skills as he or she gains more experience as a school leader. As with the effects tenure on performance through unspecified means discussed in Hypothesis 1a, I also expect a quadratic relationship between tenure and the effects on a principal's skills.

Hypothesis 1k: There is a positive, quadratic relationship between a principal's tenure and the effects of a principal's skills on school performance.

A principal's tenure therefore moderates the strength of the relationship between the six principal human capital skills and school performance.[24] Table 3.8 provides an overview of the

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[23] The question ordering for these three questions changed slightly during the panel. All three questions moved slightly earlier in the survey from 2007-08, question 2 moved slightly later in the survey from 2009-10, question 3 moved slightly later in the survey from 2010-11, and all three questions moved slightly later in the survey from 2011-12. This change in ordering should have minimal effects on the results since the questions remained in the same content area from year to year. Question 2 was worded differently starting in 2010: "Most teachers in my school work together on teams to improve their instructional practice." In 2012 the word "most" was dropped from this question. Question 3 was worded differently in 2012: "My school sets high standards for student work in their classes." Since the change in wording is minimal, I do not anticipate that it will affect the results.

[24] I do not include a principal's level of education as a human capital quality for two reasons. First, previous research indicates a principal's level of education seems to be unrelated or negatively associated with school performance (Ballou & Podgursky, 1995; Clark et al., 2009). Second, since NYS requires a master's degree for a principal certificate, the only variation in principal education would be between the quality of the master's degree and whether a principal had multiple master's degrees or a PhD. This information is not available from the publicly

measurements for the unobserved human capital skills measured by results from the NYC School Survey. This table includes two important measures to indicate the suitability of the measures I use for each unique skill, the eigenvalue for the single factor resulting from the indicator measures and the factor loadings for each measure. All of the skill measures in Table 3.8 resulted in one factor with an eigenvalue greater than 1.0, suggesting that the indicator measurements correspond to a single factor according to the Kaiser-Guttman rule (Brown, 2015). The average factor loadings for each measure are greater than 0.7 which is a generally accepted cut-off for inclusion of an indicator into a factor model (MacCallum, Widaman, Preacher, & Hong, 2001; MacCallum, Widaman, Zhang, & Hong, 1999). To provide a sense of the variation of the principal human capital skills, I summed the values for each of the respective indicators and calculated the mean, standard deviation, maximum, and minimum value from the resulting index. As the results in Table 3.8 indicate, NYC public school principals vary in their human capital skills. Table 3.9 summarizes the distribution of the observed human capital skill of Human Capital Management as measured by the percentage of courses taught by highly qualified teachers.

The above hypotheses assess the effects of principal human capital qualities on school performance through unspecified means for all grade 3-12 NYC public schools from the 2008 through 2013 school years. However, because managers can also play a significant role in program implementation (P. J. May & Winter, 2009; Mazmanian & Sabatier, 1989; O'Toole,

available databases. A few scholars in educational leadership focus on a principal's role in establishing a positive organizational culture defined in part by strong interpersonal relationships among school employees (Grissom & Loeb, 2011; Ladd, 2011; Murphy, 1990; Weber, 1989). While some public administration scholars also assert leaders can play a distinct role in shaping an organization's culture (Doig & Hargrove, 1990), it can be challenging to separate a leader's influence on culture from other variables such as the effects of long serving members or informal leaders (Khademian, 2000). Because of the difficulty of isolating a leader's effects on organizational culture, I do not include this measure of human capital in this model.

2004, 2012), the model above may underestimate the effects of a principal's human capital on school performance. Principals are important facilitators of programs designed to improve school performance (Grissom & Loeb, 2011). If a principal's human capital also affects his or her ability to successfully implement a program that improves school performance, it is important to account for such effects in estimating the total influence of a principal's human capital on school performance.

A challenge of assessing a manager's influence on program implementation is that the goals of many public programs are vague (Pressman & Wildavsky, 1984), thus assessing successful program implementation is often subjective. A small subset of NYC public schools received additional funds to implement a specific program to improve school performance that has measurable outputs. This next section describes this program and how I examine the effects of human capital through program implementation using this smaller subset of schools.

Effects of Program Implementation as an Intervening Variable

Policy implementation is a difficult field to study in part because there are many variables that may influence successful implementation (Goggin, 1986). Despite these challenges, there is a general agreement that the policy implementer is an important link between the design of a policy and how it is actually carried out (O'Toole, 1986). In the case of an organization implementing a policy or program, all else being equal, one would expect a higher quality manager to more successfully implement a program than a lower quality manager. For programs that aim to increase organizational performance, a manager's human capital may therefore exert an influence on performance based on how well the manager implements the program. Assessing program implementation is often difficult because many public programs have vague goals (Majone & Wildavsky, 1984; Matland, 1995). To counter this problem, I focus on the important management function of allocating resources to achieve specific outputs to assess the influence of human capital through program implementation.

New York State introduced the Contract for Excellence (C4E) in 2007 to improve the performance of public schools. The C4E initiative provides certain qualifying schools with additional funds for programs that are assumed to influence school performance. The six programs within the C4E initiative include class-size reduction, programs for individualized attention for certain students, teacher and principal quality initiatives, school restructuring, full-day pre-kindergarten, and programs for English Language Learners. While most of the C4E programs do not have clearly measurable outputs, reducing the average class size in select NYC schools is a C4E program that does provide clear goals. The evidence from studies using experimental research designs support a positive association between smaller class sizes and student achievement (Finn & Achilles, 1990; Krueger, 1999). However, scholars that use non-experimental methods often fail to find a significant relationship between class size and student achievement, potentially because reducing a school's average class size often involves hiring new teachers (Gilraine, 2017). In such cases, the hiring of new, inexperienced teachers counteracts the gains to student achievement from smaller class sizes. I discuss how I control for the effect of hiring new teachers in the subsequent section.

Principals are the key actors in the implementation of the class size reduction program and have great discretion in how the funds are committed. As described by a memorandum instructing principals on various strategies that require "complex trade-offs and decisions" for class size reduction, managing resources for the implementation of the class size reduction program is more complicated than simply hiring a new teacher (Harries, 2008, p. 1).[25] Because the C4E program began in the 2009 school year, the panel evaluating effects of human capital through program implementation encompasses the 2009 through 2013 school years. Due to fiscal constraints, the program was not implemented in the 2011 school year, thus this panel includes four school years: 2009, 2010, 2012, and 2013.

<u>Implementation of Class Size Reduction Program (N≈325 schools for each year of the panel):</u>

The average class size measure for each school equals the total number of enrolled students divided by the total number of sections.[26] For grades K-8, the average class size is determined by homeroom classes. For high schools, the average class size is calculated by the average number of students in each section of core courses (English, math, science, and social studies). The high school class size data also includes grade 6-8 students that are enrolled in accelerated courses. Since some schools face space constraints and are unable to expand the number of classrooms to decrease class size, other schools receive funds to reduce the pupil-teacher ratio (PTR).[27] I measure program implementation primarily through class size reduction but also examine PTR reduction as a robustness check for the influence of principal human capital on school performance through program implementation. I measure both as continuous variables. For example, I measure program implementation for school *j* by comparing the school's average

[25] The NYC DOE issued guidance to principals that includes strategies to assess class size data, assess where to target class size reductions to maximize performance impacts, optimize budget decisions, assess space utilization, and manage school staff among other considerations to implement C4E program funds for class size reduction.

[26] NYC schools designate four different types of classes: general education, accelerated (high school credit bearing courses offered to middle school students), integrated co-teaching (includes two teachers to accommodate up to 40% of the classroom containing special needs students), and self-contained (consists of only special education students). I exclude self-contained classes since they require different class-size requirements than the other types of classes and are reported separately.

[27] The pupil-teacher ratio is defined as the total number of students in a school divided by the total number of teachers.

class size in time *t* to the school's average class size in time *t+1*. Similarly, as a robustness check I compare the school's PTR in time *t* to the school's PTR in time *t+1*.

Tables 3.10 and 3.11 summarize the changes in class size and PTR over the course of the panel for schools that received funds for these respective C4E programs. Class size reduction funds were available starting in the 2009 school year. Since fewer schools received funding for pupil teacher ratio reduction than class size reduction, the robustness check using pupil teacher ratio reduction involves a smaller subset of the panel.

The measures for implementation of the class size reduction program enable me to assess the influences of managerial human capital on school performance through unspecified means and program implementation as specified in Figures 3.5 and 3.6. As I discussed above, I use two measures of experience (tenure and previous experience as a principal) and six skill measures (Internal Management, Goal Setting, Managing Family Involvement, Indirect Instructional Leadership, Direct Instructional Leadership, and Human Capital Management) as components of a principal's human capital that should influence school performance. It is reasonable to think that three of these skills, Managing Family Involvement, Indirect Instructional Leadership, and Direct Instructional Leadership, should not impact a principal's ability to successfully implement the C4E class size reduction program. For this smaller subset of schools that received C4E funds to reduce class size, I therefore assess the effects of principal human capital through program implementation using both experience measures and three skill measures (Goal Setting, Internal Management, and Human Capital Management) and the effects of principal human capital through unspecified means using both experience measures and all six skill measures.

Hypotheses for School Performance (Path 1-Unspecified Means)

I assess the effects of principal human capital on school performance for this smaller subset of schools using the same hypotheses (Hypotheses 1a through 1k) outlined above.

Hypotheses for School Performance (Path 2-Program Implementation)

These hypotheses focus on the effects of principal human capital on implementation of the C4E class size reduction program for the smaller subset of schools that received C4E funds for this program.

Hypotheses Focused on Principal Experience (Path 2-Program Implementation)

H2a: There is a positive, quadratic relationship between principal tenure and program implementation.
H2b: There is a positive relationship between prior experience as a principal and program implementation.

I measure tenure and experience as discussed in the previous section.

Hypotheses Focused on Principal Skills (Path 2-Program Implementation)

H2c: The higher a principal is rated by the school's teachers as a Goal Setter, the more positive the effects will be on program implementation.
H2d: The higher a principal is rated by the school's teachers as an Internal Manager, the more positive the effects will be on program implementation.

Since staff planning is an important aspect of class size reduction, it is reasonable to expect a positive relationship between Human Capital Management and implementation of the C4E class size reduction program.

H2e: The greater a principal's abilities as a Human Capital Manager, the more positive the effects will be on program implementation.

I measure a principal's Goal Setting, Internal Management, and Human Capital Management skills as discussed in the previous section.

Hypotheses for Effects of Program Implementation on School Performance (Path 3-Effects through Program Implementation)

I evaluate successful implementation of the class size reduction program by measuring the degree of implementation. For example, a principal that reduces class size by an average of one student per class should see a greater effect on school performance, all else being equal, than a principal that reduces the average class size by half a student.

H2f: The more successfully a principal implements the class size reduction program, then the more positive the effects will be on improving school performance.

Table 3.12 summarizes the hypotheses I use to assess the influence of principal human capital skills on school performance.

Task Difficulty and Resource Availability Effects on School Performance

Previous studies include other important variables impacting student performance to include measures of task difficulty and resource availability based on socioeconomic characteristics of the student body (Favero et al., 2016; Hill, 2005; Meier & Hicklin, 2008; Meier & O'Toole Jr, 2002; Stritch, 2014). As Table 3.4 indicates, the peer-weighting process adjusts a school's performance score based on the characteristics of the school's population, so I focus on other measures of task difficulty and resource availability that were not included in this process but may impact student performance.[28] I include these variables in the analysis to assess the

[28] There are five task difficulty measures that are incorporated in the peer-weighting process that previous studies commonly include as control variables: percentage of students with limited English, percentage of students enrolled

impact of principal human capital qualities while controlling for other environmental factors that influence student performance as depicted in Figures 3.5 and 3.6.

Change in Total School Enrollment**:** This variable measures the percentage change in total school enrollment from the previous school year to the current school year. Schools that experience large changes in enrollment may face additional management challenges compared to schools with more stable student populations.

Total School Enrollment**:** This variable measures the total number of students enrolled in a school.

Average Class Size: This variable is a measure of the total number of enrolled students divided by the total number of sections.

Teacher Turnover: While a minimum amount of turnover is beneficial for a school to replace poor performers and spur innovation, too much turnover is detrimental to performance (Meier & Hicklin, 2008). In turn, the stability of a school's teaching corps is an important determinant of organizational performance (O'Toole & Meier, 2003). This variable measures the percentage of teacher turnover at each school.

C4E Funding**:** There are six strategies under the Contract for Excellence (C4E) program through which schools could receive funds, five of which are applicable to Grades 3-12. To control for the effects of these additional resources, I include a variable that represents the per-pupil funding for these C4E programs. The five categories are termed Class Size Reduction, Time on Task,

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in special education programs, percentage of students eligible for free lunch, percentage of Black students, and percentage of Hispanic students. Because I hypothesize that a school's SES moderates the influence of Managing Family Involvement, I include the percentage of students eligible for free lunch as a proxy for a school's SES in my primary model. Although this variable is also included as part of the peer weighting process, it is a relatively small component only for elementary/middle schools as depicted in Table 3.4, thus its inclusion as an explanatory variable should not confound the results.

Teacher and Principal Quality Initiatives, Middle & High School Restructuring, and Model Programs for ELLs. The variable "C4E Funding" combines the additional funds from these programs into one measure of per-pupil funding. I lag this variable by one year to account for the time it would take a principal to implement organizational changes through the commitment of these funds.

I control for the same task difficulty and resource availability variables for my analysis of all schools and the smaller subset of schools implementing the C4E class size reduction program with three exceptions. For the subset of schools implementing the class size reduction program, I exclude the variable "Average Class Size" since a school's average class size affects its inclusion into the smaller subset of schools that receive additional funding. I also remove the per-pupil amount for the Class Size Reduction program from the "C4E Funding" variable and add it as a separate variable to control for the effect of different funding amounts for this specific program on program implementation. Lastly, I add the variable below to control for the amount of funds a school receives under the C4E program specifically for Class Size Reduction.

CSR Funding**:** A measure of per-pupil funding for funds committed to a school for the Class Size Reduction program. As with the C4E funding variable, I lag this variable by one year to account for the time it would take a principal to implement organizational changes through the commitment of these funds.

Table 3.13 describes the distribution of the task difficulty and resource availability measures for each year of the panel. As Meier and O'Toole Jr (2002) note, many different variables influence student performance. The ones chosen for inclusion are meant to include controls to neutralize possible sources of spuriousness (Mohr, 1995). Collinearity may be an issue with the control variables since many of them measure similar concepts. The signs of the control variables are thus not of particular interest since the model is not intended to precisely estimate their effects.

Chapter Summary

This chapter described the units of analysis I use to assess the research questions presented in the opening chapter that were informed by the theoretical framework presented in Chapter 2. I explained why NYC public schools are an appropriate unit of analysis due to the characteristics of the organizational setting and the variation in the human capital qualities of the first-line managers, school principals. I described the context in which principals operate to provide further context for how principals are held accountable for school performance. I explained how I operationalize the dependent and independent variables to assess the influence of principal human capital skills on school performance. I also described how principal human capital qualities may exert an influence on performance through the implementation of the class size reduction program. This chapter concluded with a summary of the hypotheses in this dissertation. The next chapter explains the modeling strategy I use to evaluate these hypotheses.

Table 3.1

Principal Turnover Rates, 2008 Through 2013

New Principals in School Year	Number of New Principals	New Principals as a Percentage of Total Principals
Elementary & Middle Schools		
2008	77	8.13%
2009	74	7.75%
2010	129	13.58%
2011	38	4.03%
2012	80	8.61%
2013	124	12.94%
Total	522	9.19%
High Schools		
2008	26	9.29%
2009	42	13.73%
2010	34	10.53%
2011	45	13.93%
2012	38	11.76%
2013	68	19.32%
Total	253	13.27%

Table 3.2

Distribution of School Types by Year

	2008	2009	2010	2011	2012	2013	Total
Elementary	710	708	708	706	700	710	4,242
Middle	475	487	480	468	453	473	2,836
High	280	306	324	323	323	353	1,909
Total	1,230	1,262	1,279	1,267	1,252	1,297	7,587

Table 3.3

NYC DOE School Performance Measures[29]

Student Progress				
Elementary and Middle Schools (0-60)				**High Schools (0-55)**
	Elem	Mid	K-8	
Student progress on state exams (median adjusted growth percentile) -all students -students in school's lowest third	 20 points 20 points	 30 points 30 points	 25 points 25 points	Progress in coursework toward a Regents Diploma – all students (12.5 points) – students in school's lowest third (12.5 points)
				Average completion rate for Regents Exams (5 points)
Early grade progress (3rd grade achievement weighted by demographic factors)	20 points	N/A	10 points	Pass rates for Regents Exams – English, Math, Science, U.S. History, Global History (25 points)
Student Performance				
Elementary and Middle Schools (0-25)				**High Schools (0-20)**
	Elem	Mid	K-8	
Percentage of students proficient on NYS exams Mean proficiency rating on NYS exams Core course pass rate – English, Math, Science, Social Studies	12.5 points 12.5 points N/A	10 points 10 points 5 points	10 points 10 points 5 points	Graduation Rates: -Percentage of students that graduated within 4 years (5 points) -Percentage of students that graduated within 6 years (5 points)
				Diploma Types: -Weighted diploma rate for students that graduated within 4 years (5 points) -Weighted diploma rate for students that graduated within 4 years (5 points)

[29] The median adjusted growth percentile compares a student's growth to the growth of all students in the NYC DOE who started at the same level of proficiency in the previous school year. It is a number between 0 and 100 that represents the percentage of students that scored the same or lower on the current year's test. Higher scores are better. For example, a median adjusted growth percentile of 0 means that no students in other schools that started at the same level of proficiency scored the same or lower than the school's students on this year's exams. Students in the lowest third for high schools are based on a student's 8th grade exam scores in English Language Arts and Math. Students that do not have 8th grade scores are excluded from a school's lowest third. The demographic factors considered for the early grade progress criterion are Black or Hispanic, Temporary Housing eligible, qualified for additional support services, and English Language Learner.

Table 3.4

Peer Index Process[30]

	Elementary & K-8 Schools	**Middle Schools**	**High Schools**
Scale	0-100 (higher index score indicates a higher need population)	1-4.5 (lower index score indicates a higher need population)	1-4.5 (lower index score indicates a higher need population)
Formula	[(% temporary housing + % qualified for public assistance * .5 + % eligible for free lunch * .5) * 30] + [% Black/Hispanic students * 30] + [% of students with disabilities * 30] + [% of English language learners * 10]	[Average 4^{th} Grade English and Math Proficiency on State Exams] - [2 * % of students with disabilities]	[Average 8^{th} Grade English and Math Proficiency on State Exams] - [2 * % of students with disabilities] - [2 * % of special education students] - % of over-age students
Peer Group Size	40 for Elementary Schools (20 with a peer index immediately higher and 20 with a peer index immediately lower) 30 for K-8 Schools (15 with a peer index immediately higher and 15 with a peer index immediately lower)	40 (20 with a peer index immediately higher and 20 with a peer index immediately lower)	40 (20 with a peer index immediately higher and 20 with a peer index immediately lower)

[30] Over-age students are age 16 or older as of December 31^{st} of their 9^{th} grade entry year. Additionally, students are considered over-age if they have less than 11 high school credits at 16 years old, less than 22 credits at 17 years old, less than 33 credits at 18 years old, and less than 44 credits at 19-21 years old.

Table 3.5

Peer and Citywide Ranges for School Performance Criteria

Percent of Range	**Interpretation**
0%	Two or more standard deviations below average
25%	One standard deviation below average
50%	Equal to the Average
75%	One standard deviation above the average
100%	Two or more standard deviations above the average

Table 3.6

Progress and Performance Score Descriptive Statistics

Elementary and Middle Schools									
	Progress Scores					**Performance Scores**			
Year	n	Mean	Std Dev.	Min	Max	Mean	Std Dev.	Min	Max
2008	996	31.21	9.50	0	60	15.39	3.84	1.5	25
2009	1,008	46.06	8.49	6.7	60	19.32	3.49	7.9	25
2010	1,009	28.99	11.17	0	60	7.56	4.39	0	25
2011	999	26.21	10.83	0	56.4	8.82	3.88	.4	23.8
2012	988	28.62	9.83	0	60	14.27	4.62	.2	25
2013	1,026	30.65	9.15	1.3	56.5	12.73	4.52	.3	25
Total	6,026	31.97	11.82	0	60	13.01	5.74	0	25
High Schools									
	Progress Scores					**Performance Scores**			
Year	n	Mean	Std Dev.	Min	Max	Mean	Std Dev.	Min	Max
2008	280	32.98	9.05	14.9	60	14.74	4.81	3.2	25
2009	306	37.40	9.14	11.9	60	16.06	4.54	5.3	25
2010	324	37.58	8.55	12.5	60	16.00	4.59	3.8	25
2011	323	35.40	7.87	10.4	58.3	15.83	4.09	3.2	23.8
2012	323	32.49	7.73	10.8	52.8	12.77	3.27	1.0	19.1
2013	354	30.32	8.87	6.5	54.1	12.32	3.50	2.4	19.7
Total	1,910	34.3	8.95	6.5	60	14.57	4.43	1.0	25

Table 3.7

Principal Tenure and Prior Experience Descriptive Statistics

Elementary and Middle Schools								
	Tenure				**Experience**			
Year	Mean	Std Dev.	Min	Max	Mean	Std Dev.	Min	Max
2008	4.31	4.00	0	45	.13	.94	0	12
2009	4.67	3.91	0	46	.14	.99	0	12
2010	4.75	4.06	0	47	.16	1.01	0	12
2011	5.53	4.15	0	48	.17	1.00	0	12
2012	5.94	4.37	0	49	.15	.97	0	12
2013	5.77	4.61	0	50	.15	.95	0	12
Total	5.16	4.23	0	50	.15	.98	0	12
High Schools								
	Tenure				**Experience**			
Year	Mean	Std Dev.	Min	Max	Mean	Std Dev.	Min	Max
2008	4.09	3.16	0	28	.16	.91	0	7
2009	4.01	3.07	0	18	.16	.82	0	9
2010	4.33	3.19	0	17	.26	1.11	0	9
2011	4.46	3.43	0	18	.25	1.08	0	11
2012	4.75	3.64	0	19	.30	1.35	0	16
2013	4.23	3.73	0	20	.49	1.71	0	16
Total	4.32	3.40	0	28	.28	1.22	0	16

Table 3.8

Principal Skill Measures and Descriptive Statistics

Human Capital Variable		Results from the 2007-2012 NYC School Survey				
Principal as Goal Setter (Teacher Responses) (Eigenvalue 1.47):	Factor Loading	N	Mean	Std Dev.	Min	Max
-School leaders communicate a clear vision for this school. -My school has clear measures of progress for student achievement throughout the year.	.86 .86	7,453	14.92	2.57	0	20
Principal as Internal Manager (Teacher Responses) (Eigenvalue 1.74):	Factor Loading	N	Mean	Std Dev.	Min	Max
-The principal at my school is an effective manager who makes the school run smoothly. -Order and discipline are maintained at my school. -My school is kept clean.	.81 .86 .59	7,457	20.42	4.35	0	30
Principal as Manager of Family involvement (Parent/Guardian Responses) (Eigenvalue 3.27):	Factor Loading	N	Mean	Std Dev.	Min	Max
-I feel welcome in my child's school. -My child's school makes it easy for parents to attend meetings by holding them at different times of day, providing an interpreter, or in other ways. -The school keeps me informed about my child's academic progress. -How satisfied are you with how well your child's school communicates with you?	.92 .92 .84 .94	7,473	31.25	2.25	21.1	39.5
Principal as Manager of Family involvement (Teacher Responses) (Eigenvalue 2.32):	Factor Loading	N	Mean	Std Dev.	Min	Max

-Obtaining information from parents about student learning needs is a priority at my school. -Teachers and administrators in my school use information from parents to improve instructional practices and meet student learning needs. -My school communicates effectively with parents when students misbehave.	.85 .94 .85	7,450	19.86	3.81	4.3	30
Principal as Indirect Instructional Leader (Teacher Responses) (Eigenvalue 3.22):	Factor Loading	N	Mean	Std Dev.	Min	Max
-School leaders invite teachers to play a meaningful role in setting goals and making important decisions for this school. -This year, I received helpful training on the use of student achievement data to improve teaching and learning. -The professional development I received this year provided me with content support in my subject area. -The professional development I received this year provided me with teaching strategies to better meet the needs of my students.	.77 .89 .95 .96	7,451	26.32	5.20	1.1	40
Principal as Direct Instructional Leader (Teacher Responses):		N	Mean	Std Dev.	Min	Max
-School leaders visit classrooms to observe the quality of teaching at this school.		7,456	7.48	1.23	0	10
Principal as Human Capital Manager (Teacher Responses) (Eigenvalue 2.00):	Factor Loading	N	Mean	Std Dev.	Min	Max
-Teachers in this school set high standards for student work in their classes. -To what extent do you feel supported by other teachers at your school? -Most teachers in my school work together to improve their instructional practice.	.75 .81 .88	7,452	23.71	2.67	7.7	30

Table 3.9

Principal Human Capital Management Descriptive Statistics

Human Capital Management				
Year	Mean	Std Dev.	Min	Max
2008	89.16	8.72	49	100
2009	92.07	7.72	53	100
2010	93.87	6.77	59	100
2011	94.62	6.35	33	100
2012	95.18	6.33	44	100
2013	93.81	7.86	49	100
Total	93.13	7.60	33	100

Table 3.10

Class Size Reduction Descriptive Statistics

Change in Average Class Size					
Year	N	Mean	Std Dev.	Min	Max
2008	-	-	-	-	-
2009	286	-0.08	2.10	-8.75	17.5
2010	458	0.73	2.13	-13.88	7.19
2011	-	-	-	-	-
2012	284	0.40	1.74	-7.19	6.68
2013	274	0.25	1.86	-9.05	6.28
Total	1,302	0.38	2.01	-13.88	17.5

Table 3.11

Pupil Teacher Ratio Reduction Descriptive Statistics

Change in Pupil Teacher Ratio					
Year	N	Mean	Std Dev.	Min	Max
2008	-	-	-	-	-
2009	-	-	-	-	-
2010	-	-	-	-	-
2011	-	-	-	-	-
2012	96	0.54	1.21	-4.04	3.40
2013	93	0.03	0.95	-2.65	1.92
Total	189	0.29	1.11	-4.04	3.40

Table 3.12

Summary of Hypotheses

Hypothesis	Independent Variable(s) and Measures
H1a: There is a positive, quadratic relationship between principal tenure and school performance.	Principal Tenure: number of years of principal tenure in a principal's current school at the start of the school year.
H1b: There is a positive relationship between prior experience as a principal and school performance.	Principal Experience: number of years of experience as a principal in NYC prior to the current school year.
H1c: The higher a principal is rated by the school's teachers as a Goal Setter, the more positive the effects will be on school performance.	Principal as Goal Setter: single factor from the following questions from the NYC Teacher Survey: -School leaders communicate a clear vision for this school. -My school has clear measures of progress for student achievement throughout the year.
H1d: The higher a principal is rated by the school's teachers as an Internal Manager, the more positive the effects will be on school performance.	Principal as Internal Manager: single factor from the following questions from the NYC Teacher Survey: -The principal is an effective manager who makes the school run smoothly. -Order and discipline are maintained at my school. -My school is kept clean.
H1e: As a school's SES increases, the higher a principal is rated by the school's parents as a Manager of Family Involvement, the more positive the effects will be on school performance	Principal as Manager of Family involvement: single factor from the following questions from the NYC Parent Survey: -I feel welcome at my child's school -My child's school makes it easy for parents to attend meetings by holding them at different times of day, providing an interpreter, and in other ways -The school keeps me informed about my child's academic progress -How satisfied are you with how well your child's school communicates with you?
H1f: A principal's skills as an Indirect Instructional Leader have an effect on school performance.	Principal as Indirect Instructional Leader: single factor from the following questions from the NYC Teacher Survey:

H1g: A principal's skills as a Direct Instructional Leader have an effect on school performance.	-School leaders invite teachers to play a meaningful role in setting goals and making important decisions for this school -This year, I received helpful training on the use of student achievement data to improve teaching and learning -The professional development I received this year provided me with content support in my subject area -The professional development I received this year provided me with teaching strategies to better meet the needs of my students. Principal as Direct Instructional Leader: single factor from the following questions from the NYC Teacher Survey: -School leaders visit classrooms to observe the quality of teaching at this school.
H1h: The grade level of a school has an effect on the influence of Instructional Leadership on school performance.	
H1i: As a school's socioeconomic status decreases, the higher a school's principal is rated as an Instructional Leader, the more positive the effects will be on school performance.	
H1j: The greater a principal's abilities as a Human Capital Manager, the more positive the effects will be on school performance.	Principal as Human Capital Manager: percentage of courses that are taught by high quality teachers.
H1k: There is a positive, quadratic relationship between a principal's tenure and the effects of a principal's skills on school performance.	Principal Tenure: number of years of principal tenure in a principal's current school at the start of the current school year.
H2a: There is a positive, quadratic relationship between principal tenure and program implementation.	Principal Tenure: number of years of principal tenure in a principal's current school at the start of the current school year.
H2b: There is a positive relationship between prior experience as a principal and program implementation.	Principal Experience: number of years of experience as a principal in NYC prior to the current school year.
H2c: The higher a principal is rated by the school's teachers as a Goal Setter, the	Principal as Goal Setter: single factor from the following questions from the NYC Teacher Survey: -School leaders communicate a clear vision for this school.

more positive the effects will be on program implementation.	-My school has clear measures of progress for student achievement throughout the year.
H2d: The higher a principal is rated by the school's teachers as an Internal Manager, the more positive the effects will be on program implementation.	Principal as Internal Manager: single factor from the following questions from the NYC Teacher Survey: -The principal is an effective manager who makes the school run smoothly. -Order and discipline are maintained at my school. -My school is kept clean.
H2e: The greater a principal's abilities as a Human Capital Manager, the more positive the effects will be on program implementation.	Principal as Human Capital Manager: percentage of courses that are taught by high quality teachers.
H2f: The more successfully a principal implements the class size reduction program, then the more positive the effects will be on improving school performance.	Program implementation: change in average class size

Table 3.13

Task Difficulty and Resource Availability Descriptive Statistics

School Enrollment				
Year	Mean	Std Dev.	Min	Max
2008	740.19	590.35	127	4,472
2009	714.55	557.99	51	4,662
2010	718.47	561.90	115	4,947
2011	715.70	559.83	116	5,140
2012	713.61	551.64	113	5,332
2013	695.21	537.46	101	5,451
Total	716.10	559.84	51	5,451
Percent Change in School Enrollment				
Year	Mean	Std Dev.	Min	Max
2008	2.57	17.33	-33.85	229.23
2009	2.05	15.76	-32.29	162.40
2010	1.87	10.62	-39.44	125.49
2011	0.91	8.95	-34.83	91.30
2012	0.13	8.18	-30.97	78.15
2013	-0.22	7.65	-38.95	92.44
Total	1.22	12.06	-39.44	229.23
Average Class Size				
Year	Mean	Std Dev.	Min	Max
2008	23.36	3.55	6.48	35.50
2009	23.36	3.55	9.21	39.00
2010	24.04	3.36	8.87	33.56
2011	24.53	3.26	12.14	39.87
2012	24.94	3.09	14.17	33.61
2013	25.29	3.02	12.57	34.17
Total	24.26	3.39	6.48	39.87

Teacher Turnover				
Year	Mean	Std Dev.	Min	Max
2008	18.05	10.24	0	64
2009	16.11	9.47	0	58
2010	14.79	8.49	0	53
2011	15.28	9.38	0	65
2012	15.74	9.61	0	63
2013	17.73	10.20	0	78
Total	16.27	9.65	0	78
C4E Funding				
Year	Mean	Std Dev.	Min	Max
2008	-	-	-	-
2009	282.96	357.14	0	4051.67
2010	412.74	345.78	0	3966.11
2011	-	-	-	-
2012	289.72	246.73	0	2537.54
2013	272.57	241.09	0	2195.31
Total	251.44	302.22	0	4051.67

Figure 3.1

Distribution of Elementary Schools by District

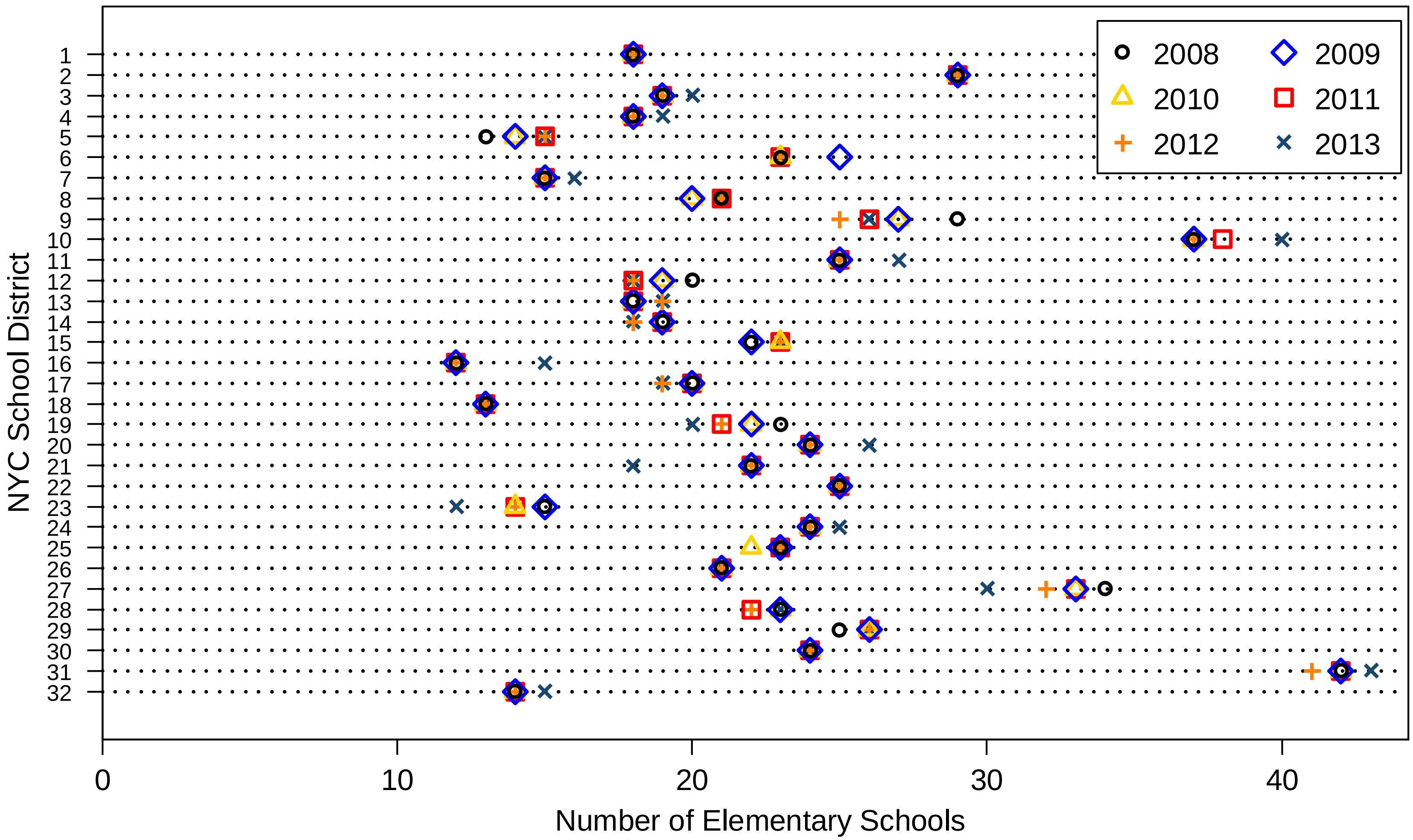


Figure 3.2

Distribution of Middle Schools by District

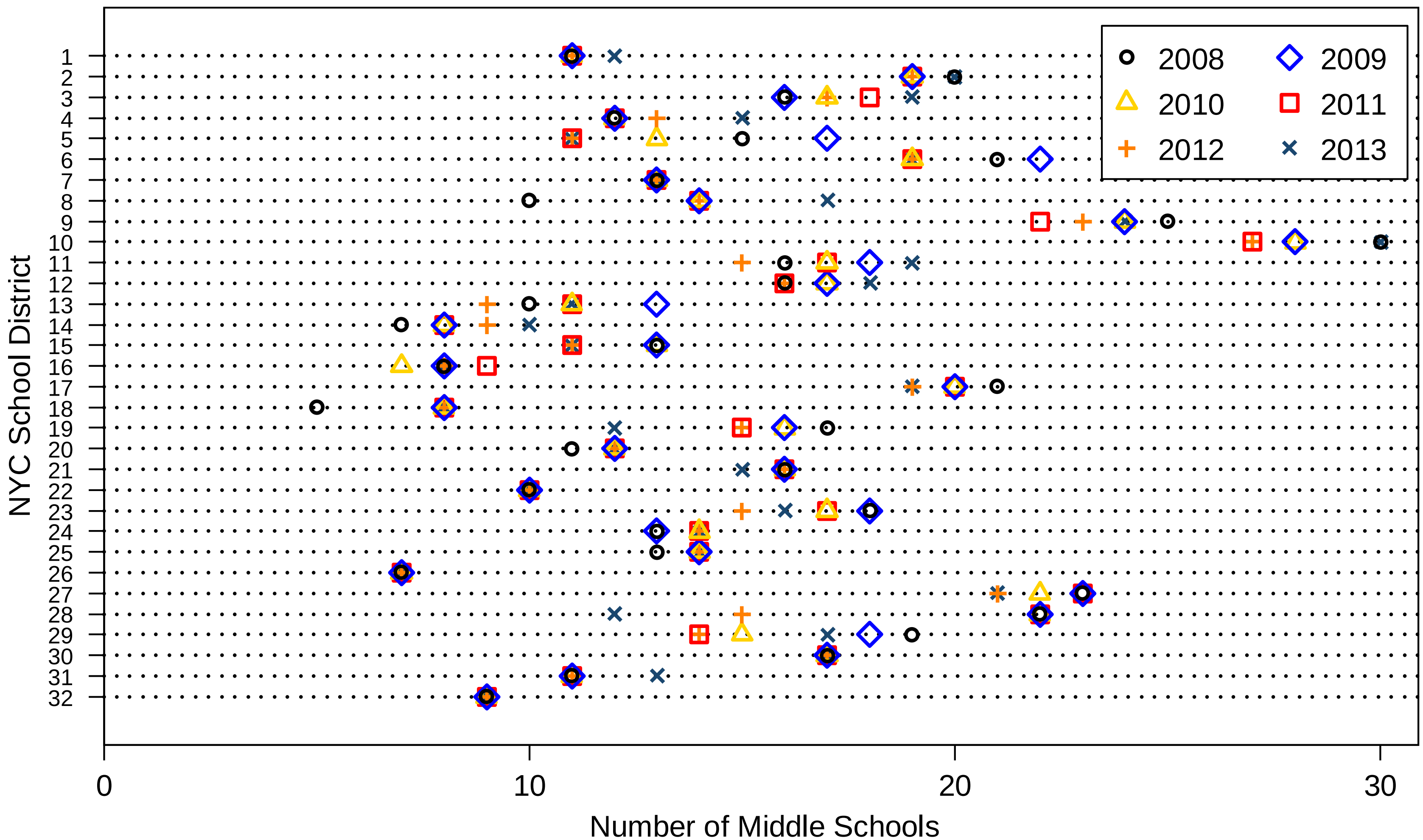


Figure 3.3

Distribution of High Schools by District

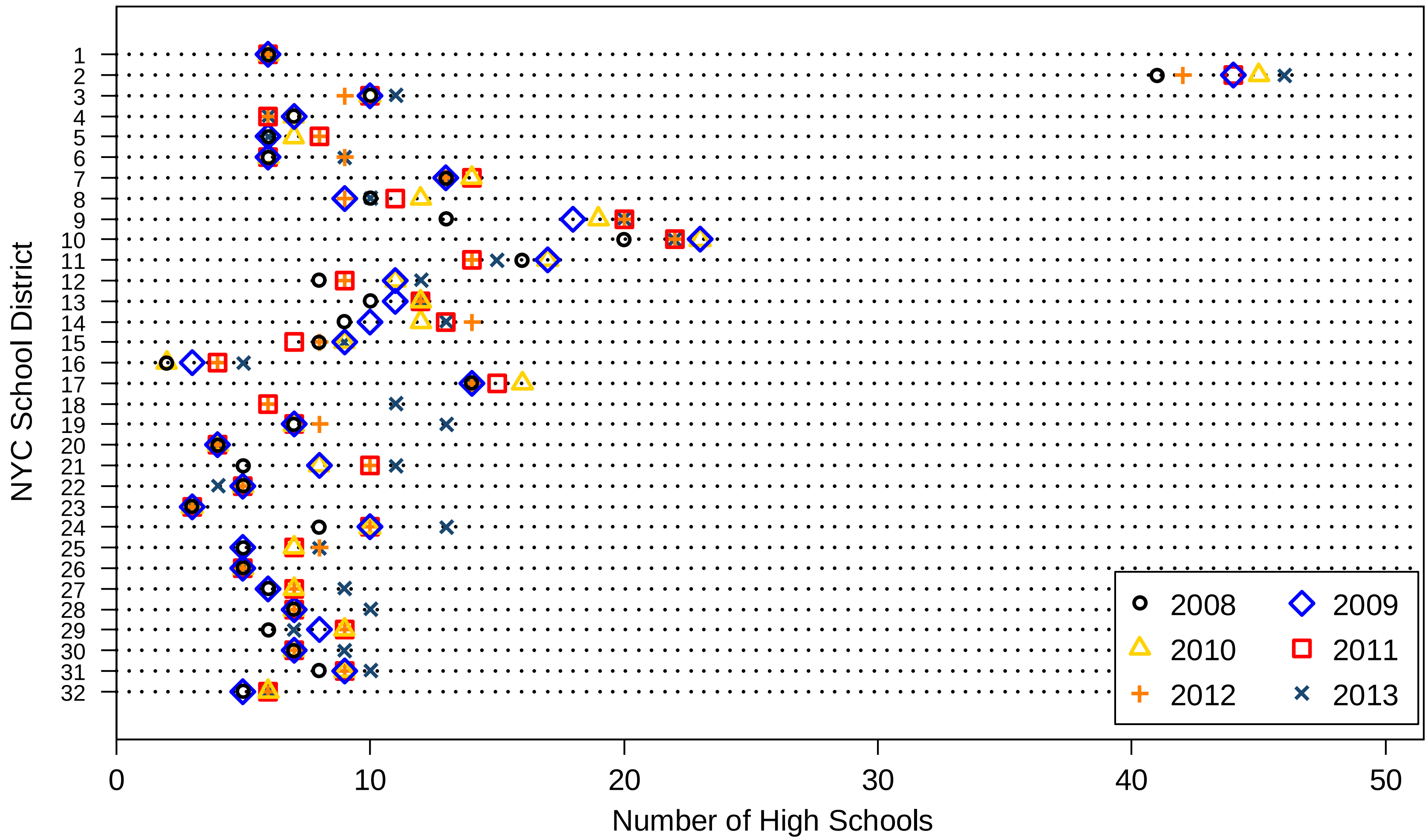


Figure 3.4

NYC DOE Organizational Chart

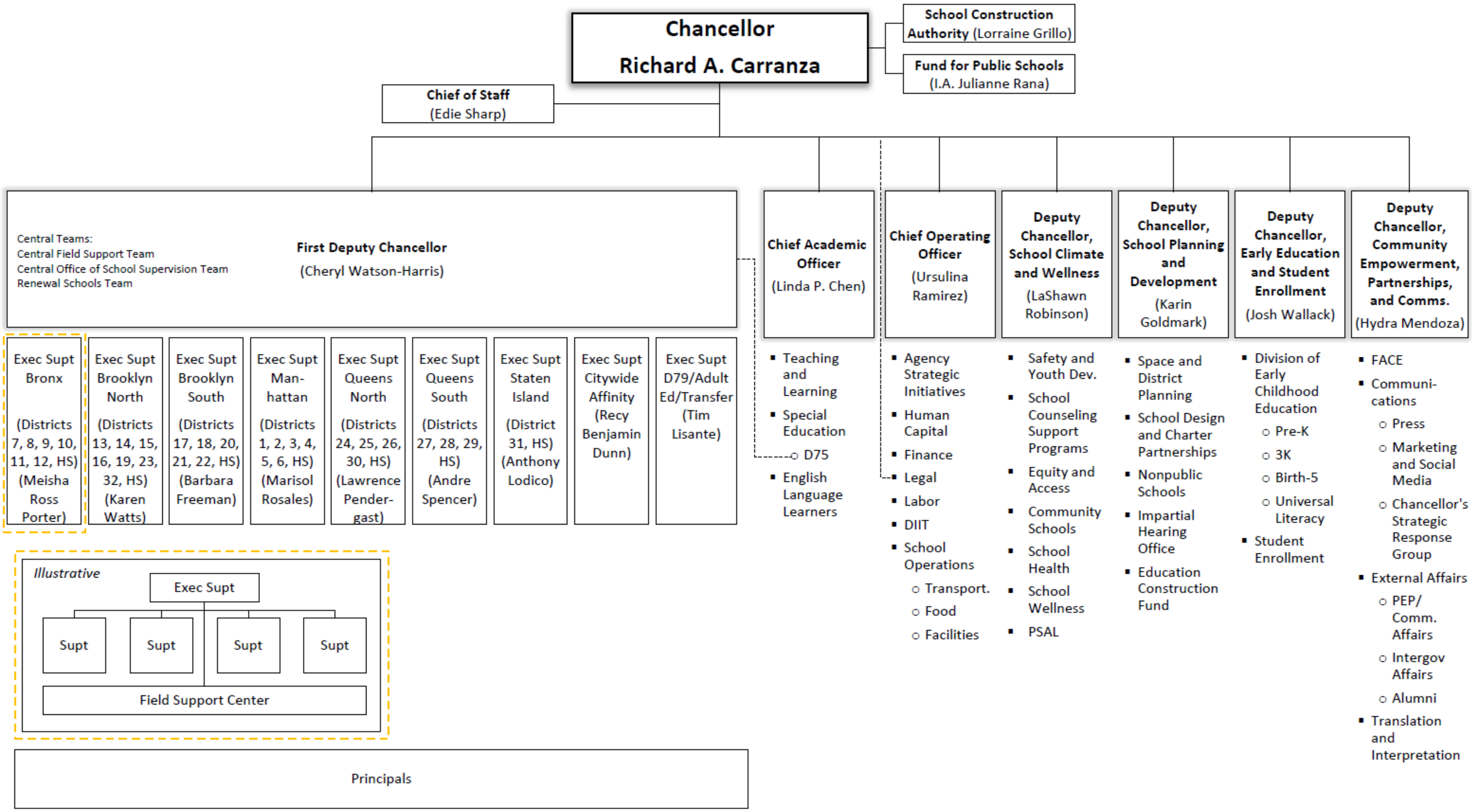


Figure 3.5

Path Diagram for the Effects of Principal Human Capital on School Performance Through Unspecified Means

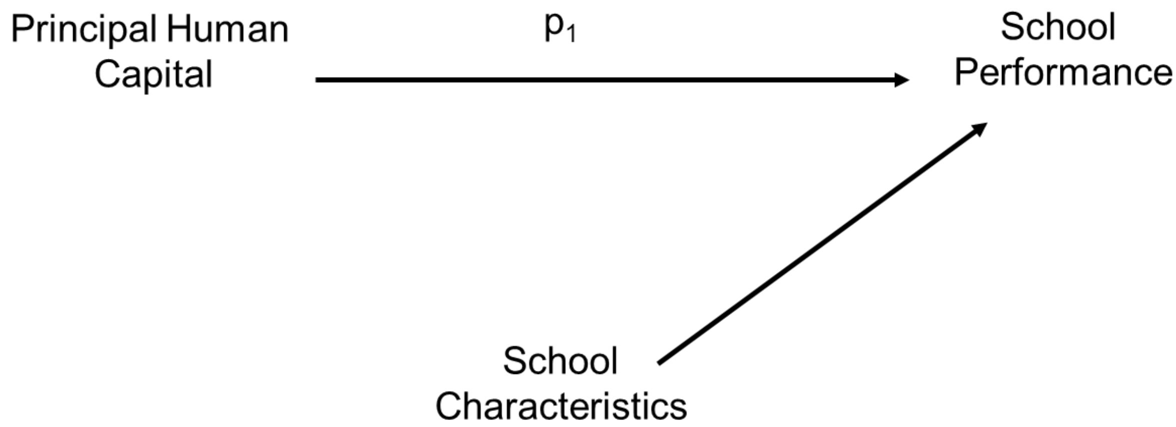
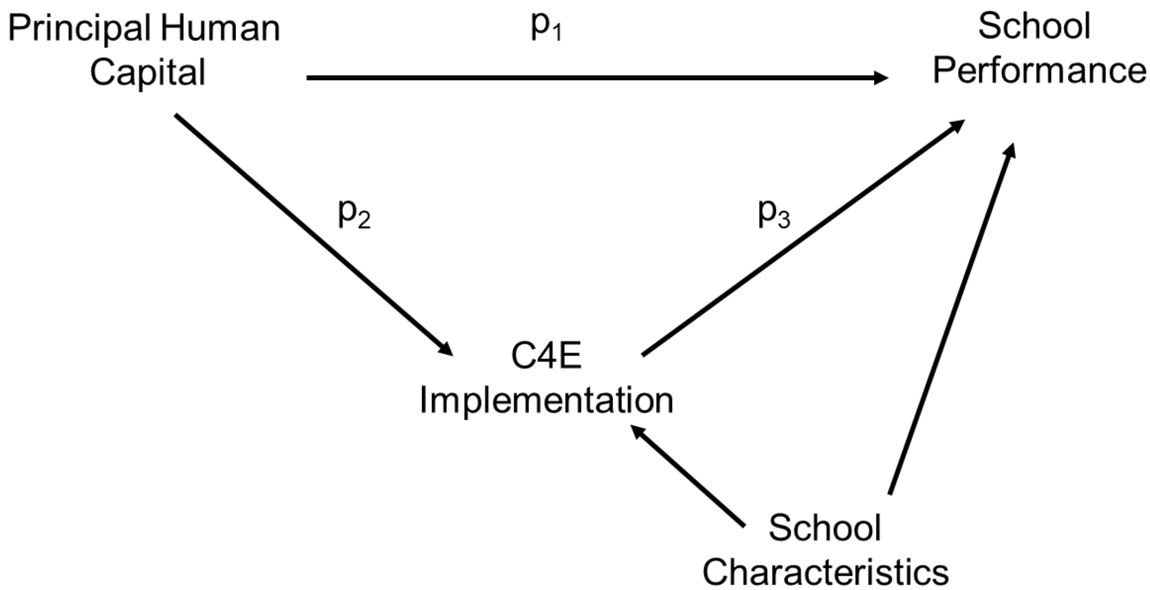


Figure 3.6

Path Diagram for the Effects of Principal Human Capital on School Performance Through Implementation of the C4E Program



CHAPTER 4

RESEARCH METHODS

This chapter focuses on the research methods used to analyze the association of human capital characteristics of New York City (NYC) principals and school performance. The first section of this chapter describes the non-experimental nature of this research design and how I mitigate some of the downsides of this method. Next, I describe the use of panel data in public administration literature and the benefits and limitations to different strategies for analyzing panel data. I then explain why structural equation modeling is an appropriate method to address my research questions based on the characteristics of the units of analysis described in Chapter 3. Because school level effects could affect the results using my primary estimation method of a pooled structural equation model, I describe the process I use to include point estimates of latent variables from a structural equation model in a random effects regression to estimate the effects of a principal's human capital on school performance as a robustness check. I discuss some limitations of both methods, strategies I use to mitigate these disadvantages, and techniques to assess model fit. Lastly, in the conclusion I address how the characteristics of the research design affect my ability to claim a causal relationship between a principal's human capital and school performance.

Non-Experimental Research Design

Social scientists characterize research designs into one of three categories which are experimental, quasi-experimental, and non-experimental, or ex post facto (Mohr, 1995; Singleton

& Straits, 2010). In this section I address why my research design falls into the non-experimental category. I discuss how spuriousness is a threat to internal validity in a non-experimental design which an experiment or quasi-experiment would avoid. I describe how I manage this challenge and other threats to internal validity, and despite the limitations of a non-experimental design, why it is the appropriate design to address the research questions described in Chapter 1.

The locus and mode of selection are two important concepts that determine the type of research design. The locus of selection refers to who makes the decision on which treatment a subject receives. The locus of selection could be a centralized authority such as the researcher or a program manager that decides who receives a treatment (or the level of treatment) and who does not. A centralized locus of selection eliminates spuriousness, or the chance that the variation of some other variable leads to changes in the independent variable and the dependent variable such that they appear related to each other. Alternatively, the locus of selection may be decentralized such as when participants self-select into groups.

The mode of selection refers to the method by which individuals are assigned into treatment or control groups. The mode of selection could be a random process such as picking names out of a hat in which each participant has an equal chance of being assigned to a particular group. A non-random selection process fails to institute procedures that make the chance of assignment into a particular group equal for all participants.

Experimental designs feature a centralized locus of selection and a randomized method of selection. The internal validity of experimental designs is typically higher than other designs since a central authority controls the manipulation of the independent variable(s) of interest prior to the measurement of the dependent variable. Since an experiment also involves a random mode of selection, it avoids the problems of selection effects inherent in other designs. Selection effects result from initial differences between groups that affect the dependent variable and are therefore confounded with the effects of the treatment the researcher wishes to examine.

Since experimental designs eliminate spuriousness and selection effects as threats to internal validity, the primary threats to internal validity in an experimental design are chance and contamination. A common example of contamination in an experiment is a subject adjusting his or her behavior based on the way the researcher administers a treatment variable. While a strength of experiments is their internal validity, they are infrequently used in public administration research in part because many public administration studies are at the organizational level of analysis (Bozeman & Scott, 1992). This is the case in my study since schools are the units of analysis. Since the treatment effect I wish to examine is the human capital of principals, it is not possible for me to administer this treatment by controlling which principal is assigned to which school. Even if it was possible for a centralized authority to assign a treatment effect to schools, it would be difficult to employ such a design for ethical reasons since one would expect a principal with lower levels of human capital to negatively influence school performance. It is also not possible to randomly assign schools into treatment or control groups.

The main difference between a quasi-experiment and experiment is that the mode of selection in a quasi-experiment is non-random. Selection effects are therefore a threat to internal validity for quasi-experiments because of the possibility that differences between treatment and control groups will affect the outcome since the assignment of subjects is non-random. Quasi-experiments are especially vulnerable to contamination since the researcher does not have the safeguards available in a laboratory setting to guard against these effects (Singleton & Straits, 2010). However, like experiments, quasi-experiments eliminate the problem of spuriousness since there is a centralized locus of selection which decides which subjects receive a treatment.

Since I am interested in understanding the effects of principal human capital on school performance, I am not able to conduct an experiment or quasi-experiment and control the level of treatment, or the principal human capital, applied to my units of analysis. Rather than manipulated by some central authority, the assignment of principal human capital to schools is made by different authorities for different schools as described in Chapter 3. My research design is therefore non-experimental since the locus of selection is decentralized. Since there is no central authority that assigns the treatment effect (principals with particular human capital skills) to schools, I must reconstruct observations of different levels of principal human capital across different schools and assess the resulting effects on school performance.

Because a non-experimental design lacks a centralized locus of selection, this design is the weakest of the three because I cannot eliminate spuriousness as a threat to internal validity. To address the threat of spuriousness, one must incorporate potentially spurious variables into the research design as control variables. As I discussed in Chapter 3, I include several independent variables focused on task difficulty and resource availability that may impact the human capital of a school's principal and the school's performance. However, I cannot be certain that I controlled for all factors that may influence both a principal's human capital qualities and school performance. As a result of these limitations I cannot completely eliminate the threat of spuriousness from my research design.

As in the case of a quasi-experiment, selection effects are also a threat to the internal validity of non-experimental designs. Mohr (1995) classifies selection effects in terms of P (bias due to groups starting out in different places) and Q (one or more causes of results are omitted and confounded with the variable of interest) effects. I am less concerned with P effects due to the variables I control for statistically with this research design than Q effects. An example of the selection effect of divergent history influencing school performance would be the introduction of a new curriculum that affects components of the Student Progress and Student Performance scores. If some schools introduced a new curriculum but others did not, this divergent event may confound the results. Other potential Selection Q effects include turnover in assistant principals or other variables that affect school performance which I did not include in my model. It is also difficult to account for other variables that may impact the leader's behavior. Since principals may change cities when they change positions, the effects of this move (disruptions to family routines, access to supportive mentors, etc.) are not accounted for.

Despite these challenges to the internal validity of my research design, the benefit of a non-experimental design is that it enables me to conduct my research in a natural setting of a large, diverse school district with a broad range of principals with different human capital skills. The nature of the research question therefore guides the research design I use since it is difficult to conduct an experiment or quasi-experiment to assess the influence of a manager's human capital on performance. The counterfactual in this study is what the performance of schools would be with a different principal. By taking before measures of performance, I estimate the counterfactual by observing the resulting state of performance for each school given different human capital qualities of the principals. Although a non-experimental design presents challenges to internal validity, this type of design is necessary to obtain a counterfactual and inform the estimate of the causal effects of a principal's human capital on performance. I take steps to neutralize the most serious threats to the internal validity of my research design, but given the challenges inherent in a non-experimental design, I am cautious in my estimates of causal effects as I discuss in the conclusion of this chapter.

Panel Data

The data in this study consist of observations from NYC public schools over a six-year period from 2008-2013. The data set is therefore considered a panel because it consists of spatial (schools) and temporal (school years) dimensions. The panel is an unbalanced panel since the number of time periods is not the same for all schools because some schools opened and others closed over the course of the panel. There are two primary advantages of panel data over cross-sectional data. First, because panel data enable the researcher to observe changes in response variables as reactions to different inputs in the temporal dimension, panel data provide a more sound basis for assessing causality than cross-sectional data (Monogan, 2011). Panel data also enable the researcher to increase the number of observations compared to a cross-sectional analysis.

While panel data provide a stronger basis for evaluating causality than cross-sectional data, an accompanying challenge is to account for unit effects, in this case the effect of factors unique to each school, which may cause bias or inefficiency in the results (Monogan, 2011). As Zhu (2013) notes, complete pooling often leads to biased estimation because there is temporal dependence across time for units. Such unit effects are likely given my units of analysis. One would expect that the performance of two demographically different schools would differ even if they were led by principals with the same levels of human capital qualities due to unobserved qualities unique to each school.

The Breusch-Pagan Lagrangian multiplier test (LM test) is a common method to assess if there is a significant difference across units in a panel and determine if pooled ordinary least squares is an appropriate model (Breusch & Pagan, 1979; Wooldridge, 2015). I conducted a LM test to assess the presence of unit effects, using the principal human capital and task difficulty/resource availability measures described in Chapter 3 as explanatory variables for Student Progress and Student Performance scores for elementary/middle and high schools. In each case, the LM test resulted in a *p*-value of 0.0 which indicates the presence of unit effects.[31] Pooled ordinary least squares is therefore an inefficient estimator for this panel since there is sufficient evidence that there are significant differences across schools.

In addition to unit effects, another challenge of using panel data is serial correlation. Serial correlation refers to the correlation due to repeated observations of the same individual. Since ordinary least squares assumes uncorrelated errors, serial correlation can lead to biased estimates. A method to account for serial correlation is the inclusion of a lagged dependent variable as a covariate in the model. However, since this panel of NYC schools features only six waves, or years, of data, including a lagged dependent variable negates one year's worth of observations. Although a lagged dependent variable can account for unit effects and serial correlation, in short panels such as the NYC schools panel, serial correlation can be hard to account for (Monogan, 2011). In turn, the costs of a lagged dependent variable approach outweigh the benefits.

[31] For elementary/middle schools, the LM test resulted in a chi-squared value of 212.19 for Performance scores and 104.12 for Progress scores. For high schools, the chi-squared value from the test was 233.87 for Performance scores and 272.23 for Progress scores. For this test I used an additive index of the indicator questions for each human capital skill as the measure for Goal Setting, Internal Management, Managing Family Involvement, and Indirect Instructional Leadership.

Two other prevailing techniques to account for unit effects and serial correlation are fixed effects or random effects. Fixed effects accounts for the unobserved heterogeneity between units by creating a unit-specific intercept for each unit through dummy variables. Fixed effects are appropriate when the researcher expects that unit effects are correlated with the explanatory variables. However, when the number of units is large as is the case with this panel of NYC schools, estimation with fixed effects can be inefficient. Unit dummy variables also run the risk of discarding cross-unit variations that are explained by the other independent variables in the model and therefore lead to Type 1 errors (Zhu, 2013).

Fixed effects models may especially lead to biased estimates when the number of observations is large but the time period is small (Nickell, 1981) such as in the NYC schools dataset used for this study. A benefit of a fixed effects model is that it produces unbiased estimates under the assumption that there is correlation between the explanatory variables in the model and unit effects. A fixed effects model also addresses the possibility of omitted variable bias by examining variation across time instead of across units.

As opposed to fixed effects, a random effects model assumes unit dummy variables are unnecessary since the other independent variables explain most of the unit specific effects. Stated differently, with random effects, the researcher assumes that an individual effect can be considered independent of the regressors. While this assumption is problematic since there is likely some correlation between the unit effects and the explanatory variables in this study, I expect that the unit effects are small in comparison to the explanatory variables since I control for several resource and task difficulty variables.

Because of concerns regarding inefficiency of a fixed effects model given the large number of units, a random effects model is arguably more appropriate for this panel of NYC schools. I am also more interested in variation between units than variation over time which further supports random effects over fixed effects for my model. Although these two points support a random effects model, in the next two chapters I include the results of a Hausman test for each model which is a common test to consider whether fixed or random effects is the appropriate estimation technique (Wooldridge, 2015).

Heteroskedasticity also poses a challenge for panel data analysis. Heteroskedasticity may result if there is unmodeled variance in the dependent variable that differs from individual to individual. It is also possible that individuals have similar errors at particular times during the panel due to a time-dependent factor, a condition termed contemporaneous correlation. As I describe in the next section, I use structural equation modeling and a random effects regression to estimate the effects of principal human capital on school performance. For the structural equation models, I use clustered standard errors to allow the errors to be correlated within clusters but vary between clusters to address the threats to my analysis from heteroskedasticity. The clusters, or panel variables, consist of the spatial component of schools and the temporal component of school years. For the random effects regression models, I use robust standard errors which is equivalent to using clustered standard errors for my panel variable with this estimation procedure (StataCorp, 2013b).

Lastly, missing values may pose a problem for research designs with panel data. Values may be missing due to attrition as individuals may choose not to participate in each iteration of the panel or the researcher may not be able to gather data for each individual during each year of the panel. Conversely, some participants may join the panel in later iterations. A key consideration for a researcher is determining whether observations are missing completely at random (missing on *x* unrelated to observed values of other variables and the unobserved values of x), missing at random (missing on x uncorrelated with the unobserved value of x after adjusting for observed variables), or missing not at random (missing on x is correlated with the unobserved value of x).

If missing values exist in the panel, common approaches include a complete-case analysis of only observations for which all data are present, multiple imputation methods to estimate missing values, or maximum likelihood. The complete-case method is the easiest to apply since most software packages use listwise deletion by default. However, the researcher assumes that the resulting sample for a complete-case analysis is a random sample of the originally targeted sample (Pigott, 2001). If there are many missing observations, the assumption that the missing values are missing completely at random may be difficult to support which is the main drawback to a complete-case analysis.

While estimation methods for missing values and maximum likelihood can result in unbiased estimates, these methods do involve some important assumptions. These methods assume that the missing data are missing at random or missing completely at random and multivariate normality. One common technique for estimating missing values, multiple imputation, consists of three basic steps (D. B. Rubin, 1976). The researcher generates several data sets through a process of introducing random variation to impute missing values. The researcher then analyzes each of these data sets which consist of slightly different imputed values and combines the results into a single set of estimates. Instead of generating data sets through imputation, maximum likelihood adjusts the likelihood function so that observations that have complete and incomplete data inform the estimates of the observed variables.

Although multiple imputation and maximum likelihood involve the same assumptions, Allison (2012) states several reasons why maximum likelihood is a preferable method to deal with missing observations. Since multiple imputation involves random draws to impute missing values, it produces a different result each time whereas maximum likelihood produces the same result. Maximum likelihood is also more efficient and involves fewer decisions on the part of the researcher. Lastly, the models used by a researcher to impute missing values may differ from the models used to analyze the data.

Based on the assumptions for each approach to missing data and the nature of the NYC schools dataset, I conduct the analysis in Chapters 5 and 6 using the complete-case method but also compare these results using maximum likelihood to account for missing observations. Tables 4.1 and 4.2 indicate the number of cases missing each variable and the corresponding percentage of these missing cases as a percentage of the total cases.[32] 97% of cases for elementary/middle schools and 85% for high schools have complete data on all variables for schools with Progress and Performance scores reported by the NYC DOE. As these tables indicate, most of the missing observations are due to a lack of complete data on the task difficulty and resource availability measures I control for such as enrollment, average class size, and teacher turnover. Since there are few cases missing overall, the complete case method is appropriate since it is reasonable to assume that the missing cases are a random sample of the overall population of schools with Progress and Performance scores.

I also analyze the results using maximum likelihood to meet the less stringent criteria that the missing observations are missing at random instead of missing completely at random. For the NYC schools dataset, it is reasonable to assume that values are at least missing at random since the independent variables that measure management quality and school conditions should

[32] I excluded the control variable of C4E funding from these tables since I marked any schools that did not receive funding as reported by the NYC DOE with a value of zero.

be strong predictors of missing observations. However, the joint normality assumption is more difficult. While most of my variables follow a normal distribution as shown in Figures 4.1 through 4.4, the histograms for tenure, experience, Managing Family Involvement, Human Capital Management, enrollment, teacher turnover, and C4E funding are noticeably skewed. I use a log transformation of the tenure, experience, and school enrollment measures in the model to more closely approximate a normal distribution for these variables.[33] Although I estimate that the complete-case method is appropriate, comparing these results with the maximum likelihood method of accounting for missing observations will inform my assessment of whether it is reasonable to assume that the missing observations are missing completely at random.

Structural Equation Modeling

Based on the characteristics of panel data described above, I use a pooled structural equation modeling (SEM) as my primary estimation technique and a random effects linear regression as a robustness check to estimate the effects of a principal's human capital qualities on school performance. SEM synthesizes two different types of models together: measurement models that describe the relationships between observed indicators and latent (unobserved) variables and structural models that describe the causal relationships among the endogenous and exogeneous factors in the model (Bollen, 1989; Jeon, 2015). By estimating the measurement and structural models as part of one large system, SEM has the advantage of incorporating uncertainty in measures into estimates of quantities such as regression coefficients.

[33] I chose not to use a log transformation of Managing Family Involvement, Human Capital Management, teacher turnover, and C4E funding since joint normality is not strictly necessary (StataCorp, 2013a) and to facilitate the interpretation of the results.

A downside of SEM is that it can be difficult for software to estimate a complex structural model (StataCorp, 2013a). The ideal model would include school level random effects in a structural equation model, but this model is too complex to estimate. In this section, I explain why this is the case and how I account for this limitation with my primary and alternate estimation techniques.

SEM is an ideal technique to address my research questions for a couple of reasons. First, many of my independent variables of interest, principal skills, are difficult to observe. While some variables such as a principal's tenure are not susceptible to measurement error, skills such as Indirect Instructional Leadership are not directly observable and therefore subject to measurement error. As I explain below, SEM enables me to employ measurement models that use multiple indicators to construct measurements for latent variables that are not directly observable. Second, since I hypothesize that some of the variables in my model have an effect on school performance but also mediate the relationship between other variables and school performance, SEM enables me to estimate these effects simultaneously.

The estimation of the measurement model is often identified as the first stage of a SEM. The measurement model is useful to validly and reliably measure complex constructs that are unobservable or difficult to measure with a single indicator (Jeon, 2015). Returning to my example of the principal skill of Indirect Instructional Leadership, this skill is not directly observable, but I am able to observe indicators of this skill through responses from a principal's subordinates to survey questions related to this skill. By using multiple indicators (in my case responses to survey questions) to measure latent variables, measurement models account for the measurement error in latent variables and lead to less biased estimates (Brown, 2015). Accounting for measurement error is especially important for panel data as a failure to do so may lead the researcher to observe a change in variables over time when no true change took place (Finkel 1995).

Two common techniques for constructing measurement models are exploratory factor analysis and confirmatory factor analysis. Exploratory factor analysis is a data-driven approach to identify the structure of latent variables from a set of variables and is typically used when the researcher does not have a theoretical basis to guide the selection of indicators for latent variables. In confirmatory factor analysis, the researcher specifies the structure of how particular indicators relate to a latent construct and uses the data to verify the accuracy of this hypothesized structure (Harrington, 2009). Since I draw on educational leadership literature to specify the principal skills that should influence school performance, I use confirmatory factor analysis because the theoretical framework from this literature guides my selection of indicators for each latent variable. A benefit of measurement models is that they allow the researcher to assess model fit and adjust the model depending on any observed areas of poor fit.

The latent variables in my model are Goal Setting, Internal Management, Managing Family Involvement, Indirect Instructional Leadership, and Direct Instructional Leadership. Table 4.3 summarizes the indicators for each of these variables as described in Chapter 3 as well as alternate measures for Managing Family Involvement and Human Capital Management that serve as robustness checks on the primary measures. Brown (2015) recommends at least three indicators per latent variable. I adhere to this recommendation for the latent variables in my model with the exception of Goal Setting and Direct Instructional Leadership since few survey questions directly address these skills. In particular, there is only one survey question that relates to the skill of Direct Instructional Leadership.

While it is reasonable to set error variance for the other human capital qualities of tenure, experience, and percentage of high-quality teachers (my measure for human capital management) to zero which assumes they are measured without error, this assumption does not apply as well to the survey question used to measure the latent variable of Direct Instructional Leadership. I therefore use the technique recommended by Brown (2015) of calculating this indicator's measurement error by multiplying the measure's sample variance estimate by 1 minus the best estimate of the indicator's scale reliability. While there is not specific research that estimates this indicator's reliability as a measure of Direct Instructional Leadership, a similar question was used in a recent study as one of seven indicators of principal instructional leadership.[34] Merrill et al. (2018) reported a reliability estimate of .97 for elementary schools and .96 for middle and high schools for the set of indicators they examined. I use the low end of this range, .96, as my reliability estimate for my indicator of Direct Instructional Leadership but also conduct a sensitivity analysis to assess how a lower reliability estimate affects the results.

The measurement model in Figure 4.5 summarizes the indicators I use to construct the measures for the latent variables of Goal Setting, Internal Management, Managing Family Involvement, Indirect Instructional Leadership, and Direct Instructional Leadership. In structural equation modeling, the causal arrows typically point from the latent variable to the indicator variables. This technique enables me to assess the relationship that I hypothesize exists between the indicator variables, in my case survey responses, and the latent variables of principal human capital skills. Using the example of Goal Setting, the causal interpretation of the diagram in Figure 4.5 is that a principal possesses the skill of Goal Setting that influences the responses that

[34] The question used by Merrill, Lafayette, and Goldenberg (2018) was from the 2015-16 NYC Teacher Survey and was worded "The Principal at this school (not Assistant Principal(s)) knows what's going on in my classroom."

teachers give to the two survey questions that address teacher perceptions of this skill. If the causal arrows pointed from the indicators to the latent variable, the interpretation would be that the answers to the survey questions produce the skill of Goal Setting which is not the relationship that I hypothesize.

Table 4.4 describes the notation used in the measurement and structural models throughout this dissertation. In Appendix A I list the equations for the measurement models of the latent variables, provide a diagram for each, and describe the indicators for the latent variables in greater detail. I evaluate how well the model in Figure 4.5 fits the data and adjust it to improve model fit in Chapter 5.[35]

After specifying the measurement model, the second stage of the SEM process is referred to as the structural model. In this stage, the latent variable measures from the measurement model are combined with the observed variables to estimate the hypothesized causal relationships. In my model this step incorporates the observable principal skills of tenure, experience, and Human Capital Management with the latent variables from the measurement model along with the other independent variables I control for to assess the relationship between principal human capital skills and school performance. Figure 4.6 depicts a simplified version of this structural model while a complete version of the model is presented in Figure A.7 in Appendix A. As indicated in Figure 4.6, this structural model allows me to examine how tenure influences school performance through unspecified means but also affects performance through the human capital skills in the model.

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[35] In addition to the five latent variables of Goal Setting, Internal Management, Managing Family Involvement, Indirect Instructional Leadership, and Direct Instructional Leadership, I employ alternate measures for Managing Family Involvement and Human Capital Management as robustness checks for the primary measures of these skills. I describe these measures in Figure A.4 and A.6 in Appendix A respectively and assess model fit for these alternate measures in Chapter 5.

SEM can accommodate different estimation techniques (Bollen, 1989) as well as account for multilevel factor modeling (Brown, 2015). A multilevel model is appropriate since there is a theoretical justification that unit effects at the school level influence school performance. However, due to the complexity of the model, the SEM depicted in Figure 4.6 would not estimate when adding a school level random effect on school performance.

I therefore face a choice between a pooled SEM or using point estimates of the five latent variables from the measurement model in a random effects regression to estimate the effects of principal human capital on school performance. These point estimates consist of the predicted values and standard errors from the measurement model for each of the four latent variables. A downside of the pooled SEM is that there is theoretical and statistical evidence that school level unit effects are present, therefore this is an inefficient estimator. Using clustered standard errors helps to account for correlation within my clusters (schools) over time, so while the estimator may be inefficient, the standard errors are reliable.

Conversely, a random effects regression is efficient, but a downside of using the predicted values from the measurement model in a random effects regression is that this technique underestimates the measurement error for the latent variables in comparison to estimation through SEM. As a result, the standard errors for the latent variables are lower than they should be when estimating the random effects regression.[36]

[36] To adjust these standard errors, I employed a procedure that involves taking repeated samples of the latent variable predicted values. I drew these samples randomly from a normal distribution based on the mode and standard error of the predicted values of the latent variables. I then estimated the random effects regression using the average from the repeated samples for each of the latent variables to account for the measurement error of the latent variables. Since the latent variables are correlated, however, I was unable to simulate this correlation in the process of drawing repeated samples for each of the latent variables. This limitation constrained my ability to adjust for the measurement error of the latent variables in the random effects regression.

Since each estimation technique has some drawbacks, I include both in my analysis but use the pooled SEM as my primary estimation technique. A benefit of the pooled SEM is that it allows me to estimate the effects of tenure on the human capital skills and tenure on school performance simultaneously. Conversely, a limitation of the random effects regression is that I cannot estimate these effects simultaneously. After adjusting the measurement model in Figure 4.5 based on model fit, in Chapter 5 I assess the influence of tenure on the indicators for the latent variables and the observed human capital skills using a structural model.[37]

I analyze the effects of principal human capital on performance for elementary/middle and high schools separately. There are two reasons why separating the schools into these groups will lead to more precise results. First, previous studies note a difference in the effects of principal qualities on performance depending on grade level (Grissom et al., 2013), thus it is valuable to assess the results across elementary/middle and high schools separately. Second, the NYC DOE assigns Progress Report scores separately for elementary/middle and high schools and uses different scales for each. I standardize the Progress Report scores to assess the effects of principal human capital qualities across all schools, but I do not expect these results to be as instructive as the results for elementary/middle and high schools separately.[38]

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[37] A limitation of Structural Equation Modeling using the Stata software program is that it is unable to estimate the effects of an explanatory variable through a latent variable if the latent variable is correlated with other latent variables. This is the case for my model which predicts that tenure affects school performance through the latent variable measures for human capital that are correlated with each other. To account for this constraint, I model the indicators for the latent human capital skills as a function of tenure and the latent skill as depicted in Figure 4.6. Although this technique prevents me from assessing the effect of tenure through the latent variable human capital skills on performance, it does enable me to assess the relationship between tenure and the human capital skills in the model. I assess the effects on tenure on performance through the human capital skills by comparing the results from the model in Figure 4.6 to one that excludes the effects of tenure on the human capital skills.

[38] Some schools serve both elementary/middle school and high school students. For such schools I average the Progress or Performance scores across these two different levels.

I also consider two different groups of schools in addition to the delineation of elementary/middle and high schools. The analysis in Chapter 5 assesses the influence of principal human capital qualities on school performance using the model depicted in Figure 4.6 for all grade 3-12 NYC public schools. This model therefore assesses the influence of principal human capital on school performance through unspecified mechanisms. To summarize, the steps for this model are as follows:

1-Estimate a measurement model for the five unobservable human capital skills (Goal Setting, Internal Management, Managing Family Involvement, Indirect Instructional Leadership, and Direct Instructional Leadership)
2-Adjust this model based upon indicators of model fit
3-Predict point estimates for these human capital skills for each observation to use in a random effects regression
4-Estimate the results using a pooled structural equation model
5-Compare the results in Step 4 to estimation with a random effects regression using the observed variables and the point estimates for the latent variable measures with school level random effects

The analysis in Chapter 6 focuses on a smaller subset of schools implementing the Contract for Excellence Class Size Reduction program described in Chapter 3. This smaller subset of schools enables me to evaluate the effects of principal human capital on school performance through the implementation of this specific program as depicted in Figure 4.7. As with the analysis for all schools, the primary estimation technique is a pooled SEM with a random effects regression as a robustness check.

For this smaller subset of schools, I employ the same procedure described above, first assessing the simultaneous effects of principal human capital on class size reduction and school performance using a pooled SEM. For the robustness check with a random effects regression, I use point estimates from the measurement model to predict the influence of principal human capital skills on class size reduction. I then include change in class size as a predictor of school performance along with the other human capital variables. To summarize, the steps for the smaller set of schools are as follows:

1-Conduct the same analysis described previously for all schools on the smaller set of schools implementing the class size reduction program
2-Estimate a pooled structural equation model to assess the simultaneous effects of principal human capital on class size reduction and school performance
3-Compare the results in Step 2 to estimation with a random effects regression using the observed variables and the point estimates for the latent variables to estimate the effects of principal human capital on class size reduction
4- Compare the results in Step 2 to estimation with a random effects regression that includes change in class size as a predictor of school performance

Figures A.7 and A.8 in Appendix A present more detailed figures integrating the measurement models with the structural models. I list the equations for the random effects regression models and the structural equation models for these two groups of schools after these figures in Appendix A.

Model Identification and Fit Assessment

A fundamental step in structural equation modeling is model identification. A model is identified if "it is possible to obtain a unique set of parameter estimates for each parameter in the model whose values are unknown" (Brown, 2015, p. 53). There are two steps to model identification. The first is to scale the latent variables. Since latent variables are unobserved, they do not have a defined unit of measurement. Stata scales the latent variables automatically by constraining the path coefficient between each latent variable and one of its indicator variables to 1, thereby fixing the metrics for latent variables to be the same as one of its indicators (StataCorp, 2013a).

Statistical identification is the second step of model identification. It involves comparing the number of variances and covariances from an input matrix[39] of the observed variables with the number of freely estimated model parameters in the measurement model. A freely estimated model parameter could be a factor loading, factor covariance, error variance, or error covariance. The estimation process for a measurement model involves finding a set of factor loadings that yield a predicted covariance matrix (Σ) that best reproduces the input matrix (S). The model converges when it estimates a set of parameters that cannot be improved further to reduce the difference between Σ and S.

A measurement model is under-identified if the number of freely estimated parameters exceeds the number of variances and covariances in the input matrix. An under-identified model is not solvable since there are an infinite number of parameter estimates that could result in a perfect model fit (Brown, 2015). A just-identified model is one in which the number of freely estimated parameters equals the number of variances and covariances in the input matrix. A just-identified model produces a unique set of estimates for the freely estimated parameters. Lastly, a model is over-identified if the number of freely estimated model parameters is less than the number of variances and covariances in the input matrix.[40] The challenge with overidentified models is that they rarely fit the data perfectly as in the case of a just-identified model. For over-

[39] For example, a latent variable composed of two indicator variables, x and y, would have three elements in its input matrix: the variance of x, the variance of y, and the covariance of x and y. Adding a third indicator variable, z, would result in six elements in the input matrix: the variance of x, the variance of y, the variance of z, the covariance of x and y, the covariance of x and z, and the covariance of y and z.
[40] The difference in the number of variances and covariances in the input matrix and the number of freely estimated model parameters constitute a model's degrees of freedom (*df*).

identified models, the researcher must consult model fit estimates to assess the acceptability of the model.

There are many different techniques and perspectives for assessing the fit of structural equation models. Since there is not a consensus in the field that one particular technique is superior among the different approaches to assessing model fit, many scholars recommend a combination of approaches (Bollen, 1989; Thomson, Perry, & Miller, 2009). I draw upon the recommendation by Brown (2015) to use at least one fit index from each of three fit classes: absolute, parsimony, and comparative. I explain each of these classes briefly and describe some leading indicators under each before summarizing the fit criteria I use to assess the structural equation models.

Two leading indicators for absolute fit are the chi-squared test and the standardized root mean squared residual (SRMR). The null hypothesis in the chi-squared test is that the set of factor loadings produced by the model yield a predicted covariance matrix (Σ) that equals the input matrix (S). This is a very restrictive assumption since researchers often seek a model that matches the data reasonably well instead of a model that perfectly fits the data (Bollen, 1989). The chi-squared test is therefore useful for assessing model improvement (Schreiber, Nora, Stage, Barlow, & King, 2006) but because of its stringent conditions, it is difficult to find a parsimonious model that passes the test, especially in the case of large sample sizes.

Another tool to assess absolute fit is the standardized root mean square residual (SRMR). This test assesses the average differences between the correlations from the input matrix (S) and the correlations predicted by the model. A smaller SRMR value indicates better model fit. SRMR values close to 0.08 or below are generally recommended (Brown, 2015; StataCorp, 2013a).

The second category of model fit assesses model parsimony to favor models with fewer freely estimated parameters, or degrees of freedom (*df*). For two models that fit the data equally well in terms of absolute fit, a parsimony test favors the model that uses fewer *df*, thereby imposing a penalty for model complexity. A frequently used test in this category is the root mean square error of approximation (RMSEA). This test assesses the degree of discrepancy in fit for each *df* in the model. A RMSEA of 0 indicates perfect fit, therefore lower values indicate better model fit. Ideally the RMSEA should be .06 or below (Brown, 2015; Schreiber et al., 2006), but RSMEA values of .08 or below suggest adequate model fit (Browne & Cudeck, 1992).

Lastly, comparative fit measures present a more liberal approach than absolute fit measures by comparing the estimation results against a null hypothesis that there are no relationships among the variables. Two comparative fit measures are the Comparative Fit Index (CFI) (Bentler, 1990) and the Tucker-Lewis Index (TLI) (Tucker & Lewis, 1973). The TLI differs from the CFI in that it imposes a penalty for model complexity for freely estimated parameters, or *df*, that do not improve model fit. For both measures, values closer to 1 indicate better fit. Ideally the CFI and TLI should be greater than .95 (Schreiber et al., 2006), but in the case of complex models, values greater than 0.9 can also indicate acceptable model fit (Bentler, 1990).

Based on the characteristics of the fit measures described above, Table 4.5 summarizes the absolute, parsimony, and comparative indices I use to assess model fit and the thresholds for each for acceptable fit for structural equation models. In addition to these indices, I use Akaike's information criteria (AIC) and Schwarz's Bayesian information criteria (BIC) to compare the results between different models with smaller values indicating better fit for each of these criteria.

As indicated in Table 4.5, the fit statistics described above are all available using Stata's SEM command. A limitation of the SEM command is that it has limited capability to model multi-level data such as a random effect that nests observations within schools. SEM also provides predicted means for latent variables, but it does not provide predicted standard errors. The Generalized SEM (GSEM) command in Stata provides additional capabilities to fit multilevel data and computes both predicted means or modes and standard errors for latent variables.

A major difference in SEM and GSEM is that the SEM estimation process is less complex than GSEM. SEM uses estimation of the means, variances, and covariances of the observed variables whereas GSEM fits the model conditional on the values of the observed exogeneous variables. Since GSEM relaxes the joint normality assumption of the observed variables, many of the fit measures available in SEM are not available under GSEM. These differences are reflected in Table 4.5 as fewer fit measures are available in GSEM than SEM. Since the SEM estimation process is faster and slightly more accurate than GSEM (StataCorp, 2013a), I use SEM to estimate the measurement and structural models in this dissertation. SEM requires the assumption of joint normality and ignores the presence of unit effects which are both reasonable assumptions for the indicators used to measure the latent variables.[41]

In addition to the model fit indices described above, Brown (2015) recommends two procedures to examine the model for local areas of strain. Stata produces a standardized residual

[41] Although joint normality of all variables is preferred, this assumption can be relaxed (StataCorp, 2013a).

matrix which indicates how well the model's parameter estimates reproduce the variance and covariance from the data in the input matrix. Large, positive standardized residuals may indicate that additional parameters should be specified to account for the covariance between indicators. Conversely, large, negative standardized residuals indicate that the parameter may be unnecessary and can be eliminated.

Another tool to examine local areas of strain are the modification indices also produced by Stata. Modification indices test whether model fit can be improved by adding a path where none currently appears. Modification indices with values of 4.0 or greater indicate fit can be improved by adding a path to the specified indicators. While standardized residuals and modification indices may suggest changes to improve model fit, I also consider these improvements within the context of the theoretical framework that underlies the relationships depicted in the model.

Unlike estimation through SEM, there are few fit indices available when estimating a random effects regression with panel data. For these models, I report the R^2 value and the results of a Wald chi-squared test to assess model fit.

Survey Data

In addition to the limitations of a non-experimental design and the assumptions I make to address missing data, the use of survey data also presents some challenges to the internal validity of my research design. Since I use survey data to assess most aspects of a principal's human capital skills, these measures may suffer from halo effects that include respondents' overall perceptions of the organization rather than the specific aspects of a manager's human capital I intend to measure (Cooper, 1981).

To account for potential bias due to halo effects, in Chapter 5 I evaluate whether a rival model that uses the indicators of the four primary human capital skills as indicators of a single skill fits the data equally well or better than the measurement model with five separate human capital skills. This rival model enables me to use the data to assess my theory that the appropriate measurement model is the one in Figure 4.5 that allows correlations between the human capital skills but still considers them as distinct skills. My assumption is that the correlations between the human capital skills in my model sufficiently account for a potential halo bias. A likelihood ratio (LR) test between my five-skill measurement model and a single skill model will confirm whether a halo effect is present such that the overall perceptions of the school predict the skill indicators to the extent that there is no real difference in the five latent variables I intend to measure.

Causality

In order for me to assert a causal effect between these human capital qualities and performance, three conditions must be met: a nonzero correlation between the independent variables of interest and dependent variables, the independent variables precede the dependent variables in time, and a nonspurious relationship between the independent and dependent variables (Finkel, 1995). I evaluate the first condition with the path coefficients from the resulting structural equation models and random effects regression models at a 95% confidence level.

Regarding the second condition, the measures of skills and experience are taken prior to the performance measures of class size and school performance. Figure 4.8 describes the time ordering of variable measurement, using 2009 as an example school year. This figure underscores the benefit of panel data as I observe changes to school performance based on different principal human capital qualities in the spatial and temporal dimensions. Accounting for the temporal dimension is especially valuable since a person's human capital changes over time (A. Nyberg et al., 2018). Through the use of panel data and modeling a linear, quadratic relationship between tenure and a principal's human capital skills, I account for how a principal's human capital skills change over time and the subsequent effects on school performance.

Lastly, while I cannot eliminate spuriousness as a potential cause of the observed relationships, I reduce its likelihood through the addition of control variables as discussed in the first section of this chapter. Despite these steps to reduce spuriousness, the lack of a centralized locus of control does leave open the possibility that a variable not included in the model affects a principal's human capital qualities and school performance. I am therefore cautious in my claims of causality regarding the effects of principal human capital on school performance.

Despite this limitation of my research design, this study has important implications for human capital theory and its application to the public sector. As I discussed in Chapter 2, the theoretical development of human capital theory is predominately in fields outside of public administration. The richness of a theory depends on how well scholars identify the "antecedent conditions required for its operation" (Van Evera, 1997, p. 21). This study helps identify the antecedent conditions required for the application of human capital theory in the public sector through the development and assessment of a theoretical framework that connects the identification and selection of human capital with organizational performance. By empirically evaluating important components of this theoretical framework, this dissertation seeks to advance our understanding of the application of human capital theory to the public sector.

Chapter Summary

This chapter described the methodological approach I use to empirically evaluate the hypotheses described in Chapter 3. I explained the non-experimental nature of this research design, the primary threats to internal validity, and the steps I employ to mitigate these threats. I discussed the benefits of using panel data to assess a causal relationship between managerial human capital qualities and organizational performance. There are several challenges researchers face when using panel data, however, and I described my approach to address these challenges and the assumptions inherent in these choices. Since my research questions involve latent variables, I explained why structural equation modeling is the appropriate technique for my research design. I described the measurement and structural models I use to assess my hypotheses and how I perform a robustness check to account for school level effects through a random effects regression model. I also discussed a method to assess the potential for halo bias resulting from survey questions that inform some of my measures. I concluded with a discussion of causality based on the characteristics of my research design. The next two chapters present the empirical findings from the structural equation and random effects regression models presented in this chapter.

Table 4.1

Missing Data Patterns – Elementary/Middle Schools (“M” denotes missing observations and “–“ denotes non-missing observations)

Elementary/Middle Schools													
Tenure	Experience	Goal Setter	Internal Manager	Family Involvement	Indirect Instructional Leadership	Direct Instructional Leadership	Human Capital Manage-ment	Enroll-ment	Change in Enroll-ment	Average Class Size	Teacher Turnover	# of Cases	% of Cases
M	M	-	-	-	-	-	-	-	-	-	-	6	.11
-	-	M	M	M	M	M	-	-	-	M	M	1	.02
-	-	M	M	M	M	M	-	-	-	M	-	7	.13
-	-	M	M	M	M	M	-	-	-	-	M	4	.07
-	-	M	M	M	M	M	-	-	-	-	-	6	.11
-	-	M	M	-	M	M	-	-	-	-	-	11	.20
-	-	M	-	-	M	M	-	-	-	-	-	2	.04
-	-	M	-	-	M	-	-	-	-	-	-	3	.05
-	-	-	M	-	M	-	-	-	-	-	-	1	.02
-	-	-	-	M	-	-	-	-	-	-	-	1	.02
-	-	-	-	-	M	-	-	-	-	-	-	1	.02
-	-	-	-	-	-	-	M	M	M	M	M	10	.18
-	-	-	-	-	-	-	-	-	M	M	M	3	.05
-	-	-	-	-	-	-	M	-	-	M	M	35	.64
-	-	-	-	-	-	-	M	-	-	M	-	1	.02
-	-	-	-	-	-	-	-	-	M	-	M	10	.18
-	-	-	-	-	-	-	-	-	M	-	-	37	.68
-	-	-	-	-	-	-	-	-	-	M	-	24	.44
-	-	-	-	-	-	-	-	-	-	-	M	14	.26
-	-	-	-	-	-	-	-	-	-	-	-	5,281	96.67

Table 4.2

Missing Data Patterns – High Schools (“M” denotes missing observations and “–“ denotes non-missing observations)

High Schools													
Tenure	Experience	Goal Setter	Internal Manager	Family Involvement	Indirect Instructional Leadership	Direct Instructional Leadership	Human Capital Manage-ment	Enroll-ment	Change in Enroll-ment	Average Class Size	Teacher Turnover	# of Cases	% of Cases
M	M	-	-	-	-	-	-	-	M	-	-	1	.06
M	M	-	-	-	-	-	-	-	-	-	-	1	.06
-	-	M	M	M	M	M	M	-	-	M	M	1	.06
-	-	M	M	M	M	M	-	-	M	-	M	1	.06
-	-	M	M	M	M	M	-	-	-	M	M	8	.48
-	-	M	M	M	M	M	-	-	-	M	-	26	1.57
-	-	M	M	M	M	M	-	-	-	-	M	5	.30
-	-	M	M	M	M	M	-	-	-	-	-	12	.72
-	-	M	M	-	M	M	-	-	-	-	M	1	.06
-	-	-	-	-	-	-	M	M	M	M	M	3	.18
-	-	-	-	-	-	-	M	-	M	M	M	1	.06
-	-	-	-	-	-	-	M	-	-	M	M	7	.42
-	-	-	-	-	-	-	-	-	M	-	M	1	.06
-	-	-	-	-	-	-	-	-	M	-	-	23	1.39
-	-	-	-	-	-	-	-	-	-	M	M	2	.12
-	-	-	-	-	-	-	-	-	-	M	-	147	8.88
-	-	-	-	-	-	-	-	-	-	-	M	15	.91
-	-	-	-	-	-	-	-	-	-	-	-	1,401	84.60

Table 4.3

Indicators for Latent Variables

Latent Variable	Observable Variable (NYC School Survey Questions)
Goal Setter	-School leaders communicate a clear vision for this school. -My school has clear measures of progress for student achievement throughout the year.
Internal Manager	-The principal is an effective manager who makes the school run smoothly. -Order and discipline are maintained at my school. -My school is kept clean.
Family Involvement (Primary Measure-Parent Responses)	-I feel welcome at my child's school. -My child's school makes it easy for parents to attend meetings by holding them at different times of day, providing an interpreter, and in other ways. -The school keeps me informed about my child's academic progress. -How satisfied are you with how well your child's school communicates with you?
Family Involvement (Alternate Measure-Teacher Responses)	-Obtaining information from parents about student learning needs is a priority at my school. -Teachers and administrators in my school use information from parents to improve instructional practices and meet student learning needs. -My school communicates effectively with parents when students misbehave.
Indirect Instructional Leadership	-School leaders invite teachers to play a meaningful role in setting goals and making important decisions for this school. -This year, I received helpful training on the use of student achievement data to improve teaching and learning. -The professional development I received this year provided me with content support in my subject area. -The professional development I received this year provided me with teaching strategies to better meet the needs of my students.
Direct Instructional Leadership	-School leaders visit classrooms to observe the quality of teaching at this school.
Human Capital Manager (Alternate Measure)	-Teachers in this school set high standards for student work in their classes. -To what extent do you feel supported by other teachers at your school? -Most teachers in my school work together to improve their instructional practice.

Table 4.4

Notation for Structural Equation Models

Symbol/Abbreviation	Name	Definition
Tenure	Tenure	Number of years of principal tenure in a principal's current school at the start of the school year
Tenure Sq	Tenure Squared	Squared value of tenure
Experience	Experience	Number of years that a principal served as the principal of a different school prior to beginning his or her tenure in their current school
GS	Goal Setting	Latent variable measuring a principal's skills at goal setting
IM	Internal Management	Latent variable measuring a principal's skills at internal management
HCM	Human Capital Management	Percentage of courses that are taught by high-quality teachers
FI	Family Involvement	Latent variable measuring a principal's skills at managing family involvement
IIL	Indirect Instructional Leadership	Latent variable measuring a principal's skills at indirect instructional leadership
DIL	Direct Instructional Leadership	Latent variable measuring a principal's skills at direct instructional leadership
Enrollment	Enrollment	Total number of students enrolled in a school
Ch Enrollment	Change in Enrollment	Percentage change in enrollment from the previous school year to the current school year
Teacher Turnover	Teacher Turnover	Percentage of teacher turnover
C4E Funding	Contract for Excellence Funding	Per-pupil funding for Contract for Excellence programs
Class Size	Class Size	Total number of enrolled students divided by the total number of sections
Class Size Reduction	Change in Class Size	Change in Class Size from the previous school year to the current school year
Performance	Performance	Progress or Performance Score from the NYC DOE Progress Report
ε	Epsilon	Error term in measurement equations
ζ	Zeta	Error term in structural equations

Table 4.5

Fit Measures and Threshold Values for Acceptable Fit

SEM	GSEM	Fit Category	Fit Index	Indicator of Acceptable Fit
X	X	Absolute	Chi-Squared	Lower values indicate better fit
X		Absolute	SRMR	0.08 or below
X		Parsimony	RMSEA	0.08 or below
X		Comparative	CFI	0.90 or above
X		Comparative	TLI	0.90 or above
X	X	Comparative	AIC	Lower values indicate better fit
X	X	Comparative	BIC	Lower values indicate better fit

Figure 4.1

Histograms for Independent Variables of Interest – Elementary/Middle Schools

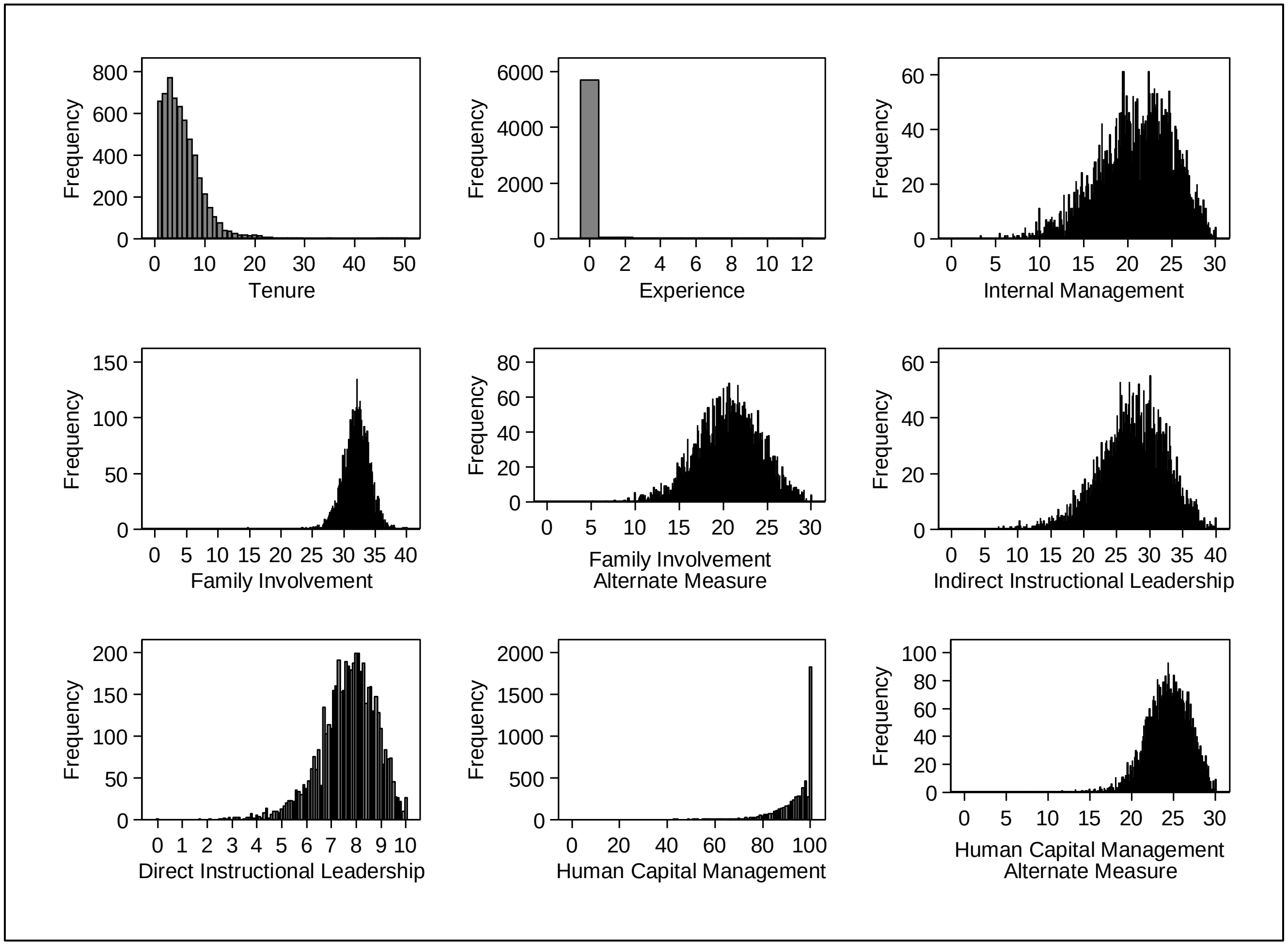


Figure 4.2

Histograms for Independent Variables of Interest – High Schools

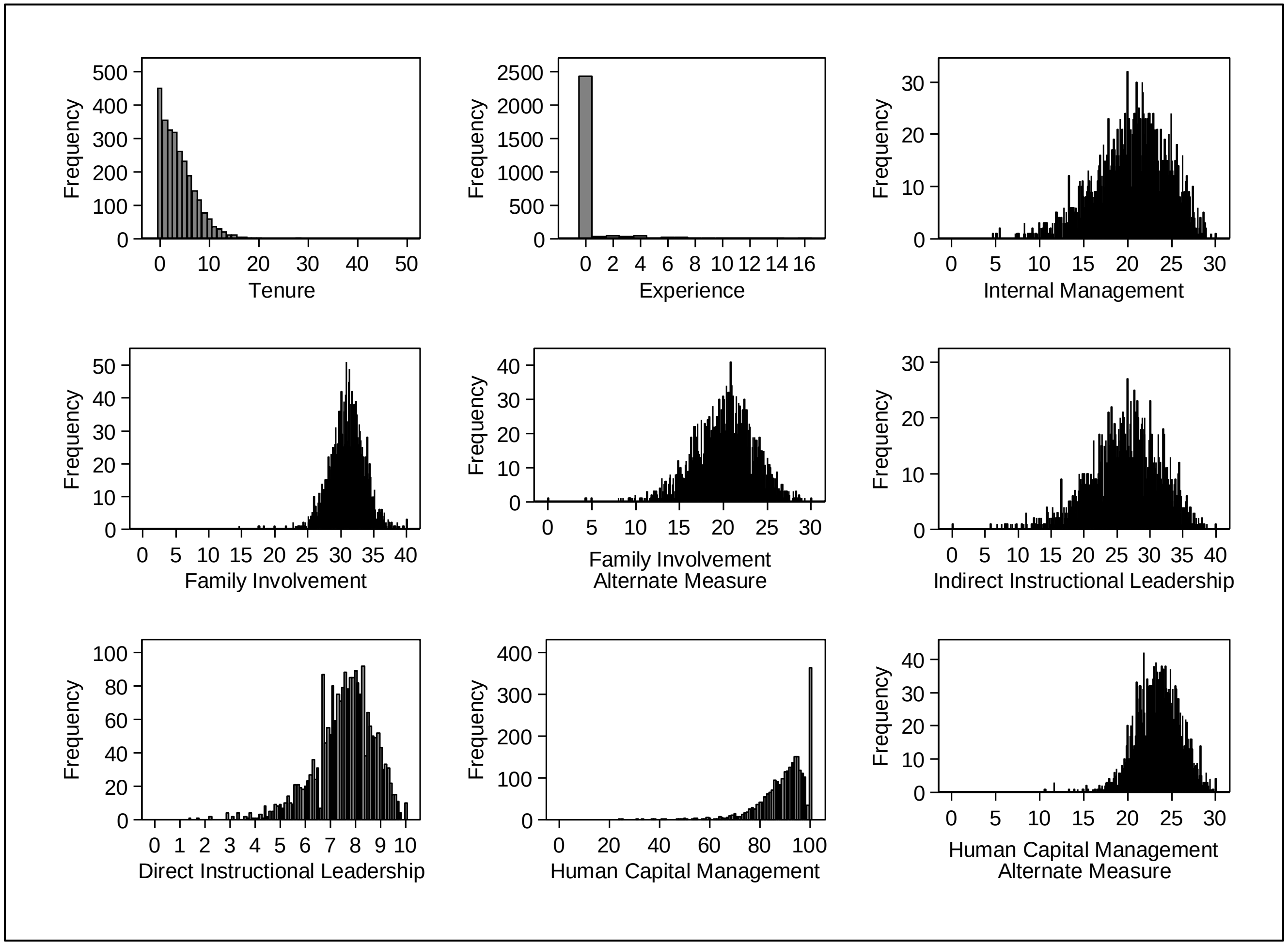


Figure 4.3

Histograms for Other Variables – Elementary/Middle Schools

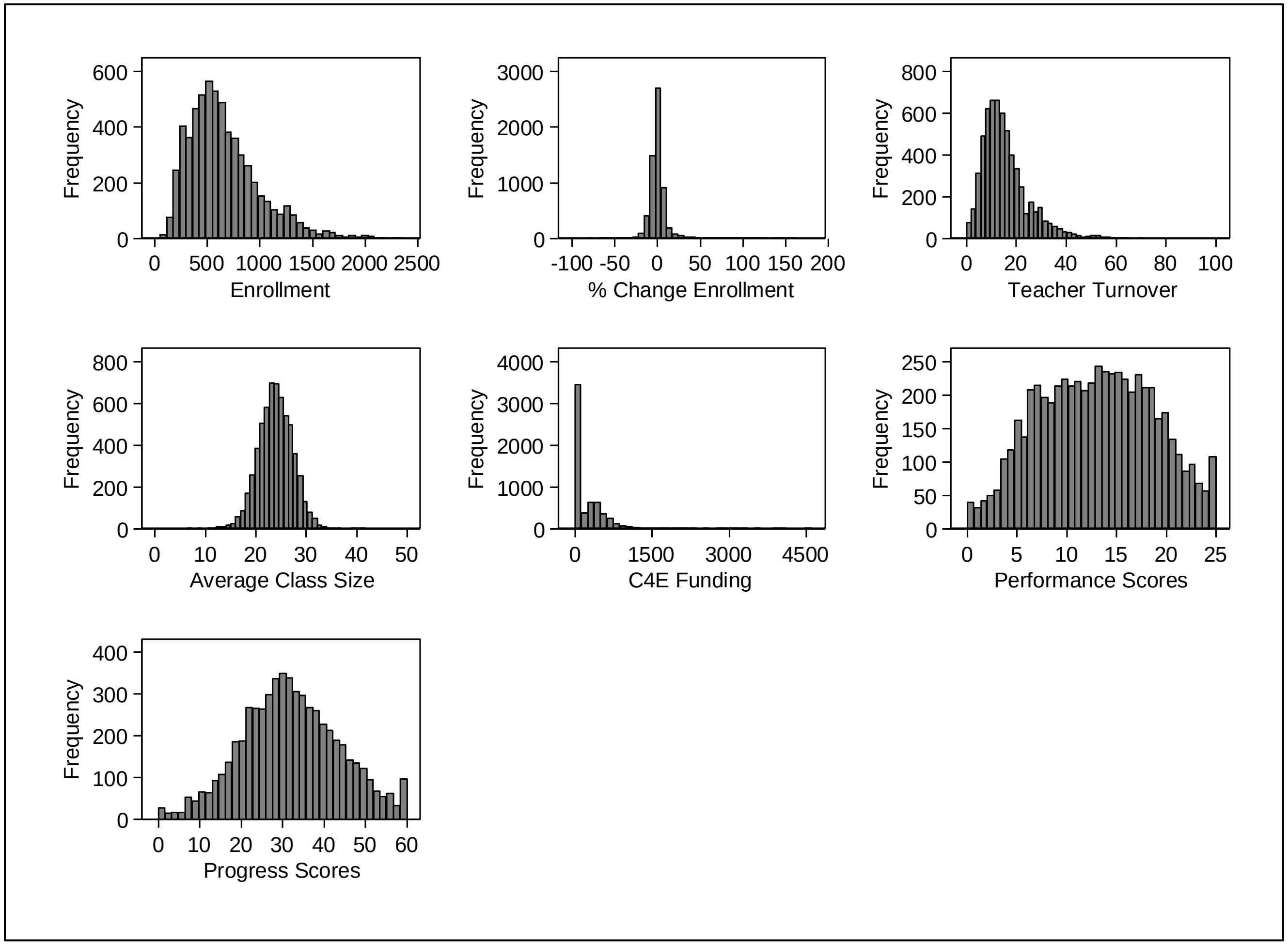


Figure 4.4

Histograms for Other Variables – High Schools

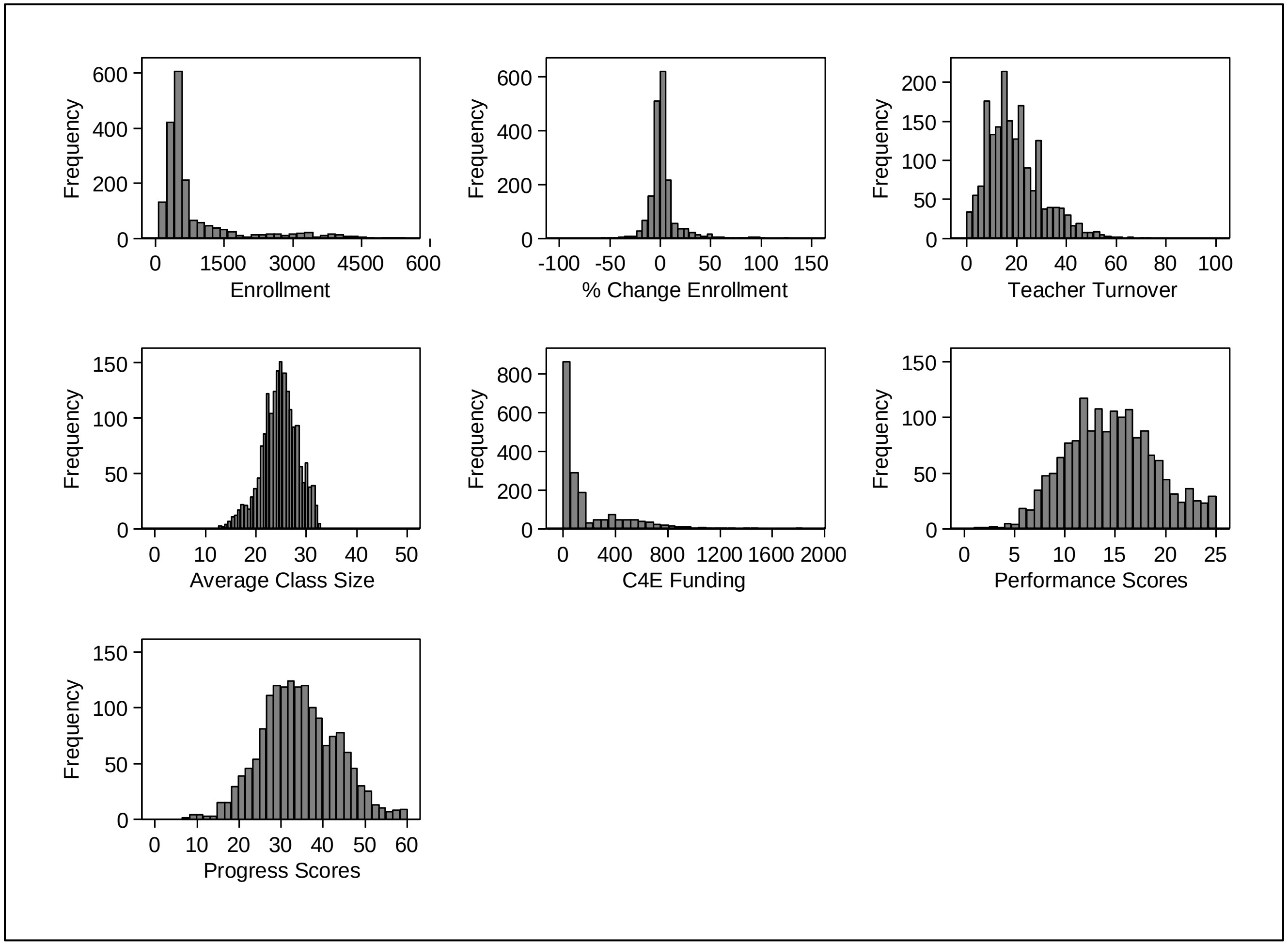


Figure 4.5

Measurement Model for Principal Skill Latent Variables

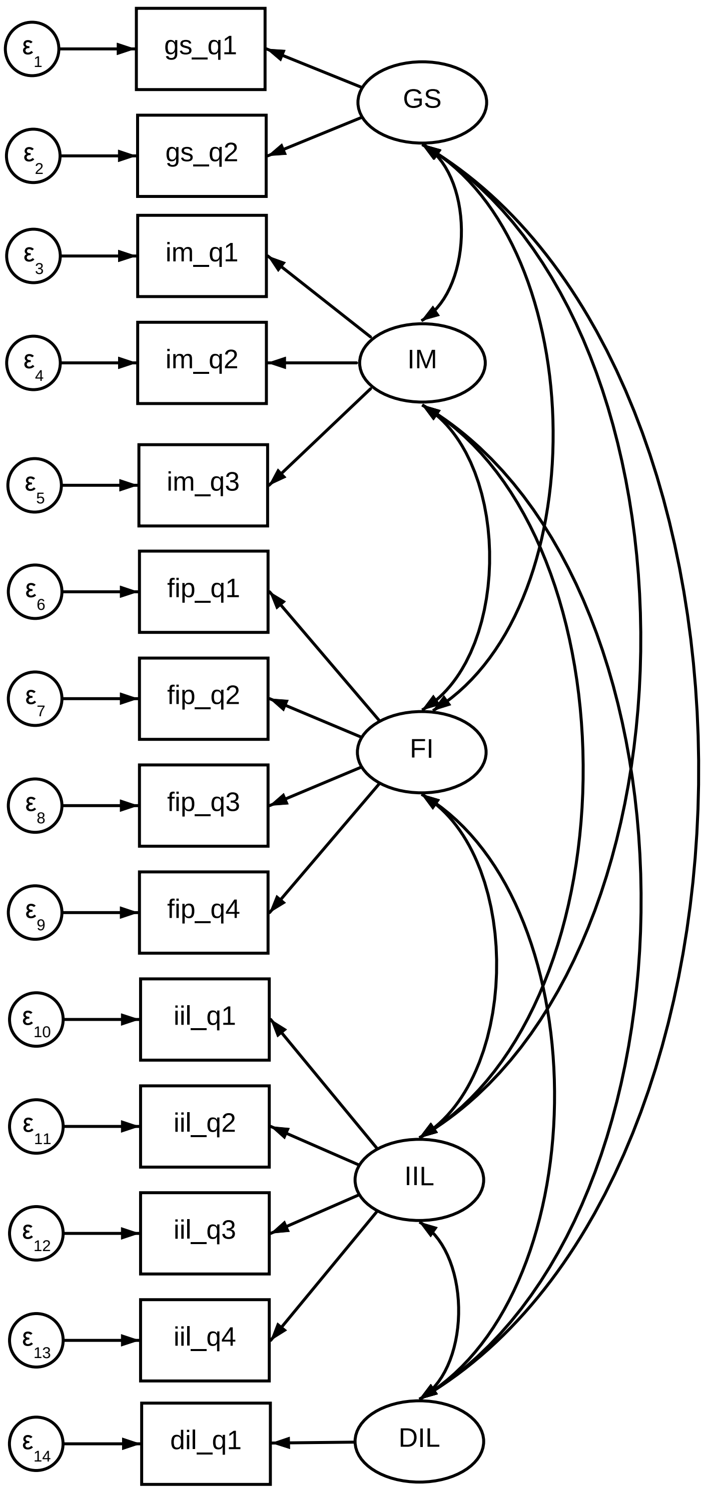
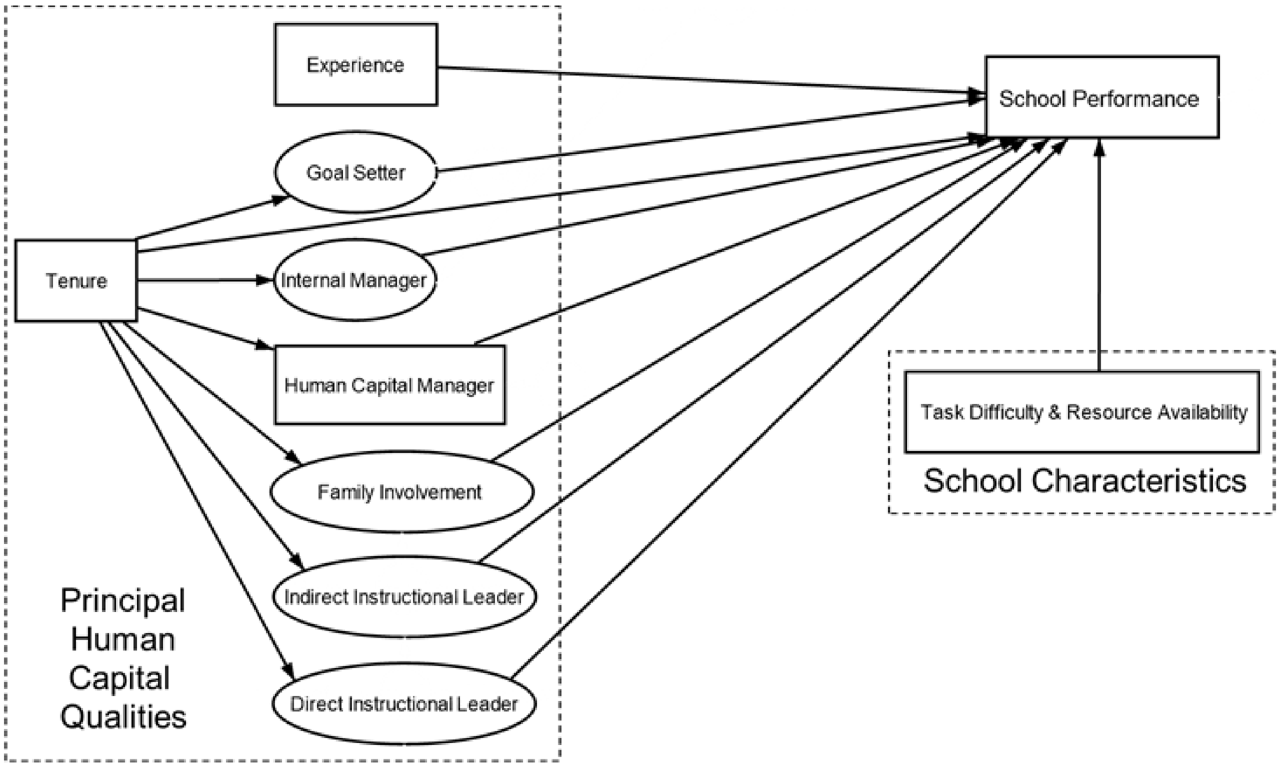


Figure 4.6

Structural Equation Model for Effects of Principal Human Capital on School Performance (all schools)[42]



[42] While the SEMs in Figures 4.6 and 4.7 represent Task Difficulty and Resource Availability as single variables, these two categories are each composed of several independent variables as described in Chapter 3. They are represented as single variables in these figures to facilitate a parsimonious version of the model. The full model also includes squared terms for tenure to model the hypothesized positive, quadratic relationship of this variable on the human capital skills in the model and school performance.

Figure 4.7

Structural Equation Model for Effects of Principal Human Capital on School Performance through the Class Size Reduction Program (schools receiving class size reduction funding)

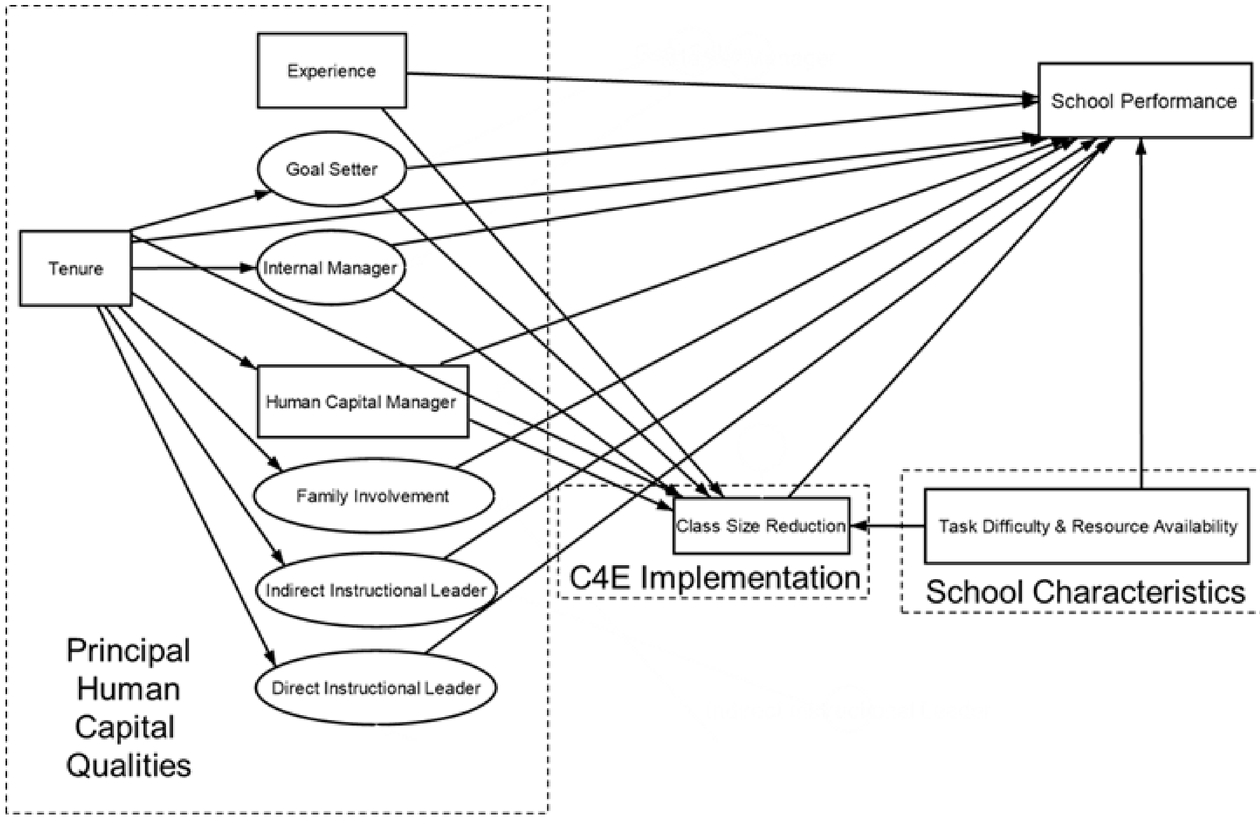
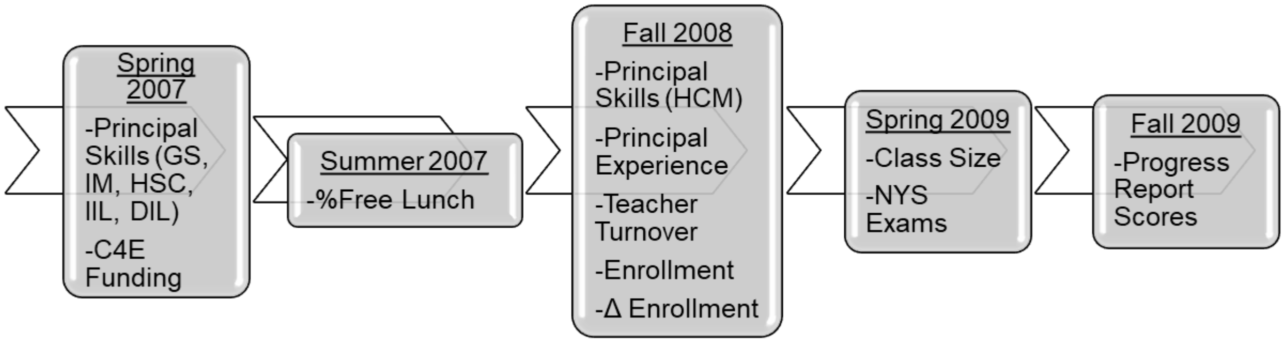


Figure 4.8

Time Ordering of Variable Measurement[43]



[43] Principal human capital skills from NYC surveys are based on responses from surveys administered in February-March. Although C4E funds are allocated at the beginning of the school year, I depict them in the spring of the previous school year to account for the one-year lag for program implementation. The data listed under summer 2007 are as of school rolls on June 30. The principal experience variables in fall 2008 are as of the beginning of the school year in September. Principal skills as a HCM, teacher turnover, and enrollment data are as of October 31. Class size statistics are published in the spring of the school year but are primarily based on student rolls as of October 31. They are published in February to adjust for data from high schools that organize into semesters to account for the first term that ends in January. The NYS exams that make up a significant portion of the Progress Report scores are administered in January (grades 9-12) and April and May (grades 3-8). Data from these tests and the additional criteria that comprise the Progress Report scores are published in October. I lag the following variables to create the time ordering presented in Figure 4.7: C4E Funding, GS, IM, HSC, IIL, DIL, and %Free Lunch.

CHAPTER 5

EFFECTS OF PRINCIPAL HUMAN CAPITAL QUALITIES ON SCHOOL PERFORMANCE

This chapter describes the effects of principal human capital qualities on school performance. A principal may affect school performance through many different activities. While I examine the influence of principal human capital on performance through the implementation of a specific program in Chapter 6, in this chapter I examine the effects of a principal's human capital on school performance through unspecified means. I begin with analysis of the measurement models I use to construct the latent variables for five of the principal human capital skills in the model described in Chapter 4. I explain the process I use to analyze how well these models fit the data and the subsequent adjustments I make based upon this analysis. Next, I combine the measurement model with the observed human capital qualities of tenure, experience, and Human Capital Management in a structural model to assess the effects of human capital qualities on school performance.

I present the results for Student Progress scores and Student Performance scores for elementary/middle schools, high schools, and for all schools. The results demonstrate that, all else being equal, a principal's tenure is positively associated with school performance. However, for most measures of school performance, there is a turning point at which the positive effects of tenure become negative. Principals skilled at Internal Management have a positive association with school performance, but this skill is highly correlated with Goal Setting and Instructional Leadership. The effects of Managing Family Involvement and Instructional Leadership depend on the type of school and the socioeconomic status of the student body. I conclude this chapter with additional analysis of the findings and a discussion of the practical implications of these results for the labor market of NYC principals.

Measurement Model for Human Capital Skills

As described in Chapter 4, structural equation modeling consists of a measurement model and a structural model. Measurement models describe the relationship between observed indicators and latent (unobserved) variables. In this study there are five latent variables that measure a principal's human capital skills: Goal Setting, Internal Management, Managing Family Involvement, Indirect Instructional Leadership, and Direct Instructional Leadership. Structural models describe the causal relationships among the endogenous and exogeneous factors in the model. I first assess the viability of the measurement models so that I can attribute any sources of poor fit in the structural model to structural components instead of measurement components (Brown, 2015). The measurement model also enables me to estimate predicted values of the latent variable measures for inclusion in a random effects regression with the observed variables in the model. In this section I describe the process I use to assess the measurement models for the five unobserved human capital variables and adjustments I make to these models based on this assessment.

Figure 5.1 summarizes the notation used for the measurement models and how the output is displayed following model estimation. Since I present several measurement models in this chapter, Figure 5.1 represents a generalized model to summarize the notation and symbology. As I described in Chapter 4, I use a measurement model to estimate measures for the five principal human capital skills of Goal Setting, Internal Management, Managing Family Involvement, Indirect Instructional Leadership, and Direct Instructional Leadership. I include double-sided arrows between the human capital skills to specify a covariance between these skills since a person's skills may share a common cause such as intelligence that is not included in my analysis. Specifying a covariance between the human capital skills in the model enables me to model their relationships without specifying the nature of these relationships. Modeling the covariance between these skills also helps account for a potential halo bias. As described in Chapter 4, survey responses may be biased by a respondent's overall impression of the organization. Modeling the covariance between the latent variables assumes that they may correlate due in part to the respondents' overall perception of a school.

The first measurement model I evaluate is the initial model specified in Chapter 4 that includes all questions from the NYC school survey that relate to the human capital skills of Goal Setting, Internal Management, Managing Family Involvement, Indirect Instructional Leadership, and Direct Instructional Leadership. Figure 5.2 displays the results of this model. As expected, each indicator loads positively and significantly on the principal human capital skills. The covariances between several of the human capital skills were greater than 1.0 which indicates the potential for poor discriminant validity between these variables (Brown, 2015). While model fit may be improved by collapsing some of these concepts into one construct, I retain them as separate skills due to the strong theoretical justification for the skills in the model that I explained in Chapter 3.

In terms of model fit, the first column in Table 5.1 summarizes the fit statistics for the initial measurement model in Figure 5.2.[44] Although the SRMR, CFI, and TLI indicate an

[44] The fit statistics in Table 5.1 are from estimation of the measurement models with normal standard errors instead of clustered standard errors since the RMSEA, CFI, and TLI are unavailable using clustered standard errors. I estimated the models with and without clustered standard errors and the results were similar. I use clustered standard errors for the results in Table 5.3 and the structural models later in this chapter.

adequate model fit, the RMSEA value suggests that a more parsimonious model would fit the data better. The standardized residuals for this initial model had several indicators with large, negative values which suggests these parameters are unnecessary to measure the latent variables in the model. The modification indices also had large values for several indicators which suggests that fit could be improved by freely estimating some paths between indicators that I omitted in Figure 5.2.

To improve upon the model in Figure 5.2, I eliminated the parameters with large negative standardized residuals in an iterative fashion, checking the fit indices after each iteration to see if the more parsimonious model improved upon the previous version. For the latent variables with three or more indicators, I did a pairwise comparison of indicators to confirm which indicators best fit the data. This process led to the more parsimonious model in Figure 5.3.

As the fit measures indicate in the second column of Table 5.1, this more parsimonious model provides a better overall fit for the data. The RMSEA and TLI values are above the acceptability thresholds for parsimony discussed in Chapter 4. The covariances between the latent variables as well as the variances of the latent variables are similar to the results in Figure 5.2. These results, combined with a qualitative review of the indicators I dropped from the initial model to ensure that I did not exclude an important dimension of a latent variable, provide confidence that the more parsimonious model better fits the data without sacrificing the theoretical constructs that underlie each latent variable. As indicated in Table 5.2, the significant factor loadings for each indicator suggest that each of the survey questions is an important contributor to estimating the latent variable measures for the specified human capital skills.

Since later in this chapter I check the results of the primary model with alternative measures for Human Capital Management and Managing Family Involvement, I also assess the measurement models that employ these latent variable measures. First, for Human Capital Management, there are three questions from the NYC teacher survey associated with the quality of teachers in a school. I did a pairwise comparison of the results of the measurement model with these three indicators. The best fitting measurement model with Human Capital Management as a latent variable is Figure 5.4. As the results in column 3 of Table 5.1 indicate, this model conforms to the acceptability criteria for each fit indicator.

Lastly, one of my robustness checks uses teacher perceptions of a principal's skills at Managing Family Involvement instead of the perceptions of parents/guardians. There are three questions from the NYC teacher survey associated with how well the school communicates with parents/guardians. Using a pairwise comparison of the measurement model results with these three indicators, the model in Figure 5.5 best fits the data with teacher perceptions of a principal's skills at Managing Family Involvement. The results in column 4 of Table 5.1 indicate that this model also conforms to the acceptability criteria for each fit indicator.

The lower AIC and BIC of the model in Figure 5.3 with parental perceptions of a principal's skills at Managing Family Involvement compared to the model in Figure 5.5 with teacher perceptions of this skill also provide statistical confirmation of my assumption that parental perceptions should serve as the primary measure for this skill. Using parental perceptions of this skill also has lower covariances with the other latent variables in the measurement model than teacher perceptions. Although parental perceptions provide a better measure of Managing Family Involvement, the results with teacher perceptions of this skill are similar enough to justify retaining the model in Figure 5.5 as a robustness check for this measure.

Since the primary measurement model in Figure 5.3 and the models with robustness checks represented by Figures 5.4 and 5.5 have some correlations between the human capital skills that are greater than 1, I test whether a rival model would better fit the data. This rival model represented in Figure 5.6 evaluates whether there is no real difference in the five skills that I allowed to correlate in Figure 5.3. Stated differently, I evaluate whether a model that uses the indicators as measures of a single skill does just as well or better in describing the data as the model with five different latent variables. As the fit statistics demonstrate in the rightmost column in Table 5.1, this model does not pass the threshold requirements for adequate model fit. The AIC and BIC are also larger than the results in Figure 5.3. A likelihood ratio test (LR test) that the one factor model in Figure 5.6 is the true model compared to the five-factor model in Figure 5.3 resulted in a large chi-squared value of 10169.13 with 9 *df* which indicates the one-factor model is not the true model. The data therefore confirm the theoretical justification that the model with five separate skills more accurately measures a principal's human capital skills.

In summary, Figure 5.3 represents the best fitting measurement model with the five human capital skills that are latent variables. For the alternative measure of Human Capital Management as a latent variable, Figure 5.4 best fits the data. Lastly, for the robustness check using teacher perceptions of a principal's skills at Managing Family Involvement instead of parent/guardian perceptions, Figure 5.5 is the best fitting model.[45]

Principal Human Capital and School Performance

This section integrates the adjusted measurement model in Figure 5.3 with the observed variables in the model to assess the influence of principal human capital qualities on school performance. As discussed in Chapter 4, my primary estimation procedure uses a pooled

[45] I also estimated these models using maximum likelihood with missing values (MLMV). The results for each model were nearly identical between the estimates with MLMV and the complete case method, so the results displayed for each model represent the complete case method.

structural equation model as depicted in Figure 5.7. Since this estimation procedure is inefficient due to the presence of unit effects, I also estimate a random effects regression as a robustness check using predicted values from the measurement models for the latent variables. Table 5.3 summarizes the predicted factor scores derived from the measurement model in Figures 5.3 that I use for this robustness check. As this table indicates, the measurement model normalizes the measures for the latent variables with a mean of zero.

I assess the influence of principal human capital qualities on Student Progress and Student Performance scores for elementary/middle schools, high schools, and all schools. For each dependent variable and school category, I present the initial results from the structural equation model and the robustness check from a random effects regression model. I also discuss the results from estimation with alternate measures for Managing Family Involvement and Human Capital Management.

Principal Human Capital and Student Progress and Performance Scores

Table 5.4 summarizes the effects of principal human capital skills on Student Progress and School Performance scores for elementary/middle and high schools.[46] As indicated in the top row in Table 5.5, the fit statistics for the initial structural model depicted in Figure 5.7 did not conform to the acceptable fit criteria for high schools.[47] The standardized residuals for this initial model indicated that two explanatory variables I control for, teacher turnover and per-pupil C4E funding, could be eliminated to improve model fit. As the fit statistics in the second

[46] The complete results to include the other explanatory variables I control for in the model are included in Table B.1 and B.2 in Appendix B.
[47] I report the SRMR, AIC, and BIC for each model since these are the only fit statistics available with clustered standard errors.

row in Table 5.5 indicate, eliminating these two variables improves the fit criteria for each type of school and measure of performance. As I explained in Chapter 3, the measures of performance also account for school characteristics, so retaining school enrollment, percentage change in enrollment, and average class size provide adequate control variables to assess the relationships between human capital qualities and school performance that are the focus of the model.[48]

I also estimated a random effects regression to account for unit effects on the results.[49] As I described in Chapter 4, although this estimation procedure is more efficient than the pooled SEM, a downside of this technique is that it underestimates the measurement error for the latent variables. The z-scores using the random effects regression for the human capital skills are larger than they should be. As the results in Table B.3 in Appendix B indicate, as expected the z-scores for most of the human capital skills are a bit larger than the results of the pooled SEM in Table 5.4. However, the results are very similar which supports the findings summarized in this section.

Turning first to the human capital qualities related to principal experience, the results are consistent for both sets of schools. As expected, there is a positive, quadratic relationship between a principal's tenure and Student Progress and Performance scores, but the relationship is

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[48] I also estimated the pooled SEM for each school type and performance measure using maximum likelihood with missing values. The results did not change substantially between this estimation method and maximum likelihood, so the results represent the complete case method to ensure consistency for the observations used for the pooled SEM and the random effects regression presented in Table B.4.

[49] I also estimated a fixed effects model for each measure of performance. For each performance measure and school type, the results of a Hausman test suggested that the unit effects are correlated with the explanatory variables. The results of the fixed effects estimates are notably different than the results with random effects which confirms my assumption that since the number of units is large, estimation with fixed effects is inefficient. The chi-squared values for the Hausman test are as follows: elementary/middle school Student Progress scores (339.47), elementary/middle school Student Performance scores (768.35), high school Student Progress scores (255.79), and high school Student Performance scores (204.95).

only significant for Student Performance scores for high schools. When I exclude the effects of tenure on performance through the human capital skills in the model and only estimate the effects of tenure on performance through unspecified means, the results are significant in all cases except for elementary/middle Student Progress scores.[50] Tenure and the squared value for tenure are significant factors for each case when the model is estimated with a random effects regression as depicted in Table B.3 in Appendix B. Tenure appears to be a more important factor for Student Progress than Student Performance as indicated by the larger coefficients for this variable in both types of schools. While there is a positive association between tenure and school performance, as predicted the positive effects of tenure diminish as a principal gains experience in a school.

Unlike tenure, prior experience as a principal in a different school is not positively associated with Student Progress or Performance scores. Although the results were not statistically significant, the signs of the coefficients for the experience variables are all negative. Since the vast majority of new principals in NYC schools are first time principals, the experience data is skewed to the right, thus very few principals begin their tenure in a school with prior experience leading a different school.[51] This data suggests that most principals do not serve as a principal in a different NYC public school at the conclusion of their tenure in their first school.

Although I do not have data on where principals serve after leaving a school, it is reasonable to think that high performers would seek additional management responsibilities

[50] These results are in Table B.4 in Appendix B.
[51] I also assessed a model that included a squared term for prior experience. This model did not conform to the acceptable fit criteria. The values for experience and experience-squared were negative in all cases. Prior experience is a measure of a principal's previous experience as a principal in a different school and therefore does not change over the course of this panel. It is therefore reasonable to assume that the proper functional form does not include a squared term for prior experience which is confirmed statistically with the results.

within the NYC school system or in another organization. The negative association between principals with prior experience and school performance may be because principals that seek consecutive principalships are worse performers than principals that leave to pursue other opportunities.

Since some principals may retire after leaving a school, a limitation of the data is that I cannot compare the quality of principals that seek other employment after their tenure is completed with those that take another principal position within NYC schools. As Figure 5.8 indicates, I can compare the skills of principals with prior experience with those of first-time principals. Principals with prior experience are rated slightly lower on their human capital skills than principals with no prior experience.[52] The difference between each of the skill measures is very small, however, so skill differentials between experienced versus unexperienced principals do not provide a definitive explanation for the negative association between prior experience and school performance. Although I cannot identify the causal mechanisms, the results do suggest that hiring or retaining a principal with prior experience may be harmful for student performance.

The effects of principal human capital skills on school performance are consistent with my predictions with the exception of Goal Setting and to a lesser extent Human Capital Management and Managing Family Involvement. The effects of Goal Setting are particularly surprising since many studies find a positive association between the development of specific, measurable goals and organizational performance. The results are not statistically significant for Goal Setting and in three of the four cases the coefficient of Goal Setting is negative. In these

[52] The results in Figure 5.8 are based on the predicted values of the human capital skills for all schools.

cases, the coefficient remained negative for Goal Setting regardless of the SES of the student body or the quality of the school's teachers. As I explain in the subsequent section, multicollinearity between some of the human capital skills in the model likely affected these results.

Human Capital Management has a significant effect on Student Progress and Performance scores for elementary/middle schools but not for high schools. However, this skill had a negative coefficient for elementary/middle schools and a positive coefficient for high schools. In both cases the coefficient was very small, however, suggesting that Human Capital Management exerts a small influence on student performance. As discussed in Chapter 3, this result may be due to the unique teacher labor market in NYC public schools. While principals in New York City have the ability to replace teachers, they are also incentivized to hire teachers from a pool called the "absent teacher reserve" composed of poor quality teachers (Gilraine, 2017; Taylor, 2017).

The alternate measure of Human Capital Management using teacher perceptions of this skill had a negative association with Student Progress Scores in elementary/middle schools and both measures of performance in high schools as indicated in Table B.5 in Appendix B. Interestingly, the coefficient for Human Capital Management changed from negative to positive for elementary/middle school Student Performance scores. The questions used for the latent variable measure for Human Capital Management focused on the quality of teachers at a school, so the results were initially surprising but may be due to multicollinearity between the human capital skills in the model as I discuss in the following section.

As expected, Internal Management is positively associated with Student Progress and Performance scores. This effect is statistically and substantively significant in both elementary/middle and high schools. For Managing Family Involvement in high schools, the results are consistent with my expectations. As Figure 5.9 shows, a high school principal's skill at Managing Family Involvement has a positive association with Student Progress and Performance scores in schools with a higher socioeconomic status (SES) for the student body. However, as the SES of a high school's student body decreases, principals rated highly in Managing Family Involvement have a negative association with Student Progress and Performance scores. Managing Family Involvement has a positive association with Student Performance scores only at the highest levels of student body SES, however, suggesting that this skill is most beneficial for Student Progress scores in high SES high schools.

The opposite is the case with elementary/middle schools as this skill has a negative association with Student Progress and Performance scores regardless of the SES of the student body. The moderating effects of student body SES are consistent with my expectations for Student Performance scores in elementary/middle schools but not Student Progress scores. The results using the alternate measure of Managing Family Involvement are generally consistent with the results from the primary measure of this skill.[53] Managing Family Involvement therefore seems to be helpful in high SES high schools for Student Progress scores, but otherwise this skill has a negative association with Progress and Performance scores.

[53] As indicated in Table B.6 and Figure B.1 in Appendix B, Managing Family Involvement has a negative association with Student Progress and Performance Scores in elementary/middle schools as was the case with the primary measure of this skill. However, unlike the primary measure of this skill with parental perceptions, the marginal effects for Student Progress scores in elementary/middle schools with teacher perceptions of this skill are consistent with my expectations as they become more negative as the SES of the school decreases. The results for high schools with the alternate measure remained consistent with the results from the primary measure of this skill but were not statistically significant. As indicated in Figure 5.5, the alternate measure of Managing Family Involvement improved model fit for high schools but not elementary/middle schools.

Lastly, Indirect and Direct Instructional Leadership do not have a significant relationship with Student Progress scores. For Student Performance scores, there is a negative association with Indirect Instructional Leadership for both types of schools. Direct Instructional Leadership has a positive and significant association with Student Performance scores in elementary/middle schools but a negative and insignificant influence for high schools. The only significant differences I observed between school types is for Direct Instructional Leadership for Student Performance scores. While this skill has a positive and significant association with Student Performance scores in elementary/middle schools, the relationship is negative and insignificant in high schools.[54]

There are two major changes in the results using the random effects regression. While Indirect Instructional Leadership has a negative and significant effect on Student Performance scores in high schools, the coefficient for this skill is positive and insignificant in the random effects regression. For Direct Instructional Leadership in high schools, the positive effect of this skill on Student Progress scores is significant in the random effects model.

My examination of the moderating effects of the student body SES on these skills are largely different than what I expected as depicted in Figures 5.10 and 5.11. The results suggest that as the SES of the student body decreases, the marginal effects of both forms of Instructional Leadership decline with the exception of the effects of Indirect Instructional Leadership on Student Progress scores for elementary/middle schools. These results suggest that, with the exception of Direct Instructional Leadership in elementary/middle schools, principals rated

[54] As noted in Chapter 4, I used a reliability estimate of 0.96 for the indicator measure for Direct Instructional Leadership. The results did not change until the reliability estimate of this indicator was 0.92 or below. Based on the results of this sensitivity analysis, I am confident that using this single indicator provides a reasonable measure for Direct Instructional Leadership.

highly in their Instructional Leadership skills have an insignificant or negative association with school performance. In the next section I add some additional context to these findings based on the correlations of these skills with others in the model.

The results for the smaller subset of schools implementing the class size reduction program are in Table B.7 in Appendix B.[55] The results for this smaller subset of schools are comparable to the results of the larger population of schools with the following exceptions:

-Tenure and the squared term for tenure are significant for both measures of performance in high schools.
-The negative association between Goal Setting and Student Performance scores is significant in this smaller set of schools.
-The results for Managing Family Involvement are negative and significant when examining all elementary/middle schools, but for this smaller set of schools, the coefficient for this skill is positive but insignificant. As indicated in Figure B.2 in Appendix B, the marginal effects of this skill are counter to my expectations for each school type and measure of performance.
-In the smaller subset of schools, the relationship of Indirect Instructional Leadership and Student Performance scores is no longer significant. Unlike the examination with all schools, for this smaller subset the effects of Instructional Leadership on Student Performance scores increase as the SES of the student body decreases in elementary/middle schools as indicated in Figure B.3 in Appendix B.[56]
-In the smaller subset of schools, Human Capital Management is no longer significant in elementary/middle schools but it is significant in high schools for Student Performance scores.

The results for the smaller subset of schools implementing the class size reduction program are similar enough to the results for the larger group of schools that the main findings apply to both groups with the exception of Managing Family Involvement. The moderating

[55] Due to the smaller sample size for this subset of schools, I was not able to estimate the pooled SEM for Student Performance scores with the inclusion of the enrollment and percentage change in enrollment as control variables. These variables are highly correlated, therefore I fit the model by excluding percentage change in enrollment since its impact is smaller in magnitude than enrollment as indicated in Tables B.1 and B.2. The fit statistics as noted in Table B.7 still indicate an adequate model fit, and since I retain an explanatory variable for school enrollment in the model, I do not think the exclusion of percentage change in enrollment leads to an unacceptable bias in the results.
[56] I was unable to estimate the marginal effects of Instructional Leadership in high schools due to an insufficient sample size.

effects of the student body SES on the effects of Managing Family Involvement and Direct Instructional Leadership are also different in the smaller subset of schools. Table B.8 in Appendix B displays the results for Student Progress and Student Performance scores for all schools by standardizing the respective score for each school and averaging the scores for schools that serve both elementary/middle and high school students as described in Chapter 4. Although these results are not as instructive as the analysis for elementary/middle schools and high schools separately for the reasons explained in Chapter 4, the results from the analysis with all schools support the main findings in this section.

Lastly, I hypothesized that there is a positive, quadratic relationship between a principal's tenure and the effects of a principal's skills on school performance. As I discussed in Chapter 4, I am not able to estimate the effects of tenure on performance through the latent human capital variables in the model since they are correlated. I am able to estimate the effects of tenure on performance through the observed skill of Human Capital Management. The effects of tenure and tenure-squared through this skill are small and insignificant.[57] To estimate the effects of tenure on performance for the skills measured with latent variables, Figure 5.12 depicts the portion of the structural model that estimates the indicator measures for each skill as a function of tenure, tenure-squared, and the latent human capital skill. In most cases the effect of tenure is negative and insignificant while the effect of tenure-squared is positive and significant.

These results suggest that tenure has an inconsistent effect on principal human capital skills. These effects also seem to have little influence on performance since the results for the human capital skills in the full model depicted in Table 5.4 differ very little from the results of a

[57] The coefficient of tenure was -0.06 with a z-score of -0.90. The coefficient of tenure-squared was 0.03 with a z-score of 1.05.

model that excludes the effects of tenure on the human capital skill indicators in Table B.4.[58] In summary, there is little evidence that tenure exerts a positive, quadratic relationship on the effects of a principal's skills on performance. The results suggest that tenure exerts the most influence on school performance through unspecified means rather than through the six human capital skills specified in the model.

To summarize, the analysis for all schools and the smaller subset of schools implementing the class size reduction program supports my hypothesis that there is a positive, quadratic relationship between a principal's tenure and school performance. Unlike the human capital quality of principal tenure, there is a negative association between prior experience as a principal and school performance, although the results are not statistically significant. Of the six principal human capital skills, the case for a positive association with school performance is the strongest with Internal Management. Direct Instructional Leadership also has a positive and statistically significant association with Student Performance scores for elementary/middle schools. Managing Family Involvement has a positive association with Student Progress and Performance scores in high SES high schools, but this skill has a negative association with Student Progress and Performance scores in all other cases. Counter to my expectations, the effects of Goal Setting are not significant and the coefficient for this skill is negative in most cases. Lastly, the effects of Human Capital Management are small in both elementary/middle and high schools.

[58] I could not estimate the SEM in Figure 5.7 with school level random effects through the Stata GSEM procedure due to the complexity of this estimation procedure. Due to this limitation I was not able to evaluate the effects of tenure on school performance through the specified human capital skills with school level random effects in a structural equation model. The results in Figures 5.12 and the difference in the effects of the human capital skills from Table 5.4 to Table B.3 provide the best estimation of the effects of tenure on a principal's human capital skills given these limitations.

Analysis of Principal Human Capital Skills and School Performance

In this section I discuss key findings from the results of the principal human capital model on school performance. I begin with the hypotheses supported by the data to include the positive, quadratic relationship of a principal's tenure and school performance. I also discuss the findings for the skills of Internal Management and Direct Instructional Leadership. Next, I address the results that were counter to my expectations including the effects from the skills of Goal Setting, Managing Family Involvement, and Human Capital Management. I discuss how multicollinearity between the human capital skills in the model affects the results and present additional analysis to address this problem. I also offer suggestions for further analysis to build upon these findings and better understand the influence of principal human capital characteristics on school performance.

A consistent result from the primary model and the robustness checks is the positive, quadratic relationship between tenure and school performance. At a certain point the positive effects of tenure level off and this human capital quality becomes detrimental to school performance. As expected, the results from the pooled SEM for this skill differ from those of the random effects regression that accounts for unit effects. With the pooled SEM model, the effects of tenure level off much more gradually than estimation with the random effects regression.[59] Using the more efficient estimator of the random effects regression, Figure 5.13 depicts the turn-around point for principal tenure in comparison to the average principal tenure for each type of

[59] The turn-around point for the marginal effects of tenure for elementary/middle school principals and Student Performance scores is the nonsensical value of 10,000 years in the pooled SEM and 110.7 years in the random effects regression, indicating that the diminishing returns of tenure on Student Performance scores take place gradually. For high school Student Performance scores, the results are 37.6 years (pooled SEM) and 8.2 years (random effects regression). For elementary/middle school Student Progress scores, the results are 13.5 years (pooled SEM) and 8.6 years (random effects regression). Lastly, for high school Student Progress scores, the results are 20.2 years (pooled SEM) and 7.2 years (random effects regression).

school. For both Student Progress and Performance scores, the positive effects of tenure level off more quickly for high school principals than elementary/middle school principals. As this figure demonstrates, an inverted-U relationship exists for each school type and performance measure with the exception of elementary/middle school Student Performance scores. In both the pooled SEM and random effects regression, the results suggest that there is a gradual reduction in the positive effects of tenure for this performance measure.

Interestingly, the average tenure of NYC principals, approximately five years for high school principals and six years for elementary/middle school principals, is close to the turn-around point at which tenure no longer exerts a positive effect on Student Progress scores as estimated with the random effects regression. These finding supports a consistent outcome in management studies of an inverted-U shaped relationship between organizational tenure and job performance (Sturman, 2003). Although previous studies of educational leadership note a positive relationship between tenure and performance (Clark et al., 2009), this study suggests that for most types of schools and measures of performance, the relationship between tenure and school performance is an inverted-U.[60]

Although the evidence supports the hypothesis that a principal's tenure has a positive, quadratic relationship on his or her human capital skills, it appears that the effects of tenure on school performance through these skills is small in comparison to its effects through other

[60] Since (Sturman, 2003) also notes that management studies find an inverted-U relationship between age and prior job experience with organizational performance, I included principal age and prior experience in the NYC school system in a non-principal position in the model. Between the two types of schools and two measures of performance, there were no cases in which a principal's age had a significant effect on performance and in each case the coefficient for this variable was small. A principal's prior experience in a non-principal position in NYC public schools had a significant effect only on Student Progress (β=.12) scores for high schools. Again, the coefficient was small for each case which indicates that these principal qualities do not have a substantial impact on school performance. The SRMR remained the same while the AIC and BIC were slightly higher for each case, suggesting these two variables do not add much explanatory power to the model.

means. Since principals are involved in so many activities in managing a school, there are many paths through which a principal's tenure may influence performance. Since I was surprised that tenure had a positive association with very few human capital skill indicators as depicted in Figure 5.12, I excluded the squared term for tenure on human capital skills from the model. While one would expect a principal's skills to grow in a quadratic rather than linear fashion, the results in Figure 5.14 without the squared term for tenure suggest that a linear relationship may be the more proper functional form. In this model, the relationship of tenure and each skill indicator is positive and significant. The fit statistics for this model suggest that it is not quite as good of a fit for the data as the model with the squared term for tenure.

The effects of the human capital variables were similar for both models, so I retained the model with the squared term for tenure on the human capital variables since it is a slightly better fit. In either case, the effects of the human capital variables changed very little regardless of whether I included the effects of tenure and/or tenure-squared on the human capital skills or excluded both of the tenure effects on skills altogether. In summary, although Figure 5.14 supports the concept of a causal complementarity discussed in Chapter 2 that involves a generic human capital quality shaping the development of a more specific quality, these effects seem to have little influence on school performance.[61]

[61] I also assessed if age and experience in non-principal positions influence the marginal effects of tenure on school performance. It is possible that younger principals simply have more to learn about managing a school, therefore I expect the marginal effects of tenure to be lower for younger principals than older principals. Similarly, a principal with little experience in educational settings should have more to learn about managing a school than principals with high levels of experience in non-principal positions in the NYC school system. I therefore expect the marginal effects of tenure to be lower for principals with low levels of non-principal experience compared to those with high levels. As the results in Figures B.4 demonstrate, the marginal effects of tenure are lower for younger principals than older principals. As Figure B.5 depicts, the marginal effects of tenure are higher at lower levels of non-principal experience for elementary/middle schools, but the opposite is the case for high schools.

The principal skill that has the largest influence on school performance, both substantively and in terms of statistical significance, is Internal Management. This finding supports previous research in educational leadership (Grissom & Loeb, 2011; Horng et al., 2010; Owings et al., 2005) and public administration (Favero et al., 2016; Meier & O'Toole Jr, 2007) research. Since Internal Management focuses on overall school conditions instead of activities inside the classroom or networking outside of the school, a downfall of this measure is that it is a skill that influences a broad spectrum of actions a principal may take. As such, replicating the findings for Internal Management in other schools and time periods may be difficult since it may be impractical to establish construct clarity for this measure.

In this study Internal Management focuses on a principal's skills at maintaining order and discipline in a school and keeping the school clean. One could think of many different activities that could also fall under the skill of Internal Management such as managing finances, managing the non-instructional staff, and leveraging technology. Not surprisingly, studies in educational leadership take different approaches to measure internal management (Grissom & Loeb, 2011; Horng et al., 2010; Owings et al., 2005) and it is unlikely that scholars will agree on what activities should be attributed to this skill. Despite this challenge, the results in this chapter indicate that routine aspects of running a school that do not focus directly on a principal's influence inside the classroom or with external constituents has a significant and positive impact on school performance.

Since the results of Goal Setting are counter to my expectations, I examined whether multicollinearity affected the results. As Table 5.6 demonstrates, Goal Setting is highly correlated with Internal Management and Indirect Instructional Leadership and the alternative measure for Human Capital Management. It is difficult to accurately estimate the effects of such highly correlated variables (Wooldridge, 2015), but the negative coefficient for some of these skills when they are included in the same model may indicate the influence on performance when these skills are not aligned (Hare & Monogan, 2018). To assess the effects of multicollinearity on the results in Table 5.4, I first estimated each of the human capital skills in the model one at a time for each of the measures of school performance.

As Table 5.7 indicates, the coefficients of the human capital skills are positive and significant predictors of Student Progress with the exception of Managing Family Involvement for elementary/middle schools. The results for this skill are consistent with my hypothesis that a school's SES moderates the effects of Managing Involvement.[62]

Table 5.8 presents the results for Student Performance scores for each human capital skill separately. The coefficients of the human capital skills are positive and significant with the exception of Managing Family Involvement, Indirect Instructional Leadership in high schools, and Direct Instructional Leadership in high schools. Again, a school's SES appears to be an important moderator of the effects of Managing Family Involvement on Student Performance scores. While the insignificant effects of Indirect and Direct Instructional Leadership for high schools are inconsistent with my expectations, the results support my hypothesis that there are grade level differences regarding the influence of these skills. The moderating effects of a school's SES are consistent with the results when all skills are included in the model.[63]

[62] Figure B.6 in Appendix B indicates that the marginal effects of Managing Family Involvement for the model without the other human capital skills included are similar to the model that includes all of the human capital skills represented in Figure 5.9. In both cases, the results for elementary/middle schools differ from the hypothesized relationship while the results for high schools are consistent with the hypothesized relationship. The results for Student Performance scores for high schools are more consistent with my expectations that there are positive effects for this skill at higher student body SES levels when the model excludes the other human capital skills.

[63] The results in Figures B.7 and B.8 from the model that excludes the other skills closely mirror the results in Figures 5.9 and 5.10 that depict the moderating effects of a school's SES on Indirect and Direct Instructional Leadership when the other skills included in the model.

As the results in Tables 5.7 and 5.8 demonstrate, Goal Setting has a positive and significant effect on both measures of performance for both school types when the other skills are excluded from the model. This positive relationship between Goal Setting and school performance is expected whereas the negative relationship between Goal Setting and school performance when the other skills are included in the model seems counterintuitive.

Since a principal skilled at Goal Setting is usually skilled at Internal Management as well, the negative relationship between Goal Setting and school performance when controlling for Internal Management provides an interesting insight. This relationship suggests that when holding the skill of Internal Management constant, higher ratings for Goal Setting are negatively associated with performance. The data support this assertion. For elementary/middle schools, principals rated above the mean for Goal Setting and Internal Management lead schools with 4% higher Student Progress scores and 19% higher Student Performance scores compared to schools with principals rated above the mean for Goal Setting but below the mean for Internal Management. For high schools, the difference is 19% for Student Progress scores and 17% for Student Performance scores. While these results may be more indicative of the effects of Internal Management than Goal Setting, they also speak to the benefits for school performance when Goal Setting is paired with skills at Internal Management. This explanation seems plausible as a principal that sets high goals but does not have enough managerial skills to keep up with the basic functions of the organization may cause additional stress in the organization that is detrimental for performance.

An unexplored concept in this dissertation that may affect the results of Goal Setting is the concept of goal ambiguity. Chun and Rainey (2005) define goal ambiguity as the "extent to which an organizational goal or set of goals allows leeway for interpretation" (Chun & Rainey, 2005, p. 2). Previous studies note that low management capacity is associated with high goal ambiguity (Ingraham, Joyce, & Donahue, 2003). Since there is evidence that high goal ambiguity is detrimental to organizational performance (Rainey & Jung, 2012), future studies should also include measures of goal ambiguity to better understand the relationship between Internal Management and Goal Setting.

Turning to the skill of Managing Family Involvement, a surprising finding is that this skill has a negative association with school performance in elementary/middle schools regardless of the SES of the student body. These results suggest that elementary/middle school principals are better off focusing on operations inside the school or networking with other stakeholders besides parents. Although the causal mechanism for the negative effects of Managing Family Involvement for elementary/middle school principals is unclear, future studies would benefit from examining the time and methods that principals use to interact with parents to better understand the effects noted in this study.

For the Instructional Leadership skills, Direct Instructional Leadership seems to play a larger role in school performance than Indirect Instructional Leadership, especially for elementary/middle schools. This result supports previous research that, because of the higher level of subject matter expertise in high schools compared to elementary/middle schools (Grissom et al., 2013), principals are more likely to see positive effects from Direct Instructional Leadership in elementary/middle schools. It follows that the effects of Indirect Instructional Leadership differ very little between school types since this skill focuses more on the quality of professional development than whether the principal delivers this development in person.

Much like the skill of Goal Setting, the effects of Instructional Leadership are better understood in the context of a principal's skills at Internal Management since Instructional

Leadership and Internal Management are highly correlated. For elementary/middle schools, principals rated above the mean for Indirect Instructional Leadership and Internal Management lead schools with 4% high Student Progress scores and 20% higher Student Performance scores compared to schools with principals rated above the mean for Indirect Instructional Leadership but below the mean for Internal Management. For high schools, the difference is 15% for each measure of performance. Although the coefficient for Indirect Instructional Leadership is negative for both types of schools in the pooled SEM and random effects regression model, these results suggest that Indirect Instructional Leadership is particularly detrimental when a principal's skills at Internal Management are below average.

Since Indirect Instructional Leadership focuses more on a principal's organizational skills than Direct Instructional Leadership, I would expect the effects of Direct Instructional Leadership to be less sensitive to a principal's Internal Management skills than Indirect Instructional Leadership. The data support this assertion. As depicted in Table 5.6, Direct Instructional Leadership has a lower correlation with Internal Management than Indirect Instructional Leadership. In turn, the differences in school performance for schools led by principals rated highly on Instructional Leadership and Internal Management compared to schools led by principals rated highly on Instructional Leadership but below average on Internal Management are smaller for Direct Instructional Leadership compared to Indirect Instructional Leadership.[64]

[64] For elementary/middle schools, principals rated above the mean for Direct Instructional Leadership and Internal Management lead schools with 4% high Student Progress scores and 13% higher Student Performance scores compared to schools with principals rated above the mean for Direct Instructional Leadership but below the mean for Internal Management. For high schools, the difference is 11% for each measure of performance.

A surprising finding is that in most cases the effects of Instructional Leadership decrease as the SES of a school's student body decreases. Since I did not have individual classroom level data, I am not able to examine the effects of Instructional Leadership based on teacher experience. The measure of Direct Instructional Leadership also focused on the frequency of interaction between a principal and teachers and did not explore different methods a principal may use to coach his or her teachers. Different methods of Direct Instructional Leadership are likely more or less effective depending on a teacher's experience, learning style, and subject matter expertise. Because the quality and experience of teachers differ by school SES (Clotfelter et al., 2008), incorporating such factors into future studies will likely increase our understanding of the effects of Instructional Leadership on school performance.

Lastly, the effects of Human Capital Management were small using the primary measure for this skill. While previous studies indicate a principal shapes school performance through hiring teachers that support his or her vision for the school (D. J. Brewer, 1993), the results in my analysis are not conclusive. As indicated in Figure 5.14, there is a positive relationship between tenure and Human Capital Management. This relationship makes sense intuitively since it takes time for a principal to hire new teachers, especially given the contractual protections in the NYC school system that limit teacher turnover. However, when I examined the effects of tenure on performance through Human Capital Management, the results were negative in each case. Tenure may increase a principal's abilities to increase the percentage of highly qualified teachers in a school, but this outcome does not necessarily result in better school performance. The results were also not supportive of Human Capital Management as a predictor of performance for high schools when using the alternate measure of this skill based on teacher perceptions of the quality of their colleagues.[65]

The results for the primary and alternate measure of Human Capital Management therefore indicate that this skill does not have much effect on school performance. Since this result may be due to the unique labor market of NYC public schools, future studies should examine less constrained labor markets in which principals have more authority to shape their teacher workforce. Table 5.9 summarizes the findings for hypotheses 1a through 1k described in Chapter 3 that assess the influence of a principal's human capital on school performance.

Implications for the NYC Principal Labor Market

The findings in this chapter offer some practical implications for principal hiring and retention decisions in NYC public schools. First, for elementary/middle schools, the results suggest that tenure is positively associated with higher school performance. The quadratic relationship between tenure and student performance is such that the positive effects of tenure diminish more slowly in elementary/middle schools than high schools, especially for Student Performance scores. All else being equal, these results suggest that after about seven or eight years, additional years of tenure are not positively associated with Student Progress scores. For Student Performance scores, the positive effects of tenure diminish slowly for elementary/middle

[65] As indicated in Table 5.6, there is a low correlation between the primary measure for Human Capital Management and the other skills in the model, but the opposite is the case for the alternate measure. When the alternate measure of Human Capital Management is included as the only human capital variable in the model, it has a positive influence on school performance that is statistically significant for high school Student Progress and elementary/middle school Student Performance scores. Since Goal Setting, Internal Management, and Human Capital Management usually move together, the negative coefficient signals what happens when these skills are not aligned. It is reasonable to think that in cases where a principal is a poor Goal Setter and Internal Manager, teachers may work more closely together to overcome this leadership deficit.

schools, but for high schools, tenure no longer exerts a positive effect on this measure of performance after about eight years.

The results indicate that hiring a principal with previous experience as a principal is not beneficial, thus schools are likely better off hiring a first-time principal. A challenge of hiring a new principal is that it is difficult to assess their skills as a manager of a school. The results in this chapter suggest that Internal Management and Direct Instructional Leadership are particularly important skills for elementary/middle school principals. An elementary/middle school principal rated one standard deviation higher than the mean in Internal Management results in a 6% increase in Student Progress scores and an 11% increase in Student Performance scores. The effects of Direct Instructional Leadership are significant for Student Performance scores with a one standard deviation increase in this skill associated with a 2% increase in student performance scores. However, the effects of Direct Instructional Leadership are more pronounced in high SES schools than low SES schools.

I derived the skill measures for Internal Management and Direct Instructional Leadership from assessments of these skills by the school's teachers. Since these assessments are not available for first-time principals, hiring authorities must rely on other measures of these skills when considering different candidates for a principalship. Some indicators of Internal Management and Direct Instructional Leadership skills may be available from supervisor recommendations and evaluations of candidates that served as assistant principals. Principals must also go through a principal training program as part of their requirements for an administrator's license. It would be beneficial for these training programs to provide assessments of a principal's skills in Internal Management and Direct Instructional Leadership since these two skills positively influence school performance.

For high schools, Internal Management is an important predictor of performance and to a lesser extent Direct Instructional Leadership. A high school principal rated one standard deviation higher than the mean in Internal Management results in a 10% increase in Student Progress scores and an 8% increase in Student Performance scores. Direct Instructional Leadership has a positive association with Student Progress scores with a principal rated one standard deviation higher than the mean associated with a 5% increase in Student Progress scores. As with elementary/middle schools, the effects of Direct Instructional Leadership are greater in higher SES schools compared to lower SES schools.

These findings also underscore how important Internal Management is to the effects of other skills such as Goal Setting and Indirect Instructional Leadership. A principal rated highly in Goal Setting or Indirect Instructional Leadership is unlikely to generate a positive influence on school performance from these skills if he or she is rated below the average for Internal Management.

Given these findings, an important consideration is how many principals excel at Internal Management, Goal Setting, and Indirect Instructional Leadership. For elementary/middle schools, 14% of principals are one standard deviation above the mean on all three of these skills while 29% are one-half standard deviation above the mean. For high schools, 15% of principals are one standard deviation above the mean at these three skills while 23% are one-half standard deviation above the mean. These results indicate that while principals rated highly at one of these skills are typically rated highly on the other two, this may not always be the case. While Goal Setting and Indirect Instructional Leadership can be beneficial for school performance, hiring authorities should be wary about hiring principals rated highly for these two skills if they are not also rated highly for Internal Management. Lastly, with the exception of high SES high schools, the results caution against hiring a principal skilled at Managing Family Involvement.

Chapter Summary

Principals may influence school performance through a variety of means. In this chapter I did not specify a particular mechanism through which principals influence school performance, instead assessing the effects of principal human capital on school performance through unspecified means. I first constructed measurements for five of the human capital skills in my model through confirmatory factor analysis. After adjusting the measurement models in an iterative fashion based on the fit statistics, I assessed the influence of principal human capital on school performance using a pooled structural equation model. Since some of the human capital skills were highly collinear, I estimated this model with each skill separately to account for this multicollinearity in the model. I also estimated a random effects linear regression and performed several robustness checks to assess the findings from the primary estimation technique of the pooled structural equation model.

The most significant results of the model, both statistically and substantively, are a positive association between a principal's tenure and Internal Management skills and school performance. The relationship between tenure and school performance is quadratic, however, with the positive effects of tenure diminishing more quickly for high school principals than elementary/middle school principals. Internal Management and Goal Setting are highly collinear, so while Goal Setting is positive when it is the only skill in the model, its effects are negative when the other skills are included. The findings suggest that when principals are rated highly on Goal Setting but are below the average in Internal Management, the skill of Goal

Setting is detrimental for performance. The effects of Indirect Instructional Leadership are similar with principals rated highly on this skill but low on Internal Management indicating a negative association with school performance. Direct Instructional Leadership is especially beneficial for elementary/middle school Student Performance scores. As with Indirect Instructional Leadership, the effects of this skill diminish when a principal is highly skilled at Direct Instructional Leadership but is rated below the average for Internal Management.

Prior experience as a principal did not have a significant effect on school performance, and although the effects of Human Capital Management were statistically significant in some cases, their effects were small. Lastly, the effects of Managing Family Involvement and Instructional Leadership differ by school type and the socioeconomic status of the student body. I concluded this chapter with a discussion of the practical implications of these finds for stakeholders in the NYC school system. In the next chapter, I examine the effects of a principal's human capital in the implementation of a specific program designed to improve school performance.

Table 5.1

Fit Statistics for Measurement Models

	Initial Measurement Model (Figure 5.2)	Best Fitting Measurement Model (Figure 5.3)	Best Fitting Measurement Model - Human Capital Management as a Latent Variable (Figure 5.4)	Best Fitting Measurement Model - Teacher Assessments of Managing Family Involvement (Figure 5.5)	One Factor Model for Principal Skills (Figure 5.6)
Chi-Squared	7038.60	409.15	725.74	259.92	23555.44
SRMR	0.052	0.015	0.016	0.010	0.168
RMSEA	0.126	0.058	0.060	0.046	0.360
CFI	0.934	0.992	0.989	0.996	0.525
TLI	0.911	0.984	0.979	0.991	0.389
AIC	178560.6	129194.0	153146.4	144320.0	152320.3
BIC	178906.1	129437.9	153464.8	144563.9	152496.4

Table 5.2

Factor Loadings and Covariances for Best-Fitting Measurement Model

	All Schools (N=6,467)		**Elementary / Middle Schools (N=5,252)**		**High Schools (N=1,502)**	
	Path Coef / Std. Err.	z	Path Coef / Std. Err.	z	Path Coef / Std. Err.	z
Factor Loadings						
Goal Setting						
gs_q1	1* (-)	-	1* (-)	-	1* (-)	-
gs_q2	.779 (.010)	74.58	.763 (.011)	66.59	.804 (.020)	40.56
Internal Management						
im_q2	1* (-)	-	1* (-)	-	1* (-)	-
im_q3	.455 (.015)	30.09	.433 (.016)	26.63	.495 (.032)	15.28
Managing Family Involvement						
fip_q1	1* (-)	-	1* (-)	-	1* (-)	-
fip_q2	1.16 (.023)	50.19	1.16 (.026)	44.28	1.20 (.056)	21.53
Indirect Instructional Leadership						
iil_q2	1* (-)	-	1* (-)	-	1* (-)	-
iil_q4	.989 (.010)	97.35	.980 (.011)	91.19	1.02 (.025)	41.36
Direct Instructional Leadership						
dil_q1	1* (-)	-	1* (-)	-	1* (-)	-
Latent Variable Covariances						
IM-DIL	1.37 (.050)	27.31	1.45 (.056)	25.85	1.13 (.096)	11.76
IM-GS	2.03 (.061)	33.48	2.12 (.068)	30.97	1.78 (.111)	16.04
IM-FI	0.41 (.020)	20.85	0.42 (.022)	19.35	0.33 (.039)	8.49
IM-IIL	1.56 (.051)	30.39	1.66 (.058)	28.69	1.23 (.098)	12.57
DIL-GS	1.30 (.042)	31.02	1.33 (.045)	29.26	1.20 (.087)	13.88
DIL-FI	0.20 (.012)	16.54	0.21 (.013)	15.90	0.14 (.024)	6.03
DIL-IIL	1.10 (.036)	30.65	1.14 (.040)	28.33	1.01 (.070)	14.53
GS-FI	.319 (.015)	20.60	0.31 (.016)	18.91	0.28 (.033)	8.39
GS-IIL	1.54 (.045)	34.49	1.56 (.050)	31.22	1.46 (.089)	16.39
FI-IIL	.264 (.013)	20.26	0.26 (.014)	18.73	0.20 (.026)	7.66

*Paths from latent variables to the first observed endogenous variable are constrained to 1 automatically by Stata.

Table 5.3

Summary of Predicted Values for Latent Variables

	All Schools (N=6,467)	Elementary / Middle Schools (N=5,253)	High Schools (N=1,502)
Goal Setting			
Mean	0.000	0.000	0.000
Std. Dev.	1.313	1.320	1.312
Min	-6.246	-6.313	-5.426
Max	3.124	3.039	3.304
Internal Management			
Mean	0.000	0.000	0.000
Std. Dev.	1.558	1.689	1.423
Min	-6.783	-6.911	-5.833
Max	3.455	3.478	3.488
Managing Family Involvement			
Mean	0.000	0.000	0.000
Std. Dev.	0.473	0.453	0.488
Min	-2.093	-2.057	-1.938
Max	1.789	1.724	1.718
Indirect Instructional Leadership			
Mean	0.000	0.000	0.000
Std. Dev.	1.205	1.220	1.155
Min	-5.499	-5.624	-4.727
Max	3.132	3.104	2.840
Direct Instructional Leadership			
Mean	0.000	0.000	0.000
Std. Dev.	1.174	1.174	1.185
Min	-6.073	-6.102	-5.824
Max	2.455	2.423	2.545

Table 5.4

Principal Human Capital and Student Progress and Performance Scores – Pooled SEM

	Student Progress Scores				**Student Performance Scores**			
	Elementary / Middle Schools (N=5,144)		**High Schools (N=1,339)**		**Elementary / Middle Schools (N=5,144)**		**High Schools (N=1,339)**	
	Coef./Std. Err.	Z	Coef./Std. Err.	Z	Coef./Std. Err.	Z	Coef./Std. Err.	Z
Experience Variables								
Tenure	0.95 (.935)	1.01	2.43 (1.354)	1.79	0.80 (.451)	1.78	**1.26 (.601)**	**2.10***
Tenure-sq	-0.42 (.348)	-1.21	-0.93 (.533)	-1.75	-0.08 (.168)	-0.45	-0.40 (.227)	-1.76
Experience	-0.12 (.068)	-1.80	-0.09 (.098)	-0.97	-0.05 (.041)	-1.24	-0.05 (.053)	-0.94
Human Capital Skills								
Goal Setting	-2.25 (1.168)	-1.93	-2.15 (1.704)	-1.26	-0.23 (.620)	-0.38	0.55 (.841)	0.65
Internal Manager	**2.36 (.495)**	**4.77****	**4.00 (.945)**	**4.24****	**1.56 (.267)**	**5.83****	**1.14 (.437)**	**2.62****
Manager of Family Involvement	*-2.08 (.509)*	*-4.08***	0.98 (.826)	1.19	**-2.67 (.262)**	**-10.20****	-0.62 (.408)	-1.52
Indirect Instructional Leader	0.31 (.660)	0.48	-0.87 (1.093)	-0.80	**-1.11 (.346)**	**-3.22****	**-1.33 (.558)**	**-2.38***
Direct Instructional Leader	0.48 (.338)	1.41	0.45 (408)	1.12	**0.45 (.166)**	**2.68****	-0.23 (.211)	-1.07
Human Capital Manager	*-0.06 (.029)*	*-2.09**	0.04 (.036)	1.20	*-0.06 (.013)*	*-5.06***	0.03 (.018)	1.76

*p<.05, **p<.01 (two-tailed)

Bold indicates significant finding in the predicted direction
Italics indicates significant finding against the predicted direction

Table 5.5

Fit Statistics for Pooled Cross-Section Structural Equation Models

	Student Progress Scores		Student Performance Scores	
	Pooled SEM for Elementary/Middle Schools (N=5,144)	**Pooled SEM for High Schools (N=1,339)**	**Pooled SEM for Elementary/Middle Schools (N=5,144)**	**Pooled SEM for High Schools (N=1,339)**
Initial Model (all explanatory variables as depicted in Figure 5.7)				
SRMR	0.075	0.091	0.076	0.091
AIC	401223.2	108501.0	392517.4	106725.2
BIC	401707.4	108885.1	393001.5	107109.2
Adjusted Model (excluding Teacher Turnover and C4E Funding)				
SRMR	0.062	0.080	0.062	0.081
AIC	306718.3	81050.5	298920.5	79269.4
BIC	307189.6	81424.9	299391.7	79643.8
Alternate Measure for Human Capital Management				
SRMR	0.049	0.080	0.049	0.081
AIC	277828.3	72999.9	270060.1	71214.5
BIC	278371.7	73431.5	270603.4	71646.0
Alternate Measure for Managing Family Involvement				
SRMR	0.060	0.049	0.060	0.048
AIC	319234.5	79731.2	311579.6	77941.1
BIC	319705.8	80105.5	312050.8	78315.5

Table 5.6

Correlations Between Human Capital Variables

	Goal Setting	Internal Management	Managing Family Involvement	Indirect Instructional Leadership	Direct Instructional Leadership	Human Capital Management
Goal Setting	-	-	-	-	-	-
Internal Management	0.93	-	-	-	-	-
Managing Family Involvement	0.51	0.54	-	-	-	-
Indirect Instructional Leadership	0.95	0.81	0.46	-	-	-
Direct Instructional Leadership	0.84	0.73	0.36	0.78	-	-
Human Capital Management	0.21	0.21	0.19	0.19	0.19	-
Managing Family Involvement (Alternate Measure)	0.92	0.89	0.52	0.88	0.71	0.20
Human Capital Management (Alternate Measure)	0.79	0.71	0.50	0.77	0.64	0.17

Table 5.7

Principal Human Capital and Student Progress Scores – Human Capital Variables Evaluated Separately

	Student Progress Scores									
	Coef. / Std. Err.	Coef. / Std. Err.	Coef. / Std. Err.	Coef. / Std. Err.	Coef. / Std. Err	Coef. / Std. Err.	Coef. / Std. Err.	Coef. / Std. Err.	Coef. / Std. Err.	Coef. / Std. Err.
Experience Variables	EMS	HS	EMS	HS	EMS	HS	EMS	HS	EMS	HS
Tenure	0.95	2.55	0.91	2.22	0.91	3.02*	0.97	2.29	1.19	2.59*
	(.929)	(1.359)	(.930)	(1.343)	(.929)	(1.381)	(.929)	(1.350)	(.849)	(1.246)
Tenure-sq	-0.43	-1.13*	-0.42	-0.84	-0.42	-1.24*	-0.44	-0.86	-0.47	-0.95
	(.346)	(.522)	(.346)	(.527)	(.346)	(.355)	(.346)	(.532)	(.329)	(.495)
Experience	-0.12	-0.09	-0.13	-0.12	-0.12	-0.07	-0.12	-0.05	-0.12	-0.04
	(.066)	(.118)	(.066)	(.102)	(.066)	(.114)	(.066)	(.129)	(.066)	(.116)
Human Capital Skills										
Goal Setting	0.68**	1.27**	-	-	-	-	-	-	-	-
	(.161)	(.239)								
Internal Manager	-	-	1.13**	2.48**	-	-	-	-	-	-
			(.149)	(.308)						
Manager of Family Involvement	-	-	-	-	-0.02	4.05**	-	-	-	-
					(.433)	(.757)				
Indirect Instructional Leader	-	-	-	-	-	-	0.61**	0.53	-	-
							(.173)	(.298)		
Direct Instructional Leader	-	-	-	-	-	-	-	-	0.69**	1.17**
									(.158)	(.291)
Human Capital Manager	-0.05	0.09*	-0.08**	0.05	-0.03	0.09*	-0.05	0.11**	-0.05**	0.11**
	(.029)	(.040)	(.028)	(.036)	(.028)	(.040)	(.028)	(.041)	(.027)	(.040)

*p<.05, **p<.01 (two-tailed)

Table 5.8

Principal Human Capital and Student Performance Scores – Human Capital Variables Evaluated Separately

	Student Performance Scores									
	Coef. / Std. Err.	Coef. / Std. Err.	Coef. / Std. Err.	Coef. / Std. Err.	Coef. / Std. Err.	Coef. / Std. Err.	Coef. / Std. Err.	Coef. / Std. Err.	Coef. / Std. Err.	Coef. / Std. Err.
Experience Variables	EMS	HS	EMS	HS	EMS	HS	EMS	HS	EMS	HS
Tenure	0.79	1.45*	0.77	1.35*	0.79	1.47*	0.82	1.41*	0.27	1.44*
	(.447)	(.605)	(.449)	(.601)	(.446)	(.605)	(.446)	(.599)	(.407)	(.572)
Tenure-sq	-0.09	-0.54*	-0.08	-0.45**	-0.08	-0.51**	-0.10	-0.49*	0.08	-0.48*
	(.167)	(.228)	(.167)	(.226)	(.166)	(.230)	(.167)	(.226)	(.155)	(.216)
Experience	-0.06	-0.05	-0.06	-0.06	-0.06	-0.05	-0.06	-0.04	-0.05	-0.03
	(.040)	(.058)	(.040)	(.054)	(.039)	(.059)	(.040)	(.062)	(.038)	(.058)
Human Capital Skills										
Goal Setting	0.44**	0.29**	-	-	-	-	-	-	-	-
	(.080)	(.104)								
Internal Manager	-	-	0.67**	0.67**	-	-	-	-	-	-
			(.096)	(.134)						
Manager of Family Involvement	-	-	-	-	-0.58*	0.61	-	-	-	-
					(.229)	(.348)				
Indirect Instructional Leader	-	-	-	-	-	-	0.19*	-0.13	-	-
							(.225)	(.126)		
Direct Instructional Leader	-	-	-	-	-	-	-	-	0.51**	0.11
									(.080)	(.127)
Human Capital Manager	-0.07**	0.04*	-0.09**	0.03	-0.05**	0.04	-0.06**	0.05*	-0.08**	0.05*
	(.014)	(.020)	(.013)	(.018)	(.013)	(.020)	(.013)	(.020)	(.013)	(.020)

*p<.05, **p<.01 (two-tailed)

Table 5.9

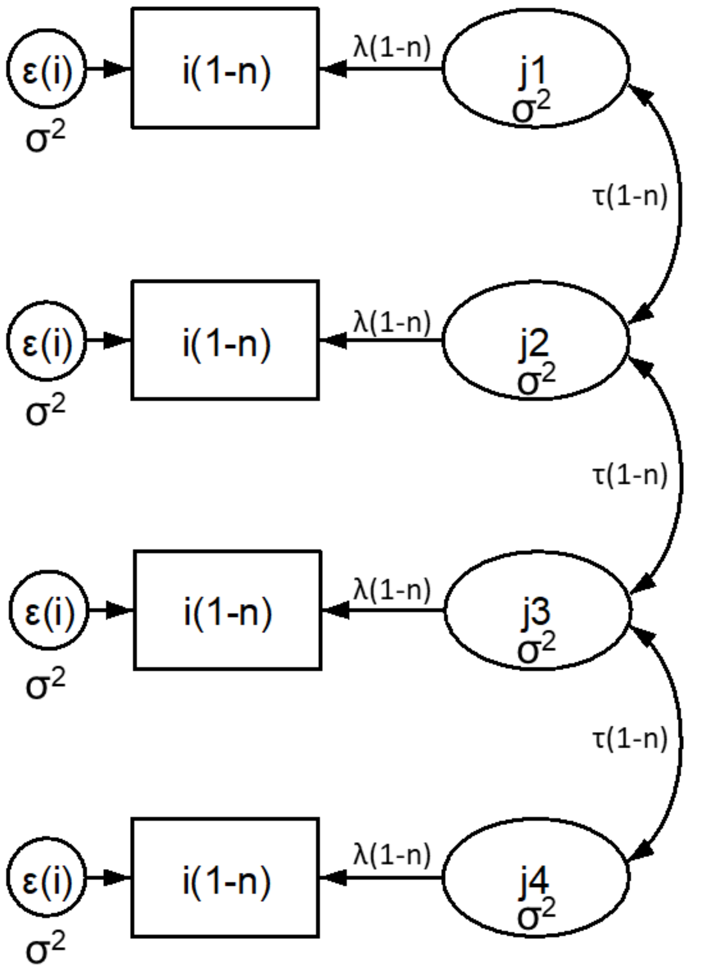
Summary of Findings

Hypothesis	Key Findings
H1a: There is a positive, quadratic relationship between principal tenure and school performance.	**Partially Supported:** The positive, quadratic relationship between school performance and tenure is consistent in the pooled SEM and random effects model. While the only statistically significant finding is for high school Student Performance with the pooled SEM, the results are statistically significant for all cases in the random effects model.
H1b: There is a positive relationship between prior experience as a principal and school performance.	**Unsupported:** The relationship between prior experience as a principal and school performance is negative in each case for the pooled SEM and random effects model.
H1c: The higher a principal is rated by the school's teachers as a Goal Setter, the more positive the effects will be on school performance.	**Partially Supported:** The relationship between Goal Setting and school performance is negative in all cases except for School Performance scores for high schools estimated with the pooled SEM. The coefficient for this skill is negative for all cases in the random effects regression. However, when the other principal skills are excluded from the model, this skill has a positive and significant association with school performance. The results indicate a positive effect for this skill when principals are rated similarly for Internal Management.
H1d: The higher a principal is rated by the school's teachers as an Internal Manager, the more positive the effects will be on school performance.	**Supported:** There is a positive and statistically significant relationship between Internal Management and school performance in all cases.
H1e: As a school's SES increases, the higher a principal is rated by the school's parents as a Manager of Family Involvement, the more positive the effects will be on school performance	**Partially Supported for High Schools:** Although this skill is not statistically significant, the marginal effects of Managing Family Involvement become positive as the SES of the student body increases in high schools. The effects of this skill appear to be beneficial for Student Performance scores only at very high student body SES levels. **Unsupported for Elementary/Middle Schools:** The marginal effects of Managing Family Involvement are consistently negative and decrease as the SES of the student body increases for Student Performance scores in elementary/middle schools.

H1f: A principal's skills as an Indirect Instructional Leader have an effect on school performance.	**Partially Supported:** The relationship of this skill is significant for Student Performance scores. Although the coefficient of this skill is negative for Student Performance scores for both types of schools, due to the correlation of this skill with Internal Management, this negative association results when principals are not rated similarly on these two skills.
H1g: A principal's skills as a Direct Instructional Leader have an effect on school performance.	**Partially Supported:** There is a statistically significant positive association between Direct Instructional Leadership and Student Performance scores for elementary/middle schools when estimated with the pooled SEM and for high school Student Progress scores when estimated with the random effects regression.
H1h: The grade level of a school has an effect on the influence of Instructional Leadership on school performance.	**Partially Supported:** There was little difference in the effects of Indirect Instructional Leadership by school type. The effects of Direct Instructional Leadership on Student Performance scores are much greater for elementary/middle schools than high schools.
H1i: As a school's socioeconomic status decreases, the higher a school's principal is rated as an Instructional Leader, the more positive the effects will be on school performance.	**Unsupported:** With the exception of the effects of Indirect Instructional Leadership on Student Progress scores for elementary middle schools, in all other cases the effects of Instructional Leadership decreased as the school's socioeconomic status decreased.
H1j: The greater a principal's abilities as a Human Capital Manager, the more positive the effects will be on school performance.	**Unsupported:** While there is a statistically significant association between Human Capital Management and school performance for elementary/middle schools, the effects of this skill are negative. The opposite is the case for high schools where the effects of this skill are positive but insignificant. The results are consistent with these findings with the alternate measure for this skill. In all cases, however, the effects of Human Capital Management on school performance are small.
H1k: There is a positive, quadratic relationship between a principal's tenure and the effects of a principal's skills on school performance.	**Unsupported:** There is a positive relationship between tenure and each human capital skill, but when the quadratic term is included, the effects of tenure on the principal skills are mixed. The effects of tenure on school performance through a principal's human capital skills are small in comparison to the effects through other unspecified means.

Figure 5.1

Measurement Model Notation



Symbol	Definition
i	Observed indicators for principal skills (from NYC DOE survey responses) numbered 1 through n for each latent exogeneous variable
j	Latent exogenous variables (principal skills)
ε(i)	Measurement errors for i
λ	Coefficients relating i to j
τ	Covariance between latent exogeneous variables
σ^2	Error variance (outside of the circle with ε) or latent variable variance (inside of the circle with j)

Figure 5.2

Initial Measurement Model: Goal Setting, Internal Management, Managing Family Involvement, and Indirect Instructional Leadership as Correlated Skills

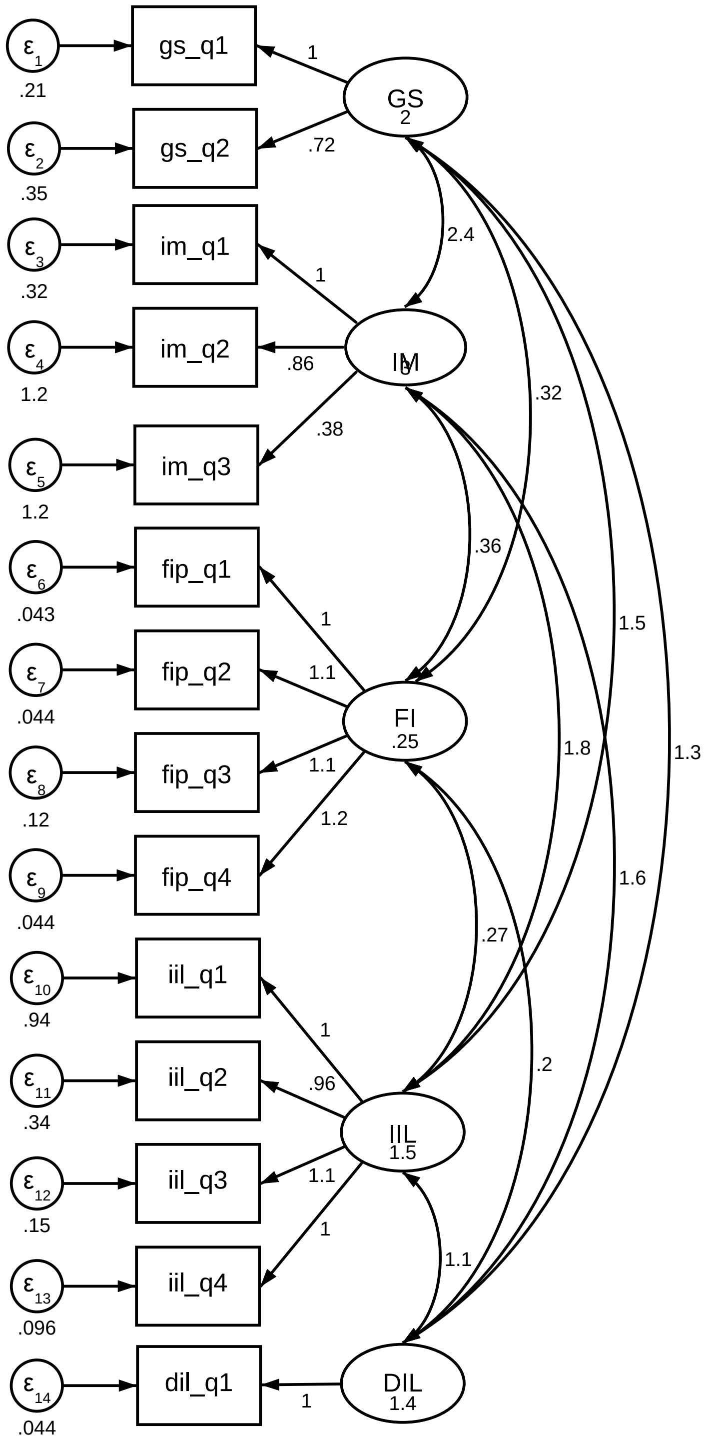


Figure 5.3

Best Fitting Measurement Model: Goal Setting, Internal Management, Managing Family Involvement, and Indirect Instructional Leadership as Correlated Skills

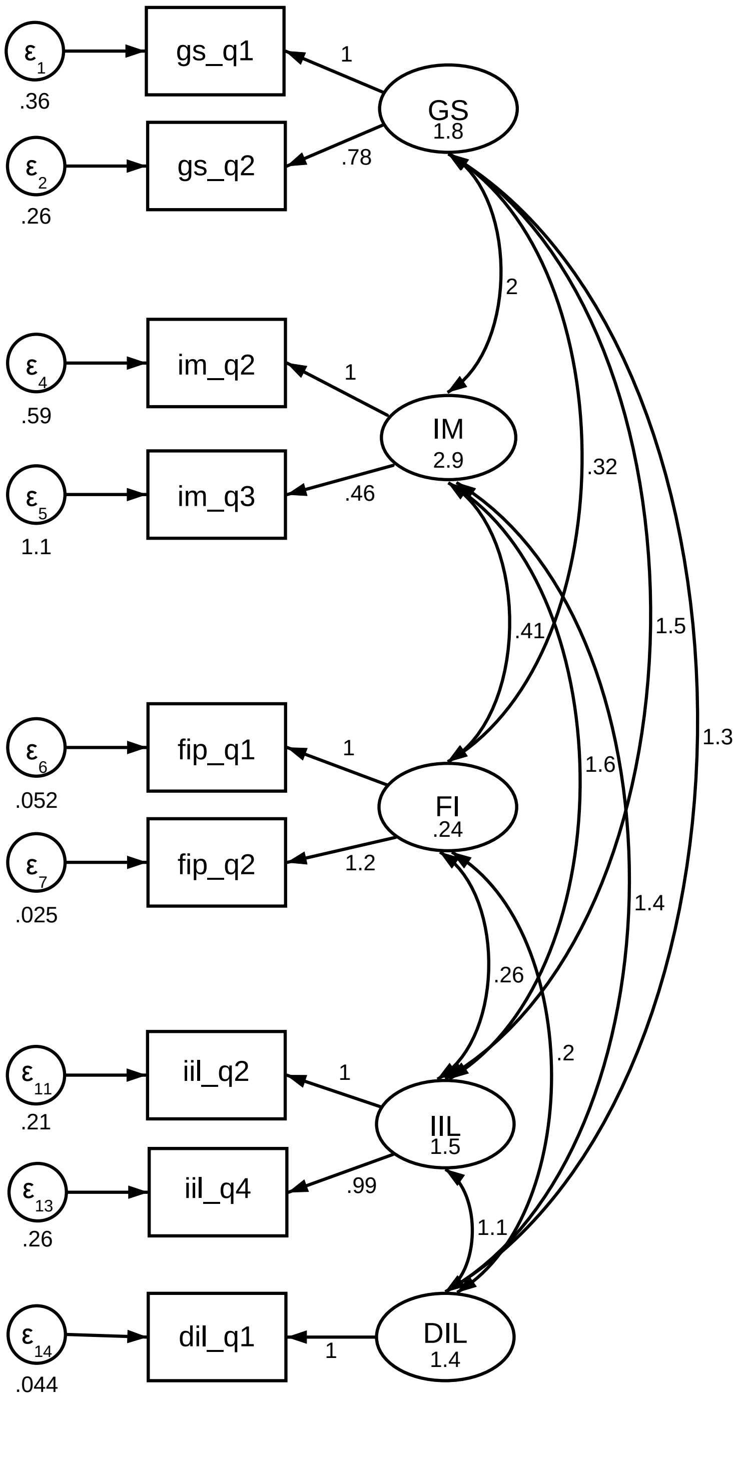


Figure 5.4

Best Fitting Measurement Model with Human Capital Management Measured as a Latent Variable

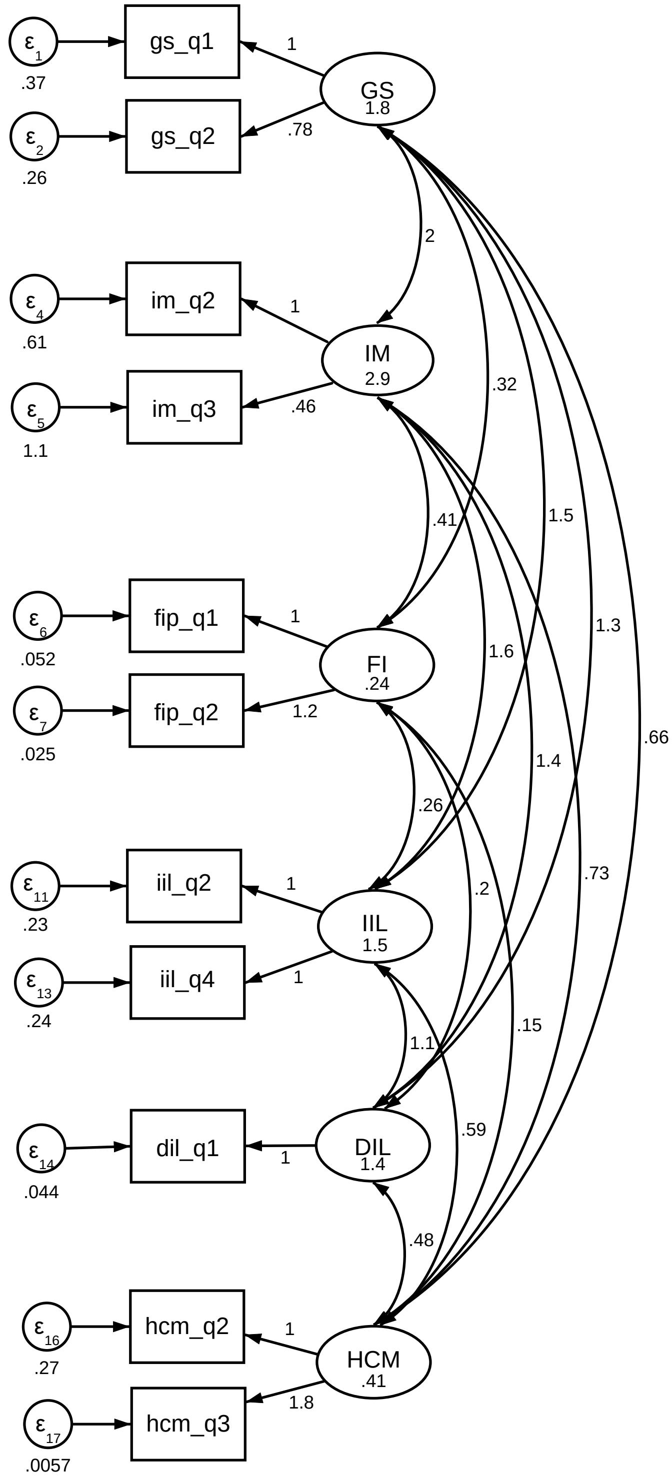


Figure 5.5

Best Fitting Measurement Model with Managing Family Involvement Measured with Teacher Responses

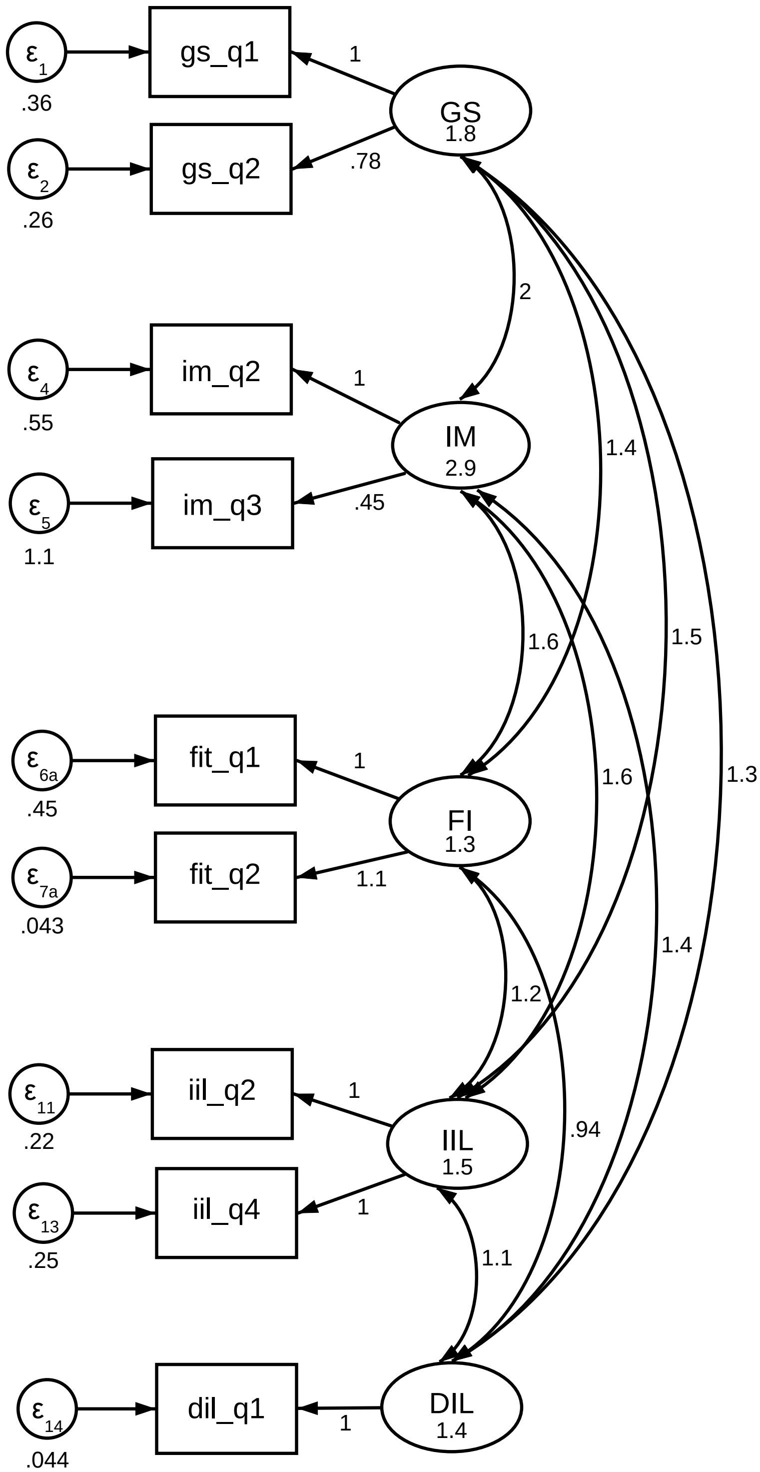


Figure 5.6

One Factor Model for Principal Skills

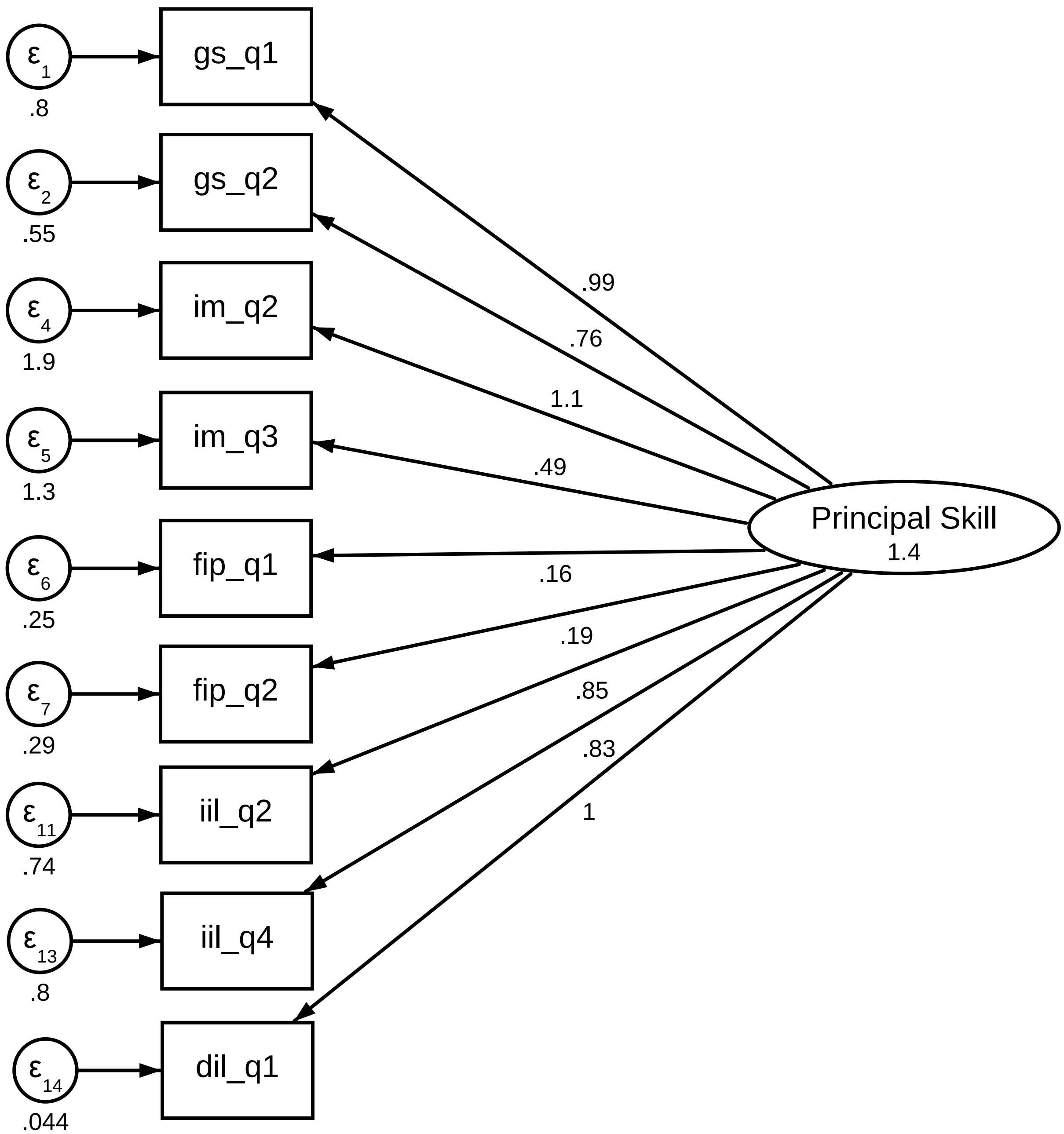


Figure 5.7

Pooled Cross-Section Structural Equation Model

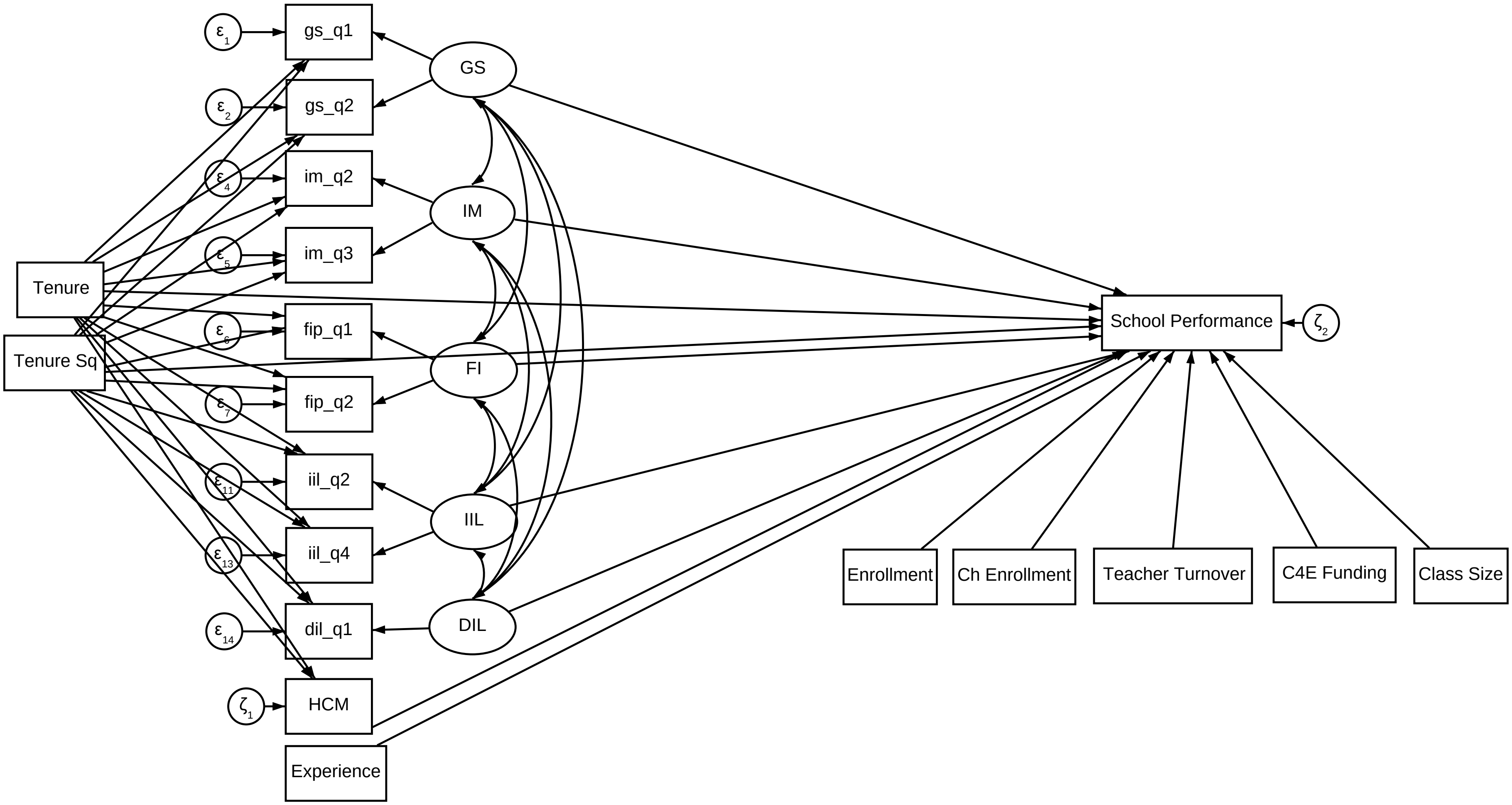


Figure 5.8

Average Ratings for Principal Human Capital Skills for Principals with and without Prior Experience

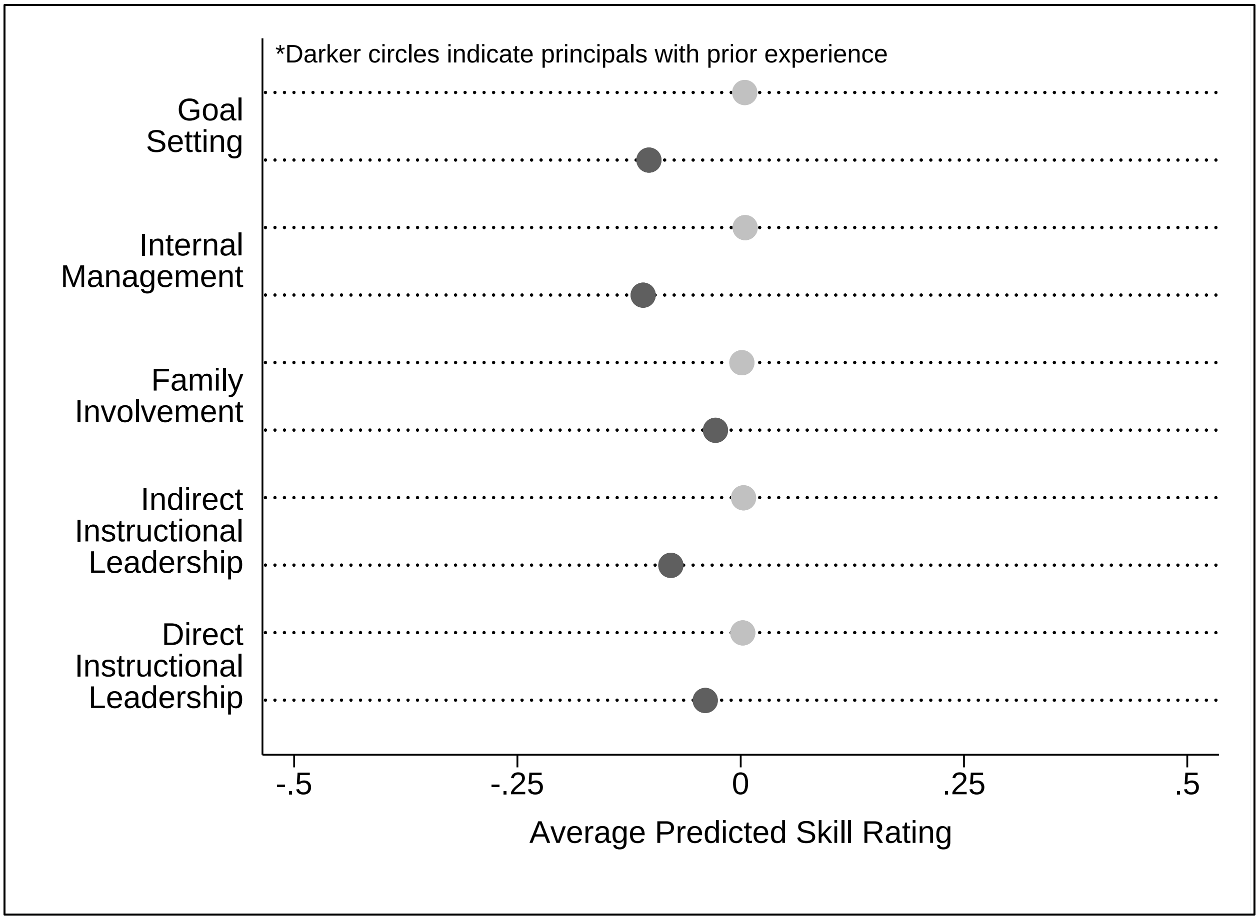


Figure 5.9

Marginal Effects of Managing Family Involvement by Student Poverty Level and School Type – Parent Assessments of a Principal's Skill at Managing Family Involvement

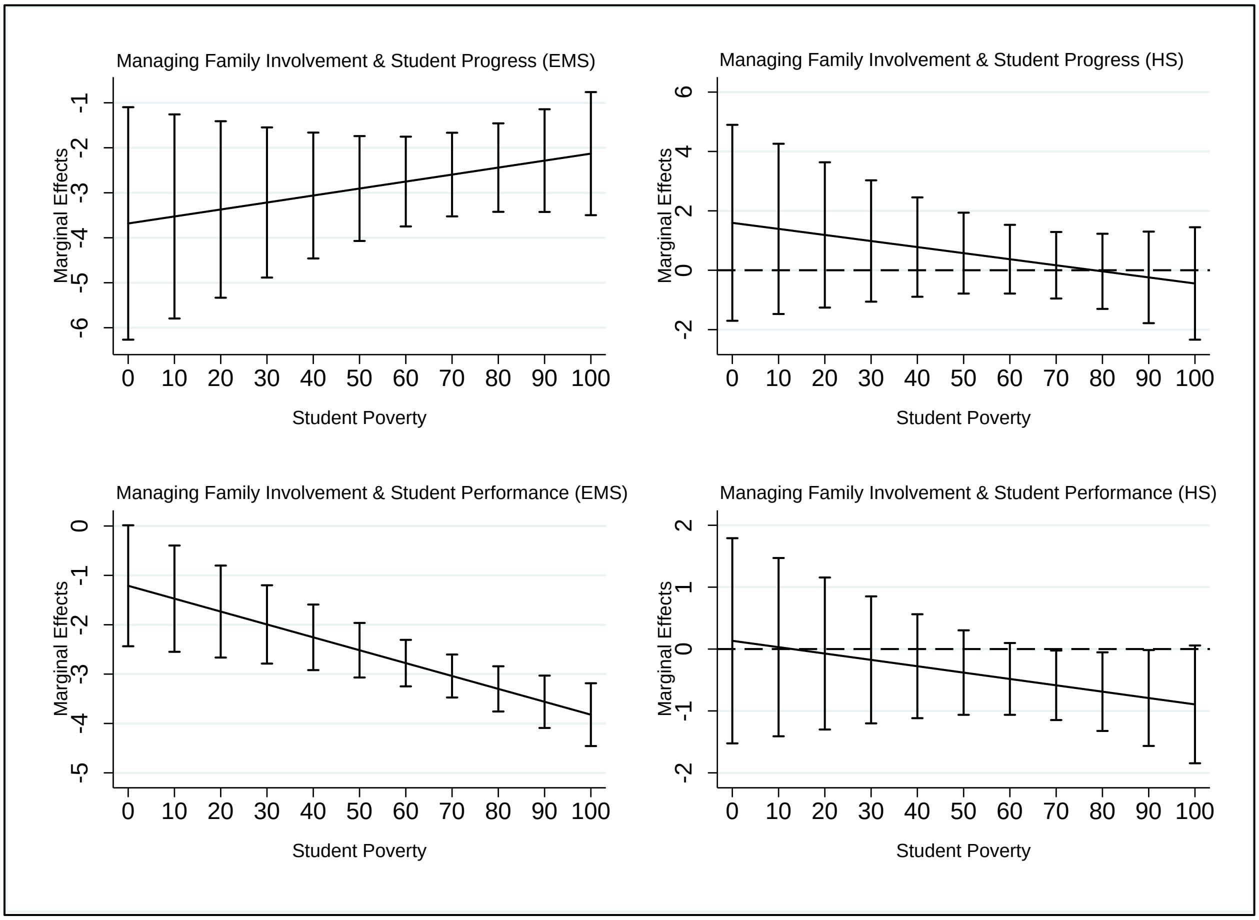


Figure 5.10

Marginal Effects of Instructional Leadership on Student Progress Scores by Poverty Level and School Type

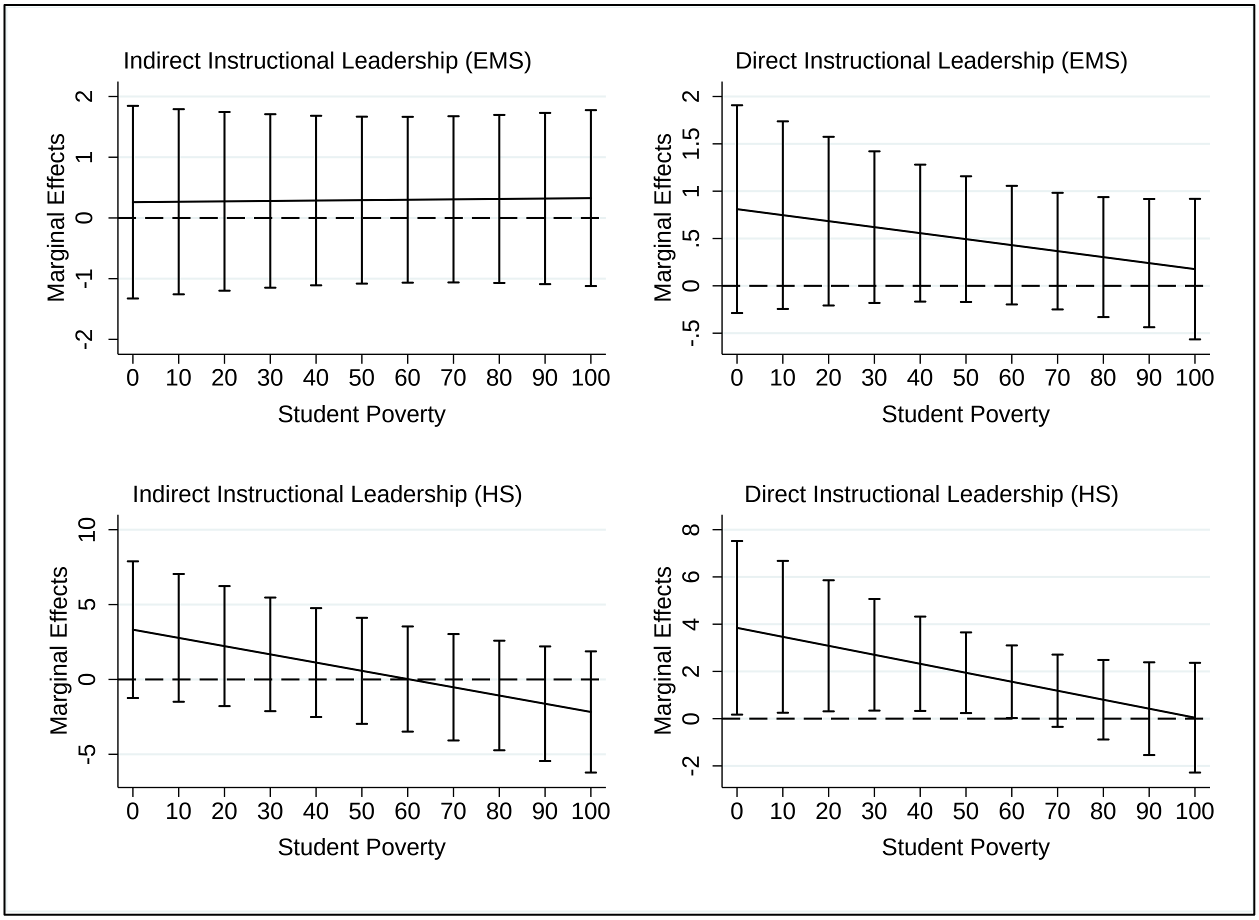


Figure 5.11

Marginal Effects of Instructional Leadership on Student Performance Scores by Poverty Level and School Type

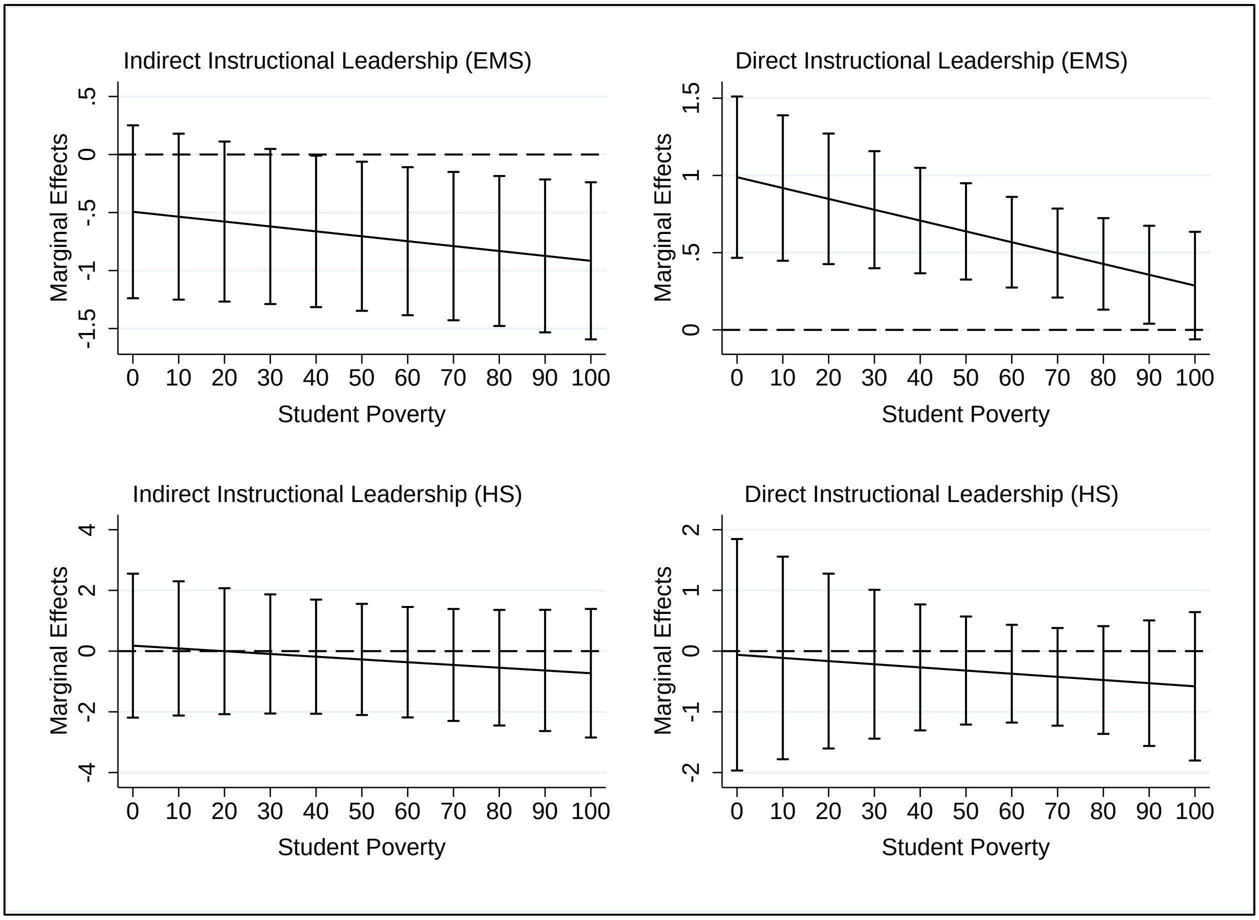
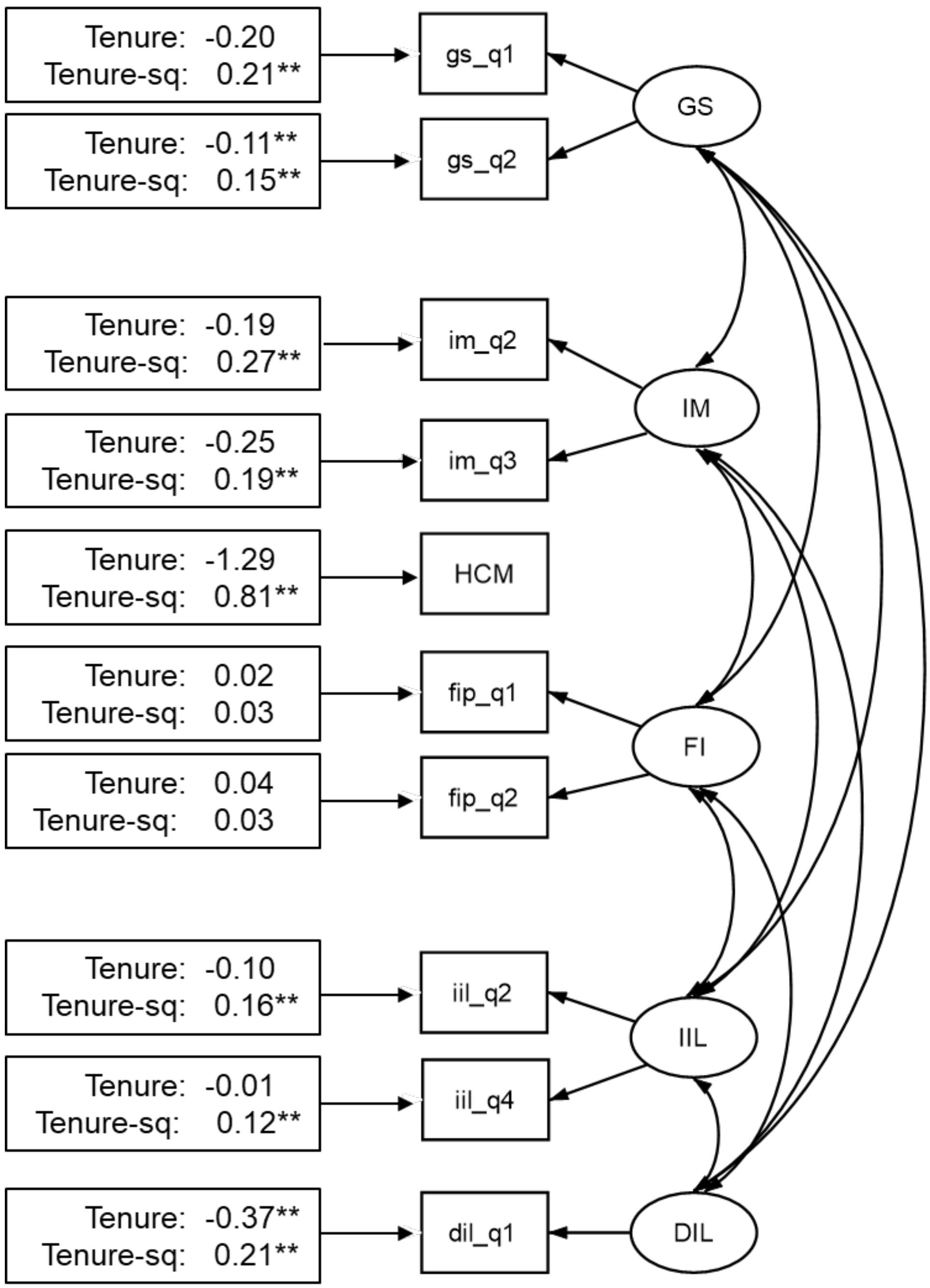


Figure 5.12

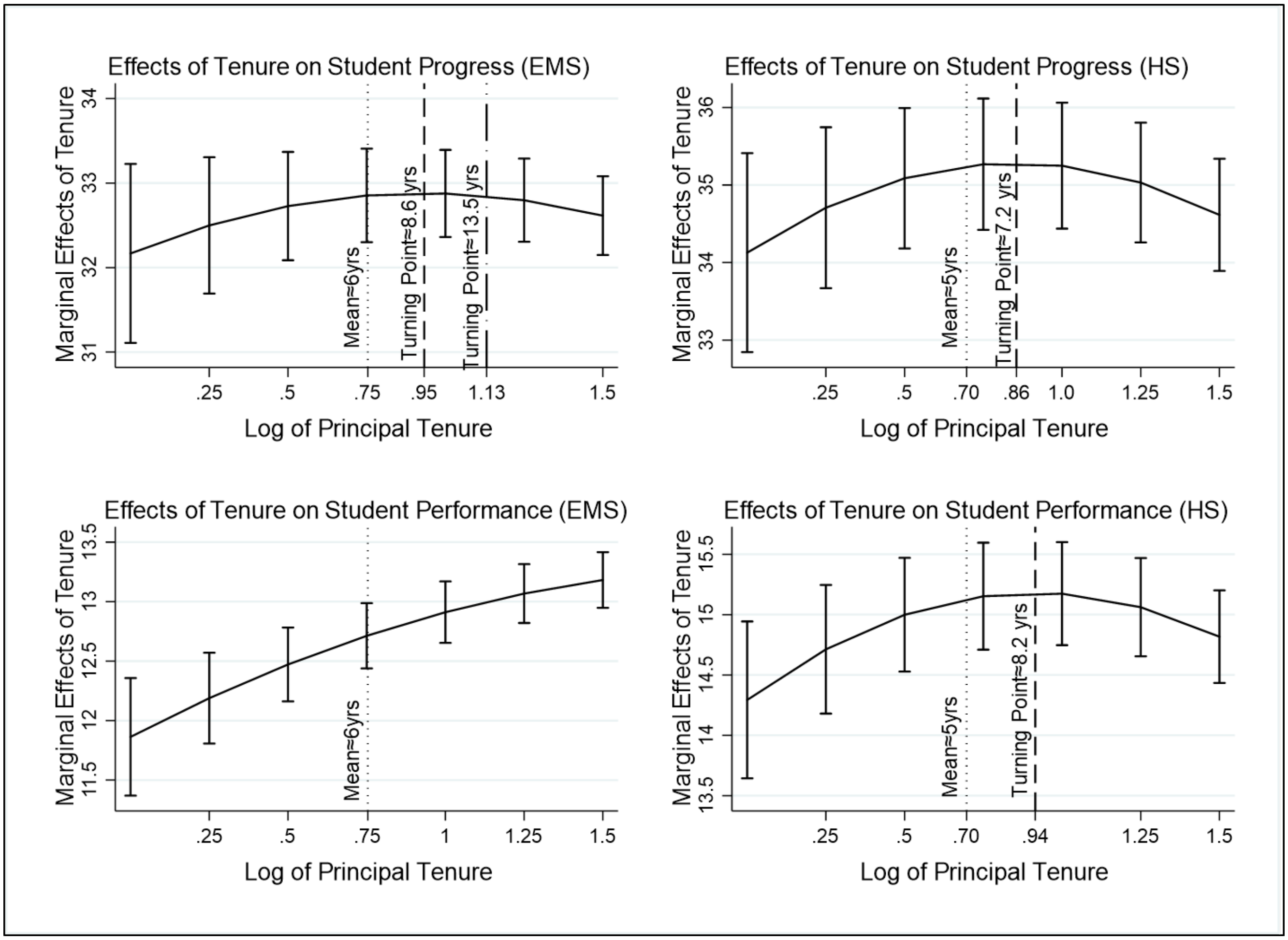
Effects of Tenure on Principal Human Capital Skills



*p<.05, **p<.01 (two-tailed)

Figure 5.13

Marginal Effects of Tenure on School Performance by School Type



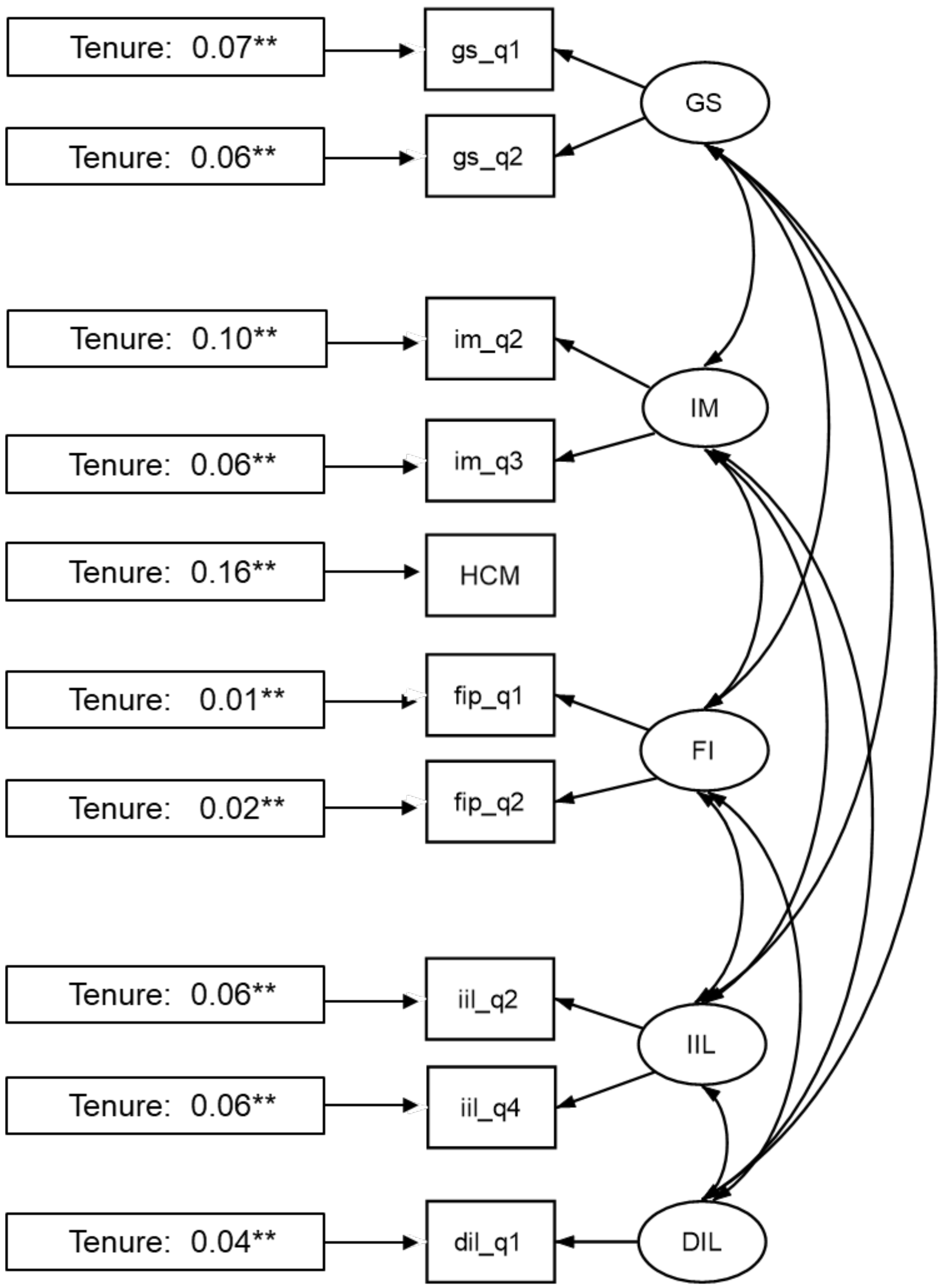
·················· Indicates Average Principal Tenure

— — — — — Indicates Turning Point Calculated with Random Effects Regression Results

—·—·—·—· Indicates Turning Point Calculated with Pooled SEM

Figure 5.14

Effects of Tenure on Principal Human Capital Skills



*p<.05, **p<.01 (two-tailed)

CHAPTER 6

EFFECTS OF PRINCIPAL HUMAN CAPITAL QUALITIES ON SCHOOL PERFORMANCE: IMPLEMENTATION OF THE CLASS SIZE REDUCTION PROGRAM

The previous chapter examined the influence of principal human capital qualities on school performance through unspecified mechanisms. In this chapter I examine the effects of principal human capital qualities on school performance through the implementation of a specific program. Like other studies of program implementation in the public sector, I confront the challenge that many programs implemented by NYC principals have vague goals and outputs that are difficult to measure. As I described in Chapter 3, NYC public schools that meet specific criteria receive funds under the New York State (NYS) Contract for Excellence (C4E) initiative to improve school performance. One program within the C4E initiative that has specific, measurable outputs is the class size reduction program. This chapter describes the influence of a principal's human capital on achievement of the goals for this program and the subsequent effects on the intended outcome of higher school performance.

I first examine the influence of principal human capital qualities on the implementation of the class size reduction program. The results demonstrate that in most cases a principal's human capital qualities are not reliable predictors of successful implementation of this program. Elementary/middle school principals skilled at Internal Management are, all else being equal, more likely to reduce their average class size than principals rated lower on this skill. In high schools, however, none of the human capital qualities are significant predictors of successful program implementation. Even if principals successfully implement the class size reduction program, the results demonstrate that a reduction in the average class size does not have a significant impact on school performance. I conclude this chapter with additional analysis of these findings and discuss the implications for implementation of the C4E program in NYC public schools.

Principal Human Capital and Program Implementation

As I discussed in Chapter 3, it is reasonable to assume that the principal skills of Managing Family Involvement, Indirect Instructional Leadership, and Direct Instructional Leadership should not affect a principal's ability to implement the class size reduction program. I therefore focus on the effects of a principal's tenure and prior experience as well as his or her skills at Goal Setting, Internal Management, and Human Capital Management on the implementation of the class size reduction program. In this section I describe the structural equation model that depicts the hypothesized relationships between a principal's human capital, program implementation, and school performance. I assess the fit of this model and describe my subsequent adjustments based upon the fit indicators. Finally, I present the results from the components of the structural model focused on the relationship between the explanatory variables and implementation of the class size reduction program.

Figure 6.1 presents the initial structural model that describes the effects of a principal's human capital qualities on class size reduction and the subsequent effects from the implementation of this program on school performance. The first row of Table 6.1 summarizes the fit statistics for this initial model. Although the results indicate an adequate model fit for each measure of performance and type of school, the standardized residuals indicate that a more parsimonious model would better fit the data. In particular, as with the model in Chapter 5 that described the influence of human capital qualities through unspecified means, the explanatory variable of teacher turnover had large, negative standardized residuals. Notably, the standardized residuals between the other human capital skills of Managing Family Involvement, Indirect Instructional Leadership, and Direct Instructional Leadership are all relatively small.[66] This result provides statistical support for my claim that these skills should not be included as predictors of implementation of the class size reduction program.

As the second row of Table 6.1 indicates, the model better fits the data when the explanatory variable of teacher turnover is excluded. As with the model in Chapter 5, I do not expect that excluding this variable from the model will introduce meaningful issues with omitted variable bias since the index process for the dependent variables described in Chapter 3 accounts for the school characteristics I wish to control for.[67] The models in the remainder of this chapter therefore exclude teacher turnover from the initial model presented in Figure 6.1. Of note, the SRMR is lower for each school type and measure of performance when the effects on performance through program implementation are included compared to the models in Chapter 5 that did not include these effects. Since the SRMR fit statistic does not penalize for model complexity, these results suggest that accounting for the effects of principal human capital qualities on performance through both unspecified means and program implementation presents a more accurate model to reproduce the data.

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[66] The standardized residuals between the indicators for Managing Family Involvement, Indirect Instructional Leadership, and Direct Instructional Leadership are all below 1.4 with the largest being 1.31 for the first indicator for Indirect Instructional Leadership. These standardized residuals are below the threshold of 2.0 that indicates a parameter should be added to the model to account for the covariance between these variables (Brown, 2015).

[67] The control variables enrollment and percentage change in enrollment also have large, negative standardized residuals. I chose to retain these variables in the model for two reasons. First, unlike teacher turnover, these variables are both substantively and statistically significant predictors of school performance. Second, since the model that excludes teacher turnover conforms to the threshold requirements I established for adequate model fit, the improvements to model fit are not worth the possible consequences of bias from the exclusion of these two variables from the model.

As I discussed in Chapter 3, I expect that a principal's tenure and prior experience along with his or her skills as a Goal Setter, Internal Manager, and Human Capital Manager have a significant effect on the implementation of the class size reduction program. Since the goal of the program is to reduce a school's average class size, the coefficients of the aforementioned human capital qualities should be negative so that an increase in these skills should, all else being equal, be associated with a smaller average class size as compared to the previous year.

The results of the model presented in Table 6.2 indicate that, in most cases, a principal's human capital qualities are not significant predictors of successful implementation of this program.[68] Turning first to the experience variables, the coefficients for tenure and the squared value of tenure are in the predicted direction, but the results are not significant for elementary/middle or high schools. When accounting for unit effects with the random effects regression model, an increase in a principal's tenure is associated with an increase in average class size but not to a statistically significant degree.[69] A principal's tenure therefore appears to have little bearing on how well he or she leads the school through the implementation of the class size reduction program.[70]

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[68] The results presented in Table 6.2 are from the structural equation model for Student Progress scores. The results are not significantly different from those with Student Performance scores as the measure of performance, so I only include the results with Student Progress scores to simplify the presentation of results. The results to include the other explanatory variables I controlled for are presented in Table C.1 in Appendix C.

[69] The results of a principal's human capital qualities on program implementation with the random effects model are presented in Table C.2 in Appendix C. There is also a positive association of tenure and tenure-squared with the change in the average class size in the results with all schools as indicated in Table C.3 in Appendix C.

[70] I also evaluated the model with a linear relationship between tenure and program implementation instead of a quadratic relationship. With the pooled SEM and the random effects models, there is a positive association between tenure and change in class size for each school type that is not statistically significant in either case. The SRMR did not change when excluding the effects of the squared value of tenure on program implementation. While it is reasonable to argue that the appropriate functional form should exclude the squared value of tenure due to the short timeframe of program implementation, I retain it in the model since its inclusion has a negligible effect on model fit. I also expect that the effects of greater experience with program implementation should grow at a decreasing rate as principals become more familiar with the means to implement the program over time.

Turning to the effects of prior experience as a principal on the implementation of the class size reduction program, this human capital quality had a small effect in elementary/middle schools that was not statistically significant. For high schools, however, principals with previous experience are associated with an increase in the average class size to a statistically significant degree, although the magnitude of this effect is very small. The pooled SEM and random effects regression models indicate that a 10% increase in prior principal experience is associated with an increase in the average class size of 0.01 students. For all practical purposes, principal experience does not have a substantial effect on the change in class size for schools implementing the class size reduction program.

The principal skills of Goal Setting, Internal Management, and Human Capital Management did not have a significant effect on the change in the average class size for high schools. Goal Setting had a significant effect in elementary/middle schools but the effect was in the opposite direction that I expected. A one unit increase in a principal's ratings as a Goal Setter (just over four-fifths of a standard deviation) is associated with an increase in the average class size of 0.35 students for elementary/middle schools implementing the class size reduction program. While this result may indicate that principals rated highly in Goal Setting have detrimental effects on the implementation of the class size reduction program, the high correlation between Goal Setting and Internal Management (correlation coefficient of .87 between these two skills) provides some additional context. As discussed in Chapter 5, since principals are usually rated similarly on these two skills, the coefficients indicate the effects of these skills when they do not move together. Stated differently, when principals are rated low on

Internal Management but high on Goal Setting, they are less likely to successfully implement the class size reduction program.[71]

Conversely, for Internal Management in elementary/middle schools, principals rated highly on this skill are associated with successful program implementation. All else being equal, a one unit increase in a principal's rating as an Internal Manager (approximately two-thirds of a standard deviation change) is associated with a decrease in the average class size of 0.3 students for elementary/middle schools implementing the class size reduction program.

Human Capital Management is not a significant predictor of program implementation for either type of school. The effects sizes are very small for the primary measure of this skill. The effects of Human Capital Management are more substantial using the alternate measure for elementary/middle schools, but these results are also not statistically significant.[72]

In summary, elementary/middle school principals skilled at Internal Management have a positive association with implementation of the class size reduction program. In elementary/middle schools, principals that are rated highly as Goal Setters but not as Internal Managers have a negative association with the implementation of this program. In high schools, prior principal experience has a negative association with the implementation of this program, but the magnitude of these effects on the increase in the average class size are small. Otherwise,

[71] I also evaluated the effects of Goal Setting and Internal Management separately as indicated in Table C.4 in Appendix C. Although the fit statistics are similar between these models and the models that include both of these skills as predictors of program implementation, the results are substantially different. Neither skill is a significant predictor of program implementation when it is included separately in the model. These results suggest that it is important to include both Goal Setting and Internal Management as predictors of program implementation.

[72] The results for program implementation with the alternate measure of Human Capital Management are in Table C.5 in Appendix C. I also estimated the effects of the alternate measure for Human Capital Management on program implementation without the other two skills of Goal Setting and Internal Management. As with the primary measure for this skill in the full model, the coefficient is in the predicted direction for elementary/middle schools but not high schools. The results are not significant for elementary/middle or high schools which is also consistent with the results from the full model.

the human capital qualities of principals are not reliable predictors of a principal's ability to implement the class size reduction program.[73]

Program Implementation and School Performance

In the first section of this chapter I established that, with the exception of Internal Management in elementary/middle schools, a principal's human capital qualities are not reliable indicators for their ability to successfully implement the class size reduction program. In this section I assess whether class size reduction has the expected positive association with school performance that NYC DOE authorities expect.

A benefit of structural equation modeling is that I can simultaneously estimate the effects of the principal human capital variables on implementation of the class size reduction program and on school performance. This estimation technique enables me to determine the portion of the human capital qualities that affect performance through the implementation of the class size reduction program and the portion that affect performance through unspecified means. For each measure of performance and type of school, I first discuss the effects of program implementation on performance as indicated by the coefficient for the change in the average class size from the previous to the current year. As the results demonstrate, the effects of the change in class size from the previous year to the current year differ by school type and measure of performance. With these effects in mind, I then discuss the effects of the principal human capital qualities of

[73] As indicated in Table C.6, human capital qualities are also not significant predictors for schools receiving funds to reduce the pupil teacher ratio. Prior principal experience has a negative association with pupil teacher ratio reduction in high schools, but as with the primary measure of class size reduction, the size of the effect is small. The smaller sample size for this alternate measure of program implementation may also limit the explanatory power of principal human capital qualities on program implementation for pupil teacher ratio reduction.

tenure, experience, Goal Setting, Internal Management, and Human Capital Management through class size reduction on school performance.

Tables 6.3 and 6.4 describe the effects of the principal human capital qualities on school performance for Student Progress and Student Performance scores respectively. The results in the last row of these tables demonstrate that class size reduction does not have a significant effect on Student Progress or Student Performance scores for either elementary/middle schools or high schools. In half of the cases (elementary/middle school Student Progress scores and high school Student Performance scores), the coefficient is in the predicted direction in that an increase in class size is associated with a decrease in school performance. In the other two cases (high school Student Progress scores and elementary/middle school Student Performance scores) an increase in the average class size is associated with an increase in performance.

Bearing these results in mind, Tables 6.3 and 6.4 also indicate the effects of the human capital skills on performance through class size reduction.[74] Since the effects of program implementation on school performance are small, not surprisingly the effects of principal human capital qualities through program implementation on school performance are also small. In no case are the effects of the human capital skills on performance through program implementation significant. The effects of prior experience and the skills of Goal Setting, Internal Management, and Human Capital Management on school performance are especially small through program implementation.[75] These results indicate that the vast majority of the effects of a principal's

[74] The results to include the other explanatory variables are displayed in Tables C.7 (Student Progress scores) and C.8 (Student Performance scores) in Appendix C. The effects of class size reduction on performance with the random effects regression are similar to the results in Figures 6.3 and 6.4 with the pooled SEM as indicated in Table C.9.

[75] The results when the model is applied to all schools together in Table C.10 in Appendix C also indicate that the effects of principal human capital qualities through program implementation on school performance are small and

human capital skills on school performance work through unspecified means rather than the implementation of the class size reduction program.[76]

Analysis of Principal Human Capital Skills and Program Implementation

The results in this chapter indicate that, for the most part, a principal's human capital qualities are not significant predictors of successful implementation of the class size reduction program. Secondly, class size reduction does not have a significant impact on school performance. In this section I provide some additional context for these findings. I first provide some descriptive statistics that provide an additional perspective on the success of the program in meeting its baseline requirement of reducing the average class size in this group of schools. I discuss some reasons why the impact on performance for schools that successfully implemented the program was not as significant as anticipated. Since the skills of Goal Setting and Internal Management are significant predictors of program implementation for elementary/middle schools but not high schools, I describe some reasons for this difference between school types. I conclude this section with a discussion of improvements to this research design to better understand how a principal's human capital qualities may influence school performance through program implementation.

insignificant. The results also do not change substantially when using the alternate measure for Human Capital Management as indicated in Tables C.11 and C.12.

[76]The implementation of the C4E program to reduce the pupil teacher ratio also did not have a significant effect on school performance. As the results in Tables C.13 and C.14 in Appendix C indicate, the coefficient for the variable change in pupil teacher ratio is in the predicted direction for each case, but the size of the coefficient is small and not statistically significant. Of note, due to the smaller sample size of schools receiving funds for this program, the model would not estimate as depicted in Figure 6.1. The addition of the third indicator question for the skill of Managing Family Involvement enabled the model to estimate for this smaller subset of schools but resulted in an SRMR outside of the acceptable range of <0.08 for adequate model fit (0.105 for high school Student Progress scores and 0.103 for high school Student Performance scores).

The subset of schools I examined in this chapter received funding specifically to reduce the average class size. The expectation was that schools would successfully implement this program and, in turn, increase student performance. How successful were the schools selected for this program in meeting the program output of reducing class size? As depicted in Figure 6.2, the implementation of this program closely follows a normal distribution.[77] For elementary/middle schools, approximately 40% of schools reduced the average class size with an average decrease of 1.6 students per class. 60% of elementary/middle schools were unsuccessful in their efforts at class size reduction with an average increase of 2.0 students per class. For high schools, 46% successfully implemented the program with an average reduction of 1.4 students per class. The 54% of high schools that did not successfully implement the program saw an average rise of 2.0 students per class.

As the results in Tables 6.3 and 6.4 demonstrate, implementation of the class size reduction program as measured by the change in the average class size does not have a significant effect on school performance. I examined just the schools that successfully implemented the program to see if the effects on performance are appreciably different. As expected given the results in Tables 6.3 and 6.4 with all schools that implemented the program, the largest effect of class size reduction is on Student Progress scores in elementary/middle schools, but again this effect is not statistically significant.[78]

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[77] I adjusted the histograms in Figure 6.2 to exclude outliers which I defined as a class size decrease or increase of greater than 10 students. The results in Tables 6.3 and 6.4 did not vary substantially with the exclusion of these outliers from the analysis.

[78] For elementary/middle schools that reduced their class size, the impact on Student Progress scores was nearly seven times more positive than was the case in the analysis with all schools implementing the program with a z-score much closer to a statistical level of significance ($z = -1.75$). The results for Student Performance scores for elementary/middle schools and both measures of performance for high schools were not as supportive and indicated that smaller class sizes had a slightly more negative association with performance than the analysis with all schools implementing the program.

Although NYC DOE authorities would prefer that all of the schools implementing the class size reduction program reduce their average class size, less than half of the schools succeeded in meeting this goal. However, even for schools that succeeded in reducing their average class size, the impacts on school performance are negligible. The results therefore suggest that either the theory that class size reduction improves performance is inaccurate or that the program was not implemented properly (Mohr, 1995).

First, it is possible that the theory that class size reduction improves student performance may simply be inaccurate or perhaps not apply in the case of NYC public schools. As I discussed in Chapter 3, experimental research designs support a positive association between class size reduction and school performance (Finn & Achilles, 1990; Krueger, 1999). However, nonexperimental studies do not consistently replicate these findings (Gilraine, 2017) which was the case in this study as well.[79]

As I discussed in Chapter 4, a weakness of my research design is that I cannot eliminate spuriousness as a threat to the internal validity of my findings. It is possible that I did not adequately control for the quality of teachers in each school that could counteract the effects of class size reduction. Although I cannot be certain that hiring new, inexperienced teachers to reduce class size counteracted the expected positive effects on student performance from smaller class sizes, two factors give me confidence that this may not be the case.

[79] A contract between the NYC DOE and the United Federation of Teachers establishes a maximum class size for each type of school. As a robustness check, I evaluated the model in Figure 6.1 with the percentage below the class size cap as a measure of program implementation instead of change in class size. If smaller class sizes improve student performance, there should be a positive association between how much a school is below the class size cap and school performance, all else being equal. The results were consistent with those from the primary measure of program implementation.

First, although it is a broad measure of teacher quality, I controlled for a principal's skills at Human Capital Management which assess the percentage of teachers that are highly qualified according to New York State standards.[80] Second, the results using the alternate measure of Human Capital Management are similar to the results with the primary measure of this skill. The alternate measure of Human Capital Management uses indicators of teacher's perceptions of the quality of their colleagues, so if a new teacher effect is present, this measure should account for its effects. A downside to this measure, however, is that I use teacher perceptions of the quality of their colleagues from the previous year so that the measure of the explanatory variable takes place before the measure of performance. In turn, this measure does not include the perceptions of teachers new to the school in the current year but rather those that were on the staff at the end of the previous school year.

It would be ideal to include a measure of teacher quality for new teachers hired by schools implementing this program, but this data was not available for my study. Although NYC schools rate teachers based on student academic improvement and principal observations, these data are not publicly available. Further complicating efforts to account for the effects of new teachers is the difficulty of assessing the quality of first-time teachers. While studies find that teacher quality improves with experience (Ost, 2014; Rockoff, 2004), it is difficult to assess the quality of first time teachers which likely constitute a portion of new hires each year. In sum, this study indicates that in the case of NYC public schools, class size reduction is not associated with increased school performance, but these findings should be considered in the context of some of the weaknesses of this research design.

[80] Although I did not include teacher turnover as a control variable to improve model fit, the results were negligible when I included this variable in the model.

The second possibility for the absence of a positive association between class size reduction and school performance is that the program was not implemented correctly. A consistent finding in studies of program implementation is the importance of resources for successful implementation (Mazmanian & Sabatier, 1989; O'Toole, 1986). The class size reduction program approved in 2007 called for an increase in program funds from year to year to compensate for increases in teacher salaries and other costs that expected to rise over the course of the program (New York City Department of Education, 2011). However, the program was not funded in 2011 and New York State reduced funding for the program starting in 2012 as the financial crisis impacted the funds available for this program. While it would be difficult to accurately estimate the counterfactual of the extent of program implementation if the program was fully funded as originally intended, it is reasonable to assume that the cuts in funding were detrimental to the success of the program.

In addition to financial resources, time may be another resource that limited the impact of this program on school performance. The implementation of this program involved analysis by principals around factors such as what grades and/or subjects should be targeted for class size reduction, staffing considerations, and space considerations (Harries, 2008). In such cases where there is ambiguity of means through which implementation can occur, successful implementation will likely depend in part on the amount of learning by policy implementers as they experiment with different means toward their desired end (Matland, 1995). Although this panel incorporates four years of data, a longer time frame of seven to ten years may be necessary for implementers to incorporate lessons learned from such experimentation into actual program adjustment (Mazmanian & Sabatier, 1989).

In summary, there is some evidence to support either case for the failure of the class size reduction program to decrease the average class size and improve the performance of NYC public schools. The theory that class size reduction improves performance may be either incorrect or not applicable to the unique environment of NYC public schools, or the program may have been implemented incorrectly due to factors beyond the control of principals to include funding reductions for the program.

While this study did not find a positive association between program implementation and school performance, the human capital skills of Goal Setting and Internal Management are significant predictors of program implementation in elementary/middle schools but not high schools. This result was surprising, especially since Internal Management was a significant predictor of school performance in both types of schools as described in Chapter 5. One reason for the difference in the effects of human capital skills by school type may be the sample size for each population. Since the sample size for high schools is only about one-third the size of the sample size for elementary/middle schools, there may be insufficient observations for high schools to accurately model the data. When there are few observations, a simple structural equation model is preferable, so the model in Figure 6.1 may be too complex for this smaller panel of high schools implementing the class size reduction program. The results from the robustness check with a random effects linear regression support this explanation. As a rule of thumb, a ratio of 30:1 is preferred between the sample size and number of predictors (Jeon, 2015). The random effects regression falls short of this ratio for high schools but not elementary/middle schools, so the explanatory power of the model for high schools is likely limited by the smaller sample size for this population.

In regard to improving the research design, future studies of the connection between principal human capital qualities, program implementation of the class size reduction program, and school performance would benefit from additional measures of program implementation. I relied on the metric of the change in class size from one year to the next as the measure of program implementation. This measure does not provide an indication of the activities that principals undertake to implement the program. While output measures such as meeting the baseline goal of the program of reducing class size are certainly important, other goals such as maintaining teacher quality are also important. Future studies would benefit from examining the strategies principals employed to implement the program. For instance, were principals more successful at reducing class size and preserving teacher quality when hiring new teachers, or is hiring teachers with previous experience a more productive strategy to reduce class size and maintain teacher quality? How do these strategies change based on indicators of the school environment such as student body socioeconomic status? Understanding how principals implement the program could provide a richer explanation for the influence of principal human capital qualities on class size reduction and, in turn, school performance.

Lastly, in this research design I estimated the effects of principal human capital on class size reduction and performance simultaneously, but due to the complexity of the data, I am not able to incorporate school level random effects using this technique. Another potential technique to estimate the effects of program implementation is two stage least squares. The challenge of this technique is to identify an instrumental variable that is highly correlated with class size reduction but uncorrelated with the error term of the regression equation for school performance. Due to the lack of a suitable instrumental variable, the analysis in this chapter represents the best specification of the model given the limitations of the data.

Implications for Implementation of the Class Size Reduction Program in NYC Schools

The effects of human capital on school performance through program implementation described in this chapter are modest, especially in comparison to the effects of human capital through unspecified means described in Chapter 5. The human capital qualities of principals therefore serve as a better guide for NYC hiring authorities in making decisions on school performance rather than decisions on how well a principal will implement specific programs. As I discussed in this chapter, there are two primary reasons that support this assessment.

First, while principals manage many programs that may influence school performance, a challenge in assessing implementation is that many programs have vague goals that are difficult to assess objectively (Talbot, 2010). Principal human capital may have a significant influence on performance through the implementation of such programs, but these effects are challenging to assess since it is difficult to quantify the degree of program implementation.

Second, even if a program has clear goals such as the class size reduction program, other factors that are beyond the control of principals may make the implementation of the program and subsequent intended effects on performance difficult to achieve. Long time horizons may be necessary to accurately estimate program implementation as principals make adjustments throughout the process. Implementation may also be affected by the quantity and consistency of financial resources to support the program. A principal's human capital qualities may not be able to overcome these resource deficits to implement the program as intended. The expected relationship between program implementation and performance may also not occur if the underlying theory is inaccurate or inapplicable due to the unique circumstances of the case at hand.

Given these challenges of assessing program implementation, some human capital qualities of principals are worth bearing in mind when considering their likely effects on program implementation. First, for high schools, prior principal experience is detrimental to implementation of the class size reduction program. Although my confidence in this finding is modest due to the small sample size of high schools implementing this program, it is consistent with the negative association of prior experience and school performance discussed in Chapter 5. Although one would expect a principal with prior experience leading a different school to have a positive effect on program implementation, this effect is likely counteracted by the lower overall quality of these principals compared to those that move on to other positions after concluding their tenure in their first school. This outcome may especially be the case in this smaller sample of schools that serve more challenging populations and therefore likely attract lower quality principals as applicants (Clotfelter, Ladd, Vigdor, & Wheeler, 2007).

For elementary/middle schools, the effects for Goal Setting and Internal Management on program implementation are consistent with the effects of these skills on performance in general described in Chapter 5. A principal's abilities as an Internal Manager have a positive association with program implementation. As with the results for school performance, NYC DOE hiring authorities should be wary of principals that are rated highly on Goal Setting but lower on Internal Management. While principals are usually rated similarly on these two skills, Goal Setting has a negative association with program implementation when they are not.

In summary, the evidence presented in this chapter and the previous chapter indicate that the influence of a principal's human capital qualities on school performance are very small in comparison to their effects through unspecified means. While few human capital qualities have a significant effect on program implementation, the effects of those that do are consistent with the effects on school performance through unspecified means. The implication of these findings for NYC hiring authorities is that it is difficult to specify the means through which principals may influence school performance, so hiring and retention decisions should consider the effects of principal human capital qualities through unspecified means rather than focusing on the effects of these qualities through the implementation of specific programs.

Chapter Summary

This chapter focused on the influence of a principal's human capital on school performance through the implementation of a specific program. The findings demonstrate that for elementary/middle schools, there is a positive association between Internal Management and program implementation. Goal Setting has a negative association with program implementation in elementary/middle schools when controlling for the effects of Internal Management. A principal's other human capital qualities are not significant predictors of his or her ability to implement the class size reduction program in elementary/middle schools. The findings for high schools are not supportive of a positive association of principal human capital qualities and program implementation, but these findings should be considered in the context of the small sample size for high schools implementing the class size reduction program.

The expectation underpinning the class size reduction program is that successful implementation of this program should be positively associated with school performance. The findings demonstrate that this is not the case. This result may be due to the inaccuracy of the theoretical association between smaller class sizes and school performance in NYC public schools or because the program was implemented poorly. I concluded this chapter with a discussion of the practical implications of these findings for NYC DOE hiring authorities. The next chapter evaluates the utility of the human capital framework presented in Chapter 2 based on the empirical analysis from Chapters 5 and 6. In this concluding chapter, I summarize the implications of this study of the effects of managerial human capital on school performance for public administration scholarship.

Table 6.1

Fit Statistics for Pooled Structural Equation Models

	Student Progress Scores		Student Performance Scores	
	Pooled SEM for Elementary/Middle Schools (N=651)	**Pooled SEM for High Schools (N=183)**	**Pooled SEM for Elementary/Middle Schools (N=651)**	**Pooled SEM for High Schools (N=183)**
Initial Model (all explanatory variables as depicted in Figure 6.1)				
SRMR	0.060	0.080	0.060	0.082
AIC	56748.7	16091.7	55556.0	15855.8
BIC	57142.3	16372.2	55949.7	16136.3
Adjusted Model (excluding Teacher Turnover)				
SRMR	0.052	0.071	0.052	0.073
AIC	52539.1	15144.4	51341.9	14908.9
BIC	52924.3	15420.4	51727.1	15185.0
Alternate Measure for Human Capital Management				
SRMR	0.050	0.065	0.050	0.068
AIC	50320.3	14612.5	49113.2	14364.3
BIC	50754.7	14923.8	49547.6	14675.6

Table 6.2

Principal Human Capital and Class Size Reduction Program Implementation– Pooled SEM

	Elementary / Middle Schools (N=651)		**High Schools (N=183)**	
	Coef./Std. Err.	Z	Coef./Std. Err.	Z
Experience Variables				
Tenure	-0.13 (.716)	-0.18	-0.29 (1.162)	-0.25
Tenure-sq	0.09 (.208)	0.43	0.13 (.353)	0.37
Experience	-0.003 (.022)	-0.15	*0.07 (.033)*	*2.19**
Human Capital Skills				
Goal Setting	*0.35 (.146)*	*2.42**	-0.04 (.146)	-0.29
Internal Manager	**-0.30 (.120)**	**-2.51***	0.05 (.171)	0.30
Human Capital Manager	0.03 (.016)	1.80	-0.02 (.020)	-1.11

*p<.05 **Bold** indicates significant finding in the predicted direction
**p<.01 *Italics* indicates significant finding against the predicted direction
(two-tailed)

Table 6.3

Principal Human Capital and Student Progress Scores – Pooled SEM

	Student Progress Scores			
	Elementary / Middle Schools (N=651)		**High Schools (N=183)**	
	Coef./Std. Err.	Z	Coef./Std. Err.	Z
Experience Variables				
Effects Through Class Size Reduction Program				
Tenure	0.06 (.075)	0.86	-0.31 (.638)	-0.48
Tenure-sq	0.01 (.052)	0.19	0.12 (.195)	0.61
Experience	0.0004 (.003)	0.15	0.01 (.020)	0.69
Total Effects				
Tenure	5.64 (4.265)	1.32	**11.89 (5.794)**	**2.05***
Tenure-sq	-1.40 (1.334)	-1.05	**-4.12 (1.759)**	**2.34***
Experience	0.15 (0.110)	1.33	-0.07 (.151)	-0.48
Human Capital Skills				
Effects Through Class Size Reduction Program				
Goal Setting	-0.04 (.055)	-0.74	-0.008 (.029)	-0.29
Internal Manager	0.03 (.047)	0.73	0.01 (.034)	0.29
Human Capital Manager	-0.003 (.005)	-0.67	-0.004 (.007)	-0.59
Total Effects				
Goal Setting	-1.75 (1.759)	-0.99	-1.95 (2.476)	-0.79
Internal Manager	**2.39 (.817)**	**2.93****	**3.90 (1.561)**	**2.50****
Manager of Family Involvement	1.52 (1.605)	0.95	-0.04 (1.875)	-0.02
Indirect Instructional Leader	-0.53 (1.145)	-0.46	-0.08 (1.768)	-0.04
Direct Instructional Leader	0.79 (1.120)	0.70	0.11 (1.074)	0.10
Human Capital Manager	-0.06 (.082)	-0.74	0.11 (.072)	1.55
Class Size Reduction Effects				
Change in Class Size	-0.11 (.153)	-0.75	0.20 (.273)	0.72

*p<.05 **Bold** indicates significant finding in the predicted direction

**p<.01 (two-tailed) *Italics* indicates significant finding against the predicted direction

Table 6.4

Principal Human Capital and Student Performance Scores – Pooled SEM

	Student Performance Scores			
	Elementary / Middle Schools (N=651)		**High Schools (N=183)**	
	Coef./Std. Err.	Z	Coef./Std. Err.	Z
Experience Variables				
Effects Through Class Size Reduction Program				
Tenure	-0.04 (.083)	-0.53	-0.07 (.252)	-0.29
Tenure-sq	0.01 (.020)	0.57	0.26 (.080)	0.33
Experience	-0.0002 (.001)	-0.15	-0.006 (.010)	-0.63
Total Effects				
Tenure	2.02 (1.754)	1.15	3.66 (2.586)	1.42
Tenure-sq	-0.12 (.547)	-0.23	-1.08 (.725)	-1.49
Experience	0.05 (0.063)	0.83	-0.04 (.096)	-0.45
Human Capital Skills				
Effects Through Class Size Reduction Program				
Goal Setting	0.02 (.024)	0.96	0.003 (.013)	0.20
Internal Manager	-0.02 (.021)	-0.97	-0.003 (.015)	-0.21
Human Capital Manager	0.002 (.002)	0.89	0.002 (.004)	0.52
Total Effects				
Goal Setting	*-2.22 (.949)*	*-2.34**	-0.34 (1.161)	-0.29
Internal Manager	**1.70 (.445)**	**3.83****	**1.30 (.567)**	**2.30***
Manager of Family Involvement	0.86 (.684)	1.25	**-1.82 (.697)**	**-2.61****
Indirect Instructional Leader	0.19 (.554)	0.34	-0.24 (.920)	-0.26
Direct Instructional Leader	**1.54 (.462)**	**3.33****	-0.42 (.570)	-0.74
Human Capital Manager	-0.01 (.027)	-0.51	0.05 (.036)	1.35
Class Size Reduction Effects				
Change in Class Size	0.07 (.058)	1.12	-0.09 (.136)	-0.63

*p<.05 — **Bold** indicates significant finding in the predicted direction

**p<.01 (two-tailed) — *Italics* indicates significant finding against the predicted direction

Table 6.5

Summary of Findings

Hypothesis	Key Findings
H2a: The greater the tenure of a principal in a school, the more positive the effects will be on program implementation.	**Unsupported:** The coefficient for principal tenure is in the predicted direction but the effects are not statistically significant in the pooled SEM. The coefficient for principal tenure is not in the predicted direction in the random effects regression or for schools receiving funds to reduce the pupil teacher ratio, but in both cases, the effects of tenure are not statistically significant.
H2b: The greater the prior experience as a principal, the more positive the effects will be on program implementation.	**Unsupported:** The coefficient for prior principal experience is in the predicted direction for elementary/middle schools, but the effects size is small and statistically insignificant. In high schools, the effect of prior principal experience is statistically significant in the pooled SEM but is in the opposite of the predicted direction. The results are similar with the random effects regression with the exception that prior principal experience is no longer statistically significant for high schools. Prior principal experience is also associated with an increase in the average class size for high schools receiving funds to reduce the pupil teacher ratio.
H2c: The higher a principal is rated by the school's teachers as a Goal Setter, the more positive the effects will be on program implementation.	**Unsupported:** In elementary/middle schools, principals rated highly on their abilities of Goal Setting are associated with an increase in a school's average class size from one year to the next. Goal Setting is highly correlated with Internal Management, however, and this skill is not statistically significant when it is included in the model without Internal Management. The effect of Goal Setting is in the predicted direction for high schools but is not statistically significant. These results are consistent between the pooled SEM and random effects regression model. The coefficient of Goal Setting is in the predicted direction for schools receiving funds to reduce the pupil teacher ratio but is not statistically significant.
H2d: The higher a principal is rated by the school's teachers as an Internal Manager, the more positive the effects will be on program implementation.	**Partially Supported:** Internal Management has a positive and statistically significant relationship with class size reduction in elementary/middle schools. The effect is in the opposite of the predicted direction for high schools, however, and is not statistically significant. These results are consistent between the pooled SEM and random effects

	regression model. The coefficient of Internal Management is not in the predicted direction for schools receiving funds to reduce the pupil teacher ratio but is not statistically significant.
H2e: The greater a principal's abilities as a Human Capital Manager, the more positive the effects will be on program implementation.	**Unsupported**: The effects of Human Capital Management are in the predicted direction for high schools but not elementary/middle schools. In both cases the effects are not statistically significant and are consistent between the pooled SEM and random effects regression. The effects remain statistically insignificant using the alternate measure for Human Capital Management and are in the predicted direction for elementary/middle schools but not high schools. The coefficient of Human Capital Management is not in the predicted direction for schools receiving funds to reduce the pupil teacher ratio but is not statistically significant.
H2f: The more successfully a principal implements the class size reduction program, then the more positive the effects will be on improving school performance.	**Unsupported:** The coefficient for the change in the average class size is in the predicted direction for elementary/middle school Student Progress scores and high school Student Performance scores. The coefficient for this variable is in the opposite of the predicted direction for elementary/middle school Student Performance scores and high school Student Progress scores. In all cases the results are not statistically significant and are consistent between the pooled SEM and the random effects regression. The coefficient for the change in the average class size is in the predicted direction for schools receiving funds to reduce the pupil teacher ratio but is not statistically significant.

Figure 6.1

Pooled Cross-Section Structural Equation Model

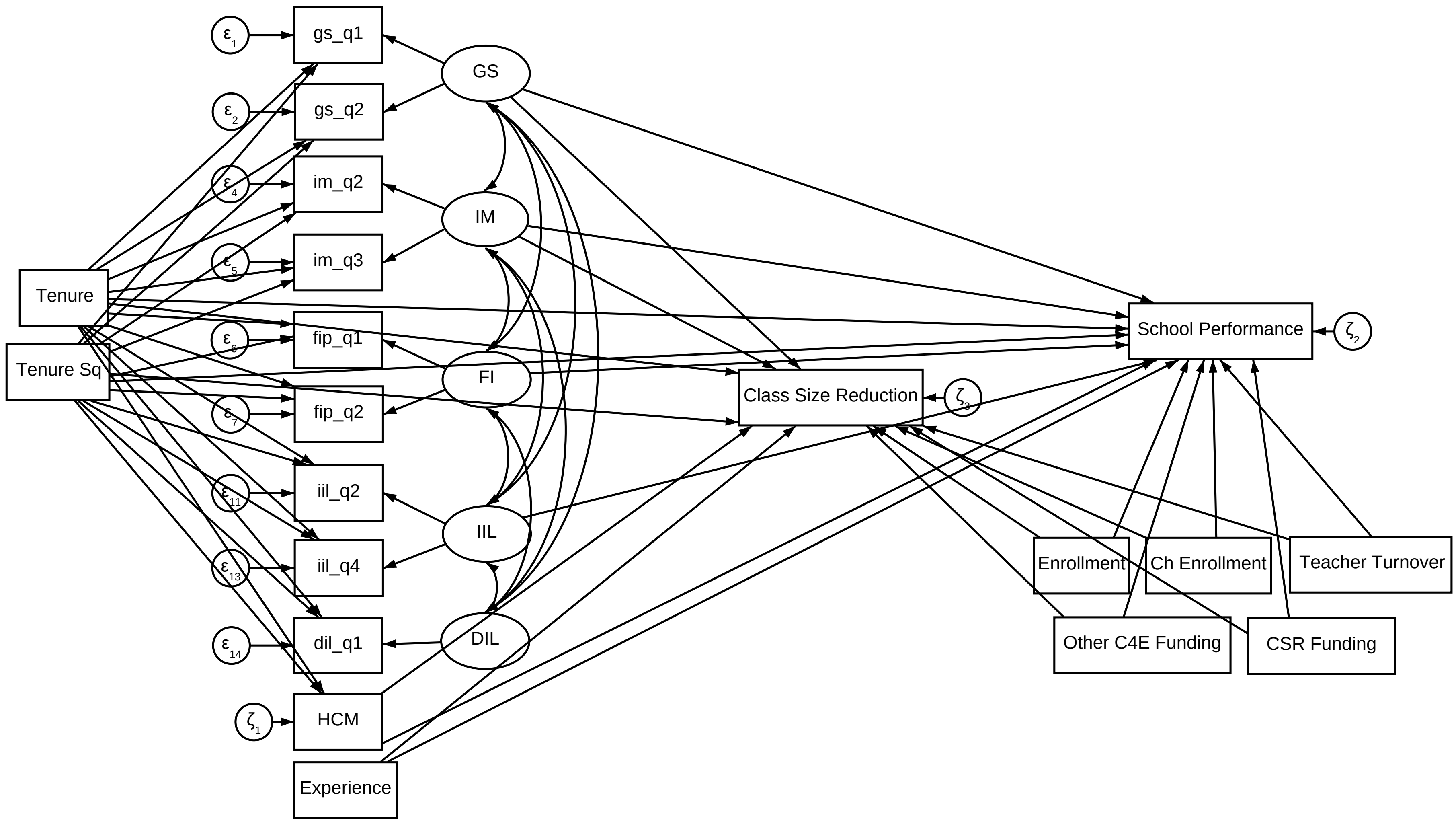
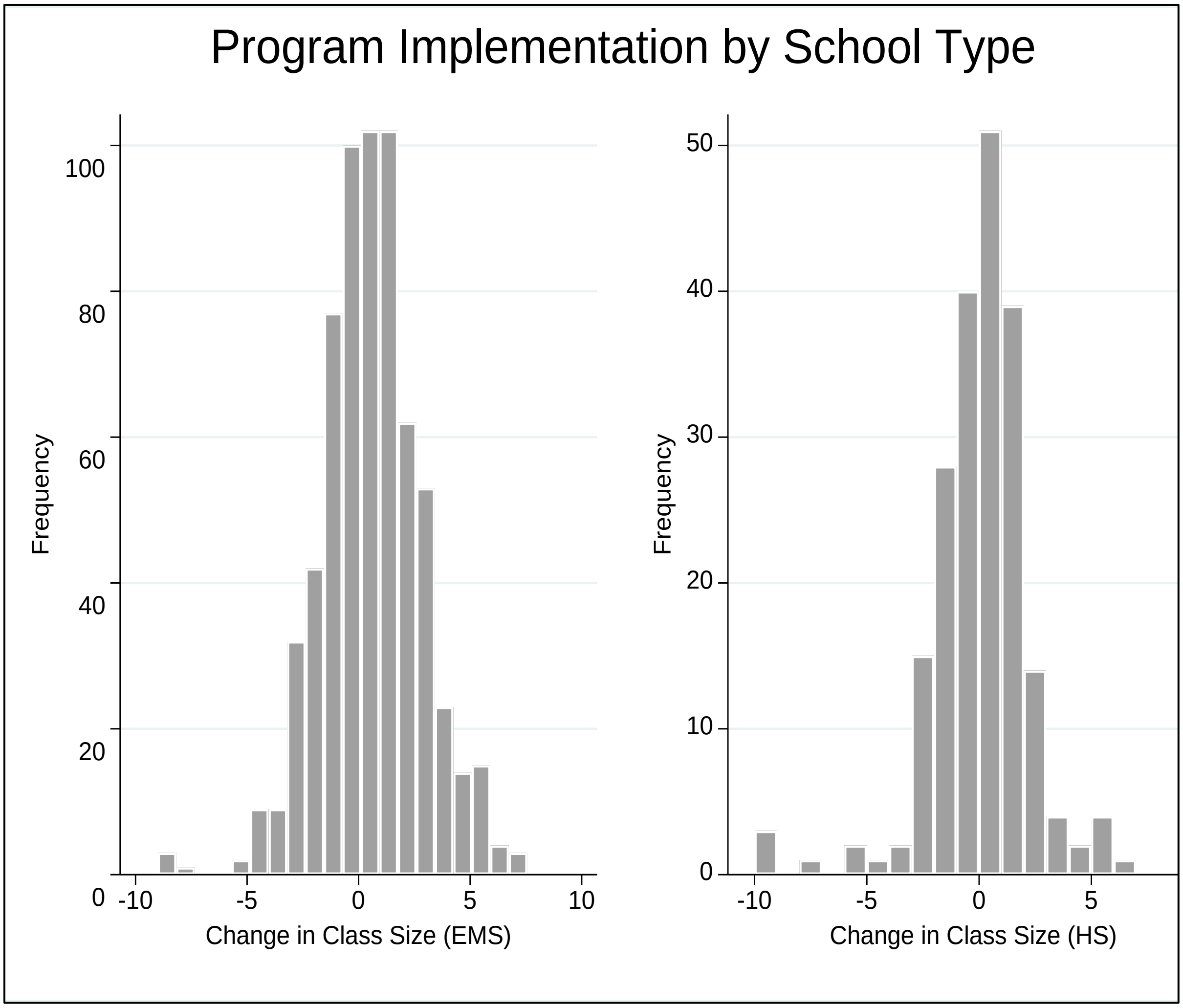


Figure 6.2

Histograms of Changes in Class Size by School Type



CHAPTER 7

DISCUSSION AND CONCLUSION

This dissertation focused on the relationship between the human capital qualities of frontline managers and organizational performance. In this concluding chapter, I discuss the findings from the previous two chapters in the context of the framework for human capital research in public administration established in Chapter 2. The purpose of this framework is to provide construct clarity for research in public administration on the relationship between human capital and organizational performance. Although the term human capital appears often in public administration literature (Selden, 2009), the theoretical development of the concept comes from other fields with little work done in public administration to clarify the application of human capital concepts to the study of public organizations (A. Nyberg et al., 2018).

The framework in Chapter 2 seeks to remedy this shortcoming. It integrates human capital concepts developed in other fields, differentiates human capital at the individual and group level, and describes the theoretical linkages between the acquisition and management of human capital and organizational performance in the unique context of public organizations. The contributions of this dissertation are therefore twofold: I developed a framework to provide construct clarity for the application of human capital in the public sector and evaluated a portion of the framework that describes a positive association between the individual human capital qualities of frontline managers and organizational performance.

The findings support the framework as a theoretical approach to examine the influence of a manager's human capital qualities on the performance of public organizations but also underscores the influence of the organization's characteristics on this relationship. As the framework acknowledges and the empirical findings in this dissertation demonstrate, causal mechanisms for the influence of human capital on organizational performance are difficult to specify. In the first section of this concluding chapter, I discuss the findings from Chapter 5 that examined the influence of human capital through unspecified means. An important contribution from this chapter is that some human capital characteristics are reliable predictors of performance, but this influence may be conditional on a combination of specific human capital skills in certain conditions. I discuss the implications of these findings for the theoretical approach specified in the human capital framework, especially in terms of the complex task of measuring a person's human capital skills.

Next, I discuss the findings from my focus on a specific mechanism instituted by NYC principals to improve organizational performance, the implementation of the New York State (NYS) Contract for Excellence (C4E) class size reduction program. The results from Chapter 6 highlight the difficulty in specifying the causal mechanisms through which a manager's human capital qualities influence organizational performance. In Chapter 6 I discussed some of the unique attributes of NYC schools that likely influenced the weak relationships I observed between principal human capital qualities and program implementation. In this chapter, I examine this issue more broadly and discuss potential methods to assess the influence of human capital on program implementation in future studies. I conclude with a discussion of future research to build upon the human capital framework in this dissertation.

Human Capital and Organizational Performance

The human capital framework depicted in Figure 2.2 begins with the initial pool of human capital in an organization and articulates how the activities of strategy formulation, design and implementation of strategic human resource management policies, and human capital management influence the level of human capital in an organization, and in turn, organizational performance. In this dissertation I focused on the right side of this framework, examining the influence of a manager's human capital on organizational performance while accounting for the organizational setting. As I discussed in Chapter 2, most human capital studies in public administration use the human capital qualities of education and experience as predictors of performance. I examined two forms of experience, organizational tenure and prior experience as a manger, but also used subordinate and stakeholder evaluations to establish skill measures for the managers I studied.

The empirical results in this chapter support prior research that there is a u-shaped relationship between tenure and organizational performance (Sturman, 2003). The results do not support a positive relationship between prior experience as a principal and organizational performance. As the framework in Figure 2.2 indicates, the available labor pool may influence the relationship between leader human capital management and levels of human capital within an organization. Although I suspect that principals that lead a second school are of lower quality than those that pursue other opportunities after completing their tenure in their first school, I could not definitively address this assumption with the data I have available. Despite this unexpected relationship between prior experience and school performance, my findings support the relationship depicted in the human capital framework that experience is an important human capital quality for leaders that affects organizational performance.

A key contribution of this chapter is the development of measures for a manager's human capital skills and an assessment of their effects on performance. Internal Management is consistently associated with higher performance across both school types and measures of performance I examined. As expected, however, the effects of skills such as Managing Family Involvement, Indirect Instructional Leadership, and Direct Instructional Leadership depend upon the school type and the socioeconomic status of the student body.

The findings in Chapter 5 support the depicted relationships between the organizational setting, levels of a manager's human capital, and effects on organizational performance depicted in Figure 2.2. The results in this chapter also bring to light several challenges for scholars in studying these relationships through the method used in this dissertation. First, I drew upon a well-established literature from educational leadership to guide my selection of skills that should influence performance for principals. While skills such as Internal Management are likely similar across different fields, others such as Instructional Leadership are specific to educational leadership.

A limitation of structural equation modeling is that it can be inappropriate in situations with weak or underdeveloped theory (Jöreskog & Sörbom, 1993). In turn, if an organization does not identify its human capital requirements as depicted in the left side of the human capital framework in Figure 2.2, or there is limited theory available to identify the skills that should influence performance, the method used in this dissertation would be difficult to employ. Conversely, I only examined the principal skills that should influence performance based upon my assessment from the educational leadership literature. There may be other principal skills I did not examine that have a significant influence on school performance. In short, the selection of which skills to examine is an important consideration for scholars, but because of the diversity of fields within the public sector, these skills will likely differ depending on the type of organization under study.

Second, this dissertation highlighted the benefits and drawbacks of structural equation modeling as a method to construct latent variables for human capital skills. As this study indicated, some of the human capital skills will likely be highly correlated. While SEM enables the researcher to model the covariation between these skills, these parameters also increase the complexity of the model which may make it difficult to estimate. I found this to be the case since I was unable to estimate the structural equation model with school level random effects. Using the predicted values of the latent variables in a random effects regression underestimates the measurement error of these latent variables, and due to the covariation of the human capital skills, I was unable to account for this measurement error through replicating the predicted values.[81] While the results were generally consistent between the pooled SEM and random effects regression models, I was not able to employ the optimal modeling strategy of a SEM with school level random effects.

Lastly, while this study demonstrated that subordinate evaluations are a plausible means to measure a manager's human capital skills, this method does have some drawbacks. Although modeling the covariation between the skills enabled me to account for halo effects of the respondents' overall perceptions of the school, I attributed the results of the assessments as reflective solely of the principal's skills. As scholars in other fields note (Ployhart et al., 2014; P. M. Wright & McMahan, 2011), the value of an individual's human capital may depend on how this individual interacts with members of his or her team.

[81] For a more complete explanation of this procedure see Footnote 6 in Chapter 4.

To provide a practical example, in this study the results suggest that a principal skilled at Goal Setting but rated lower on Internal Management has a negative association with school performance. One could imagine a situation in which a principal is skilled at setting and communicating specific, achievable goals for the school but lacks Internal Management skills. However, his or her assistant principals may be skilled at Internal Management. The interaction of the human capital qualities of this group of managers may produce different results than if their skills are considered independently as described by the concept of interactive complementarities (Adegbesan, 2009).

The personality characteristics of the principal may also influence the extent to which the human capital of his or her assistant principals shapes the influence of human capital qualities on organizational outcomes. The concept of emergence (Ployhart & Moliterno, 2011) describes such a process which I did not explore in this dissertation. Since human capital qualities combine in complex ways at the organizational level (P. M. Wright & McMahan, 2011), future public administration studies should pursue data collection that explores the interaction of individual and unit level human capital qualities through the concepts of interactive complementarities and emergence. Although the examination of managerial human capital in this study is informative, incorporating the human capital qualities of principals with those of the subordinate managers in the organization would provide a richer explanation for the effects of human capital skills on organizational performance.

Human Capital and Program Implementation

In contrast to Chapter 5 which examined the effects of a principal's human capital qualities through unspecified means, in Chapter 6 I focused on the effects of these qualities through the implementation of a specific program designed to increase school performance. This chapter incorporated policy characteristics as a moderating variable on the relationship between a manager's human capital skills and organizational performance as depicted on the right side of the human capital framework in Figure 2.2.

The findings in this chapter suggest two important implications for human capital effects in public organizations. First, the effects of a manager's human capital qualities through program implementation appear to be very small in comparison to the effects through unspecified means. While this result is not surprising since Chapter 5 compared an infinite number of causal paths to a very specific one in Chapter 6, they do suggest that the effects of human capital through program implementation are small. However, the other implication from this chapter for human capital scholars is that the complexity of program implementation in public organizations increases the difficulty of assessing the effects of human capital through this causal path.

I presented evidence in Chapter 6 that supports the case that either the theory that class size reduction increases student performance is wrong or inapplicable in the context of NYC public schools and/or that the program was implemented incorrectly. Internal Management is a significant predictor of program implementation in elementary/middle schools, but since reducing the average class size in a school did not have a significant effect on school performance, it is not surprising that the effects of this skill on performance through the implementation of this program are small. If the effect of program implementation on performance is statistically and substantially significant, perhaps the effects of human capital skills on performance through program implementation will be greater as well, but the implementation of the class size reduction program in NYC schools did not enable me to assess such conditions.

A few other limitations of this study limited my assessment of the effects of human capital qualities through program implementation. As I discussed in Chapter 6, the sample size for schools implementing this program was small given the complexity of the model, especially for high schools. Since small sample sizes can provide misleading results (Cohen, 1962), I am not as confident of the findings for this smaller subset of school as I am for the larger sample examined in Chapter 5.

Second, it would be ideal to measure the human capital skills of principals with both latent and observed measures. With the data I had available I was only able to estimate one of the human capital skills, Human Capital Management, with both an observed variable and a latent variable measure. The results may differ depending on the choice the researcher makes between observed or latent variables (Jeon, 2015). This outcome was the case for the effects of Human Capital Management on program implementation as the effects differed for each type of school depending on the measure for this skill.

Lastly, it is reasonable to assume that in some cases a principal may be highly skilled in an area that should have an effect on program implementation but he or she chooses not to devote significant time to this area. The work by Tummers et al. (2012) is instructive to assess the potential influence of a principal's personality characteristics, policy content, and organizational context on his or her willingness to implement a policy. In this study I assumed that principals agreed with the expected benefits of the class size reduction policy for school performance which may not always be the case. The consequences for failing to reduce class size for principals implementing the program are also unclear, especially in light of how many schools failed to do so as funding was reduced for the program. A survey of principal attitudes toward the policy prior to its implementation would provide some context of their willingness to implement the policy. In summary, it is plausible that a principal is highly skilled, but because he or she does not believe in the policy, they fail to devote attention to it. In turn, incorporating variables that explain the willingness of a manager to implement a policy would add an important context to the assessment of the effects of his or human capital qualities on program implementation.

Although studies emphasize the importance of high quality principals to improve schools (New York City Department of Education, 2019), the association between principal human capital qualities and program implementation is not well understood. The evidence in this study points to a limited association between human capital qualities and program implementation, but the characteristics surrounding the program being implemented and the small sample size undoubtedly contributed to these results. Such research has clear practical implications for school systems such as NYC that devote millions of dollars to programs aimed at improving school performance. Improving our knowledge of the relationship between human capital skills and program implementation can better inform principal training so they possess the skills needed to implement such programs.

Implications for Human Capital Research in Public Administration

Table 7.1 summarizes the findings for this dissertation. A quick glance at this table leads to the conclusion that the effects of human capital on performance are much more pronounced through unspecified means than through the implementation of the class size reduction program. The results also suggest that the effects of human capital differ depending on the organizational setting. In short, the human capital qualities of managers matter for organizational performance, but this relationship is much more complicated than the assertion that greater levels of human capital lead to higher performance. The complexity of the relationship between human capital and its influence on organizational performance speaks to two persistent challenges in public administration scholarship, defining organizational performance and assessing policy implementation.

First, scholarship in organizational performance points to the importance of management as a predictor of performance, but specifying what aspects of management are important is complicated due in part to the variation in skills among managers (Boyne, 2003, 2004). The concept of human capital can serve as a useful tool to address this challenge. This dissertation addresses an important gap in the field on the association of human capital qualities and organizational performance (Avellaneda, 2009a, 2009b; Cho & Ringquist, 2011), especially in terms of assessing a manager's skills.

A challenge inherent in using the framework in Figure 2.2 is that performance is inherently multi-dimensional (Moynihan, 2008; Talbot, 2010). Even with multi-dimensional measures of performance such as the ones employed in this dissertation, the researcher should remain guarded about the objectivity of these measures. All measures of performance are somewhat subjective as there are other indicators of school performance that are not included in the measures I used in this dissertation (G. A. Brewer, 2006). I focused on audited performance indicators, but other measures of performance are arguably important such as satisfaction surveys from staff and citizens (Walker et al., 2012). Other aspects of performance could include qualitative assessments of principal performance from supervisors or external evaluators. NYC public schools incorporate external reviews into the School Quality Report which succeeded the School Progress Report in 2014 as a performance evaluation tool which could be incorporated into future studies.

Although NYC schools provide multi-dimensional performance data, a downside of using schools as my unit of analysis is that research indicates limited external validity between management in the education sector and other forms of management (Martinko & Gardner, 1984). While the education sector constitutes a large portion of public sector employment, schools are arguably overrepresented as units of analysis in studies of organizational performance (Meier & O'Toole Jr, 2007). In summary, while I found a positive association between some human capital qualities and performance in this study, researchers must bear in mind the challenges of assessing organizational performance in using the human capital framework in Figure 2.2.

A second persistent challenge in public administration literature this framework highlights is the difficulty in assessing policy implementation in public organizations. Some scholars argue that there are too many variables that affect policy implementation to develop useful theories (Goggin, 1986; Lavertu & Moynihan, 2013). One could argue that it is difficult to capture the complexity of a topic like policy implementation with a quantitative ex post facto design that I used in this dissertation. Since I could not control the locus of selection assigning principals to schools, the possibility exists that some unmeasured variable was responsible for both the selection of a principal with certain human capital qualities and his or her ability to implement the class size reduction program. One method to deal with spuriousness in such designs is to incorporate control variables to eliminate potential sources of spuriousness. By including the task difficulty and resource availability variables in my analysis, I controlled for the effects of the socioeconomic background of the location and student population for a school, but I cannot in full certainty eliminate all potential causes of spuriousness.

Despite this shortcoming of my research design, a benefit of using structural equation modeling is the ability to simultaneously estimate how a manager's human capital qualities influence program implementation and performance. Instead of seeking to explain the success or failure of policy implementation with a general theory of implementation, this research is consistent with calls from implementation scholars to develop and test partial theories and explain implementation in terms of outputs and outcomes (Winter, 2012). In the case of the class size reduction program, evidence supports Internal Management as an important skill for elementary/middle school principals. Otherwise, human capital skills are not reliable predictors of a principal's ability to successfully implement the class size reduction program and the returns to school performance were not significant from implementing this program.

Although the influence of a principal's human capital on program implementation was much more modest that I expected, this research and the theoretical framework in Figure 2.2 add to the implementation literature that focuses on the influence of clusters of variables that shape implementation (Lester, Bowman, Goggin, & O'Toole Jr, 1987). Implementation scholars emphasize resources as an important variable that affects implementation (Montjoy & O'Toole, 1979; O'Toole, 1986, 2004). This study complements this line of research by incorporating human capital as a form of resources. As I note in Chapter 6, however, focusing solely on the qualities of the manager implementing the policy within his or her organization without considering the political context of the policy can lead to an incomplete understanding of the role of a manager's human capital qualities on organizational performance.

The ambiguity of goals and means for implementation and the level of conflict surrounding these goals (Matland, 1995) can shape the conditions in which managers implement a policy. Furthermore, the implementer's disposition toward the policy (O'Toole, 1986) is an important consideration that may also be shaped in part by the political context surrounding the policy. Although most of the human capital qualities I examined were not significant predictors of implementation of the class size reduction program, the constraints from the political environment in terms of financial resources likely limited the extent of implementation. In turn, it is difficult for me to assess the counterfactual of what the effects of a principal's human capital on implementation would be given a more supportive political environment in which financial resources aligned with the desired outputs.

Lastly, the data gathered for this quantitative research design did not enable me to explore the different approaches principals could take to implement the class size reduction program. Since there are several activities a principal could undertake to implement the program, some of these activities may be more helpful in achieving the outputs of the program than others. The research question in this dissertation focused on the influence of human capital on achieving outputs (class size reduction) and its effects on outcomes (school performance) rather than providing a holistic explanation of implementation success or failure. However, it is certainly possible that principals with certain human capital characteristics were more likely to pursue certain strategies than others to implement the class size reduction program. Other research methods such as structured interviews and field observation as part of a qualitative research design would complement the results in this study.

Additional Directions for Future Research

This dissertation focused on the right side of the human capital framework in Figure 2.2 that outlines a causal relationship between levels of individual human capital in an organization and organizational performance while accounting for characteristics of the organizational setting. The results of this study demonstrate the potential of this framework to guide scholars in the application of the theory of human capital developed in other field within the context of public administration. To illustrate a few examples, in future studies I would like to draw upon other components of the framework to establish a more thorough understanding of the acquisition, management, and effects of human capital within NYC public schools.

Starting on the left side of the framework, I did not examine the processes of strategy formulation within NYC schools and how these activities lead to the identification of human capital requirements for principals. As I mentioned in Chapter 2, the NYC DOE established minimum eligibility requirements for principals that include seven years of prior pedagogic experience, an administrator's license, and a master's degree. In addition to these baseline requirements, principals gain their certification through completing one of three principal training programs (Kranes et al., 2015). These programs cultivate skills for the principal candidates in the program to prepare them for their first assignment as a principal. It would also be instructive to examine the curriculum of these programs to identify the skills they seek to teach principals. New technologies such as text analysis could aid in identifying commonalities in these preparation programs in terms of skill development.

Secondly, I did not examine the process of human capital management for principals within the NYC DOE. I discussed the hiring process for NYC principals, but because I do not have access to data regarding the other candidates for open principal positions, I do not know the extent to which their human capital requirements influenced their selection or retention. A couple of findings from my analysis point to the value in examining the process of human capital management. First, it is interesting that the average tenure for principals is close to the turnover point in which the marginal effects of tenure begin to decline as illustrated in Figure 5.13. It would be interesting to examine how the human capital management policies in the NYC DOE affect turnover. Another interesting finding from my analysis is the negative relationship between prior principal experience and school performance. Examining the human capital management policies within the NYC DOE may provide further context for this relationship. This analysis should include the human capital qualities of principals that apply for consecutive principalships to provide additional context on the effect of available labor pools on principal selection for different types of schools.

In terms of the individual human capital qualities on the right side of the framework in Figure 2.2, I focused on two types of experience, tenure and prior experience as a principal. Other types of experience such as experience in the private sector (Bozeman & Ponomariov, 2009) or in other school systems may also have an effect on performance. I was also unable to examine if a principal was promoted from within the school to the principalship or was selected from a different school. This variable makes a difference on performance in some contexts (Boyne & Dahya, 2002; Karaevli, 2007; Kraatz & Moore, 2002; Petrovsky et al., 2015), so exploring these other aspects of experience would provide additional context for my findings.

I also did not examine aspects of a principal's personality in this study. As I discussed in the previous section, a principal's personality could affect his or willingness to implement the class size reduction policy. Similarly, I did not have measures of public service motivation or trustworthiness which may influence performance (G. A. Brewer et al., 2000; Sangmook Kim, 2005; Ko & Hur, 2014; Ritz, 2009).

Lastly, in this study I focused on the individual human capital qualities of managers, but a complete picture should also account for the human capital within the organization's leadership team. As scholars in other fields point out, determining the level of human capital of the leadership team may not be as simple as summing the individual human capital of the team members (Ennen & Richter, 2010; Ployhart et al., 2014). For this unit of analysis, using the concept of complementarities would lead to a more detailed understanding of how different combinations of human capital within the leadership team of principals and assistant principals influences performance. Similarly, the process of emergence can help explain how relationships and task interdependence among members of the leadership team shape measures of human capital at the organizational level. The concepts of complementarities and emergence have not been explored by public administration scholars but provide a useful tool to describe how the human capital of a school's leadership team work together to influence organizational performance.

Conclusion

This dissertation aimed to provide greater construct clarity for the theory of human capital as applied to the field of public administration and, based on this theoretical foundation, assess the influence of managerial human capital qualities on organizational performance. The theoretical framework I developed incorporates insights from human capital theory in other disciplines to the acquisition, management, and effects on performance of human capital in public organizations. This theoretical framework distinguished a human capital approach in public administration to better inform human capital in theory and practice. The empirical results from my assessment of the human capital qualities of NYC principals demonstrate that a manager's human capital qualities influence organizational performance, but specifying these effects through program implementation is difficult. These empirical results only assessed a small portion of the theoretical framework developed in this dissertation. Much more work remains to advance human capital theory within the field, but the results in this dissertation demonstrate the promise of future research on human capital within public organizations.

Table 7.1

Summary of Findings

Analysis	Hypothesis	Key Findings
Chapter 5	H1a: There is a positive, quadratic relationship between principal tenure and school performance.	**Partially Supported:** There is a positive, quadratic relationship between school performance and tenure for high school Student Performance scores. When controlling for unit effects, this relationship exists for both school types and measures of performance.
	H1b: There is a positive relationship between prior experience as a principal and school performance.	**Unsupported**
	H1c: The higher a principal is rated by the school's teachers as a Goal Setter, the more positive the effects will be on school performance.	**Partially Supported:** There is a positive effect for this skill when principals are rated similarly for Internal Management.
	H1d: The higher a principal is rated by the school's teachers as an Internal Manager, the more positive the effects will be on school performance.	**Supported:** Internal Management has a positive influence on school performance for both school types and measures of performance.
	H1e: As a school's SES increases, the higher a principal is rated by the school's parents as a Manager of Family Involvement, the more positive the effects will be on school performance	**Partially Supported:** The marginal effects of Managing Family Involvement become positive as the SES of the student body increases in high schools.
	H1f: A principal's skills as an Indirect Instructional Leader have an effect on school performance.	**Partially Supported:** Indirect Instructional Leadership has a negative association with Student Performance scores when controlling for Internal Management.
	H1g: A principal's skills as a Direct Instructional Leader have an effect on school performance.	**Partially Supported:** There is a positive association between Direct Instructional Leadership and Student Performance scores for elementary/middle schools. When controlling for unit effects, this relationship also exists for high school Student Progress scores.
	H1h: The grade level of a school has an effect on the influence of Instructional Leadership on school performance.	**Partially Supported:** The effects of Direct Instructional Leadership on Student Performance scores are much greater for elementary/middle schools than high schools.

Chapter 5	H1i: As a school's socioeconomic status decreases, the higher a school's principal is rated as an Instructional Leader, the more positive the effects will be on school performance.	**Unsupported**
	H1j: The greater a principal's abilities as a Human Capital Manager, the more positive the effects will be on school performance.	**Unsupported**
	H1k: There is a positive, quadratic relationship between a principal's tenure and the effects of a principal's skills on school performance.	**Unsupported**
Chapter 6	H2a: The greater the tenure of a principal in a school, the more positive the effects will be on program implementation.	**Unsupported**
	H2b: The greater the prior experience as a principal, the more positive the effects will be on program implementation.	**Unsupported**
	H2c: The higher a principal is rated by the school's teachers as a Goal Setter, the more positive the effects will be on program implementation.	**Unsupported**
	H2d: The higher a principal is rated by the school's teachers as an Internal Manager, the more positive the effects will be on program implementation.	**Partially Supported:** Internal Management has a positive influence on program implementation for elementary/middle schools.
	H2e: The greater a principal's abilities as a Human Capital Manager, the more positive the effects will be on program implementation.	**Unsupported**
	H2f: The more successfully a principal implements the class size reduction program, then the more positive the effects will be on improving school performance.	**Unsupported**

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APPENDIX A

STRUCTURAL EQUATION MODELS AND RANDOM EFFECTS REGRESSION MODELS

The following figures depict the measurement and structural models introduced in Chapter 4 in greater detail. Table 4.4 in Chapter 4 summarizes the notation used in the measurement and structural equations in this appendix.

Figure A.1

Measurement Model for Goal Setting

The initial measurement model for the principal human capital skill of Goal Setting (GS) contains the following two indicators.

gs_q1: School leaders communicate a clear vision for this school

gs_q2: My school has clear measures of progress for student achievement throughout the year

The equations for this model are as follows:
$gs\_q1 = GS\beta_1 + \varepsilon_1$
$gs\_q2 = GS\beta_2 + \varepsilon_2$

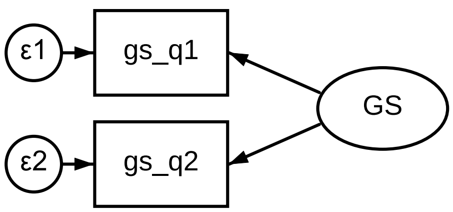


Figure A.2

Measurement Model for Internal Management

The initial measurement model for the principal human capital skill of Internal Management (IM) contains the following three indicators.

im_q1: The principal is an effective manager who makes the school run smoothly

im_q2: Order and discipline are maintained at my school

im_q3: My school is kept clean

The equations for this model are as follows:
$im\_q1 = IM\beta_3 + \varepsilon_3$
$im\_q2 = IM\beta_4 + \varepsilon_4$
$im\_q3 = IM\beta_5 + \varepsilon_5$

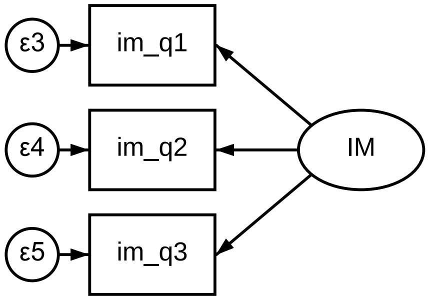


Figure A.3

Measurement Model for Family Involvement (Primary Measure-Parent Responses)

The initial measurement model for the primary measure of the principal human capital skill of Managing Family Involvement (FI) contains the following four indicators.

fip_q1: I feel welcome at my child's school

fip_q2: My child's school makes it easy for parents to attend meetings by holding them at different times of day, providing an interpreter, and in other ways

fip_q3: The school keeps me informed about my child's academic progress

fip_q4: How satisfied are you with how well your child's school communicates with you?

The equations for this model are as follows:
fip_q1 = $\text{Fi}\beta_6 + \varepsilon_6$
fip_q2 = $\text{Fi}\beta_7 + \varepsilon_7$
fip_q3 = $\text{Fi}\beta_8 + \varepsilon_8$
fip_q4 = $\text{Fi}\beta_9 + \varepsilon_9$

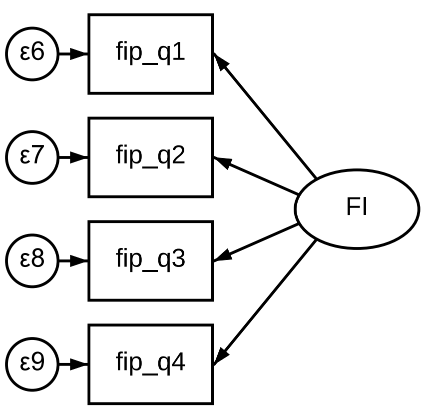


Figure A.4

Measurement Model for Family Involvement (Alternate Measure-Teacher Responses)

The initial measurement model for the alternate measure of the principal human capital skill of Managing Family Involvement (FI_ALT) contains the following three indicators.

fit_q1: Obtaining information from parents about student learning needs is a priority at my school

fit_q2: Teachers and administrators in my school use information from parents to improve instructional practices and meet student learning needs

fit_q3: My school communicates effectively with parents when students misbehave

The equations for this model are as follows:
$fit\_q1 = FI\_ALT\beta_{6a} + \varepsilon_{6a}$
$fit\_q2 = FI\_ALT\beta_{7a} + \varepsilon_{7a}$
$fit\_q3 = FI\_ALT\beta_{8a} + \varepsilon_{8a}$

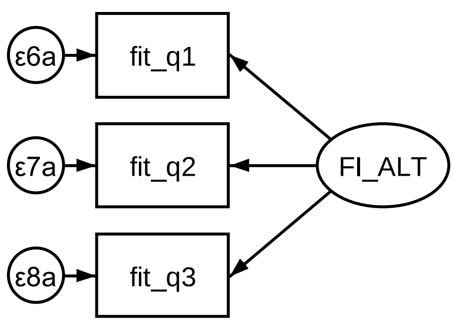


Figure A.5

Measurement Model for Indirect Instructional Leadership

The initial measurement model for the principal human capital skill of Indirect Instructional Leadership (IIL) contains the following four indicators.

iil_q1: School leaders invite teachers to play a meaningful role in setting goals and making important decisions for this school

iil_q2: This year, I received helpful training on the use of student achievement data to improve teaching and learning

iil_q3: The professional development I received this year provided me with content support in my subject area iil_q4: The professional development I received this year provided me with teaching strategies to better meet the needs of my students

The equations for this model are as follows:
$iil\_q1 = IIL\beta_{10} + \varepsilon_{10}$
$iil\_q2 = IIL\beta_{11} + \varepsilon_{11}$
$iil\_q3 = IIL\beta_{12} + \varepsilon_{12}$
$iil\_q4 = IIL\beta_{13} + \varepsilon_{13}$

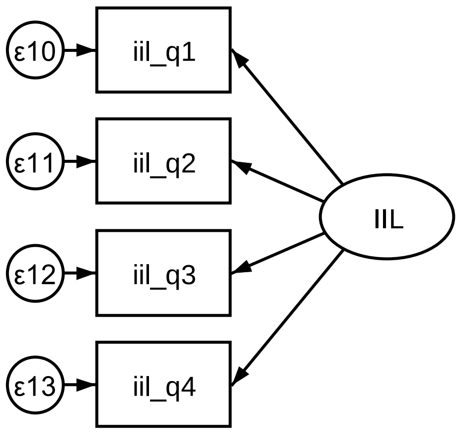


Figure A.6

Measurement Model for Human Capital Management (Alternate Measure-Teacher Responses)

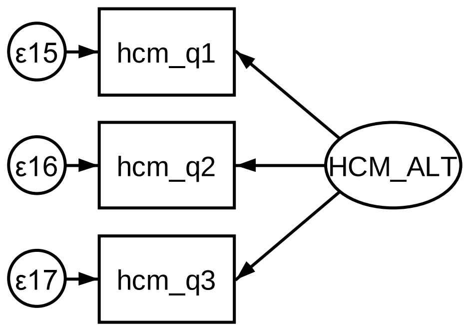
The initial measurement model for the alternate measure of the principal human capital skill of Human Capital Management (HCM_ALT) contains the following three indicators.

hcm_q1: Teachers in this school set high standards for student work in their classes

hcm_q2: To what extent do you feel supported by other teachers at your school

hcm_q3: Most teachers in my school work together to improve their instructional practice

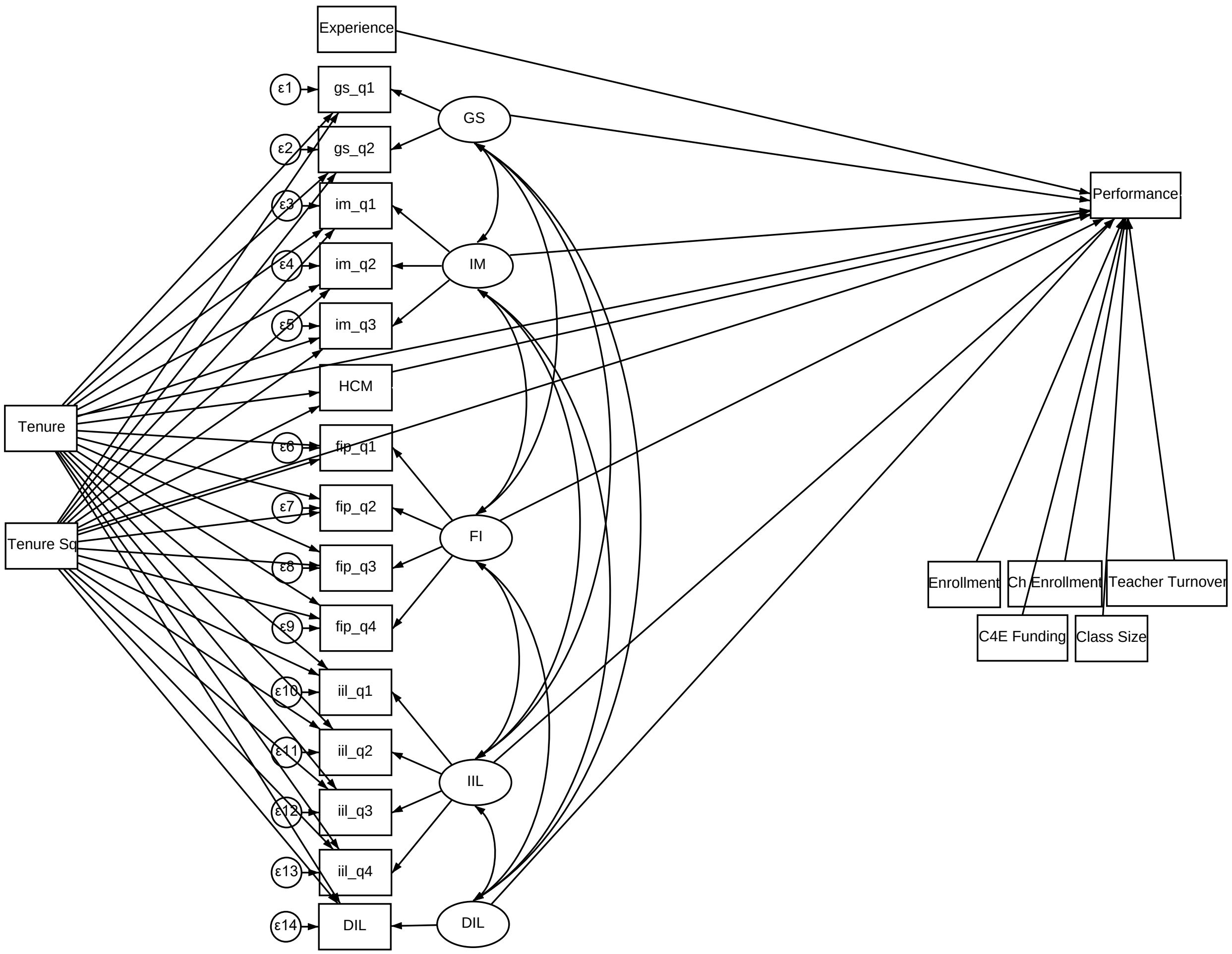
The equations for this model are as follows:
$hcm\_q1 = HCM\_ALT\beta_{15} + \varepsilon_{15}$
$hcm\_q2 = HCM\_ALT\beta_{16} + \varepsilon_{16}$
$hcm\_q3 = HCM\_ALT\beta_{17} + \varepsilon_{17}$



The following figures and equations present the structural models that integrate the foregoing measurement models with the observed variables.

Figure A.7

Structural Model for the Effects of Principal Human Capital on School Performance[82]



[82] To present a more parsimonious version of this model I excluded the error terms for the structural equations from Figures A.7 and A.8.

The equations for this model are as follows:

<u>Structural Equations for Effects of Tenure on Human Capital Skills:</u>

gs_q1 = βTenure + βTenure_Sq + βGS + ζ1

gs_q2 = βTenure + βTenure_Sq + βGS + ζ2

im_q1 = βTenure + βTenure_Sq + βIM + ζ3

im_q2 = βTenure + βTenure_Sq + βIM + ζ4

im_q3 = βTenure + βTenure_Sq + βIM + ζ5

HCM = βTenure + βTenure_Sq + ζ6

fip_q1 = βTenure + βTenure_Sq + βFI + ζ7

fip_q2 = βTenure + βTenure_Sq + βFI + ζ8

fip_q3 = βTenure + βTenure_Sq + βFI + ζ9

fip_q4 = βTenure + βTenure_Sq + βFI + ζ10

iil_q1 = βTenure + βTenure_Sq + βIIL + ζ11

iil_q2 = βTenure + βTenure_Sq + βIIL + ζ12

iil_q3 = βTenure + βTenure_Sq + βIIL + ζ13

DIL = βTenure + βTenure_Sq + ζ14

<u>Structural Equation for Effects of Explanatory Variables on Performance:</u>

Performance = βTenure + βTenure_Sq + βExperience + βGS + βIM + βHCM + βFI + βIIL+ βDIL + βEnrollment + βCh_Enrollment + βTeacher_Turnover + βC4E_Funding + βClass_Size + ζ15

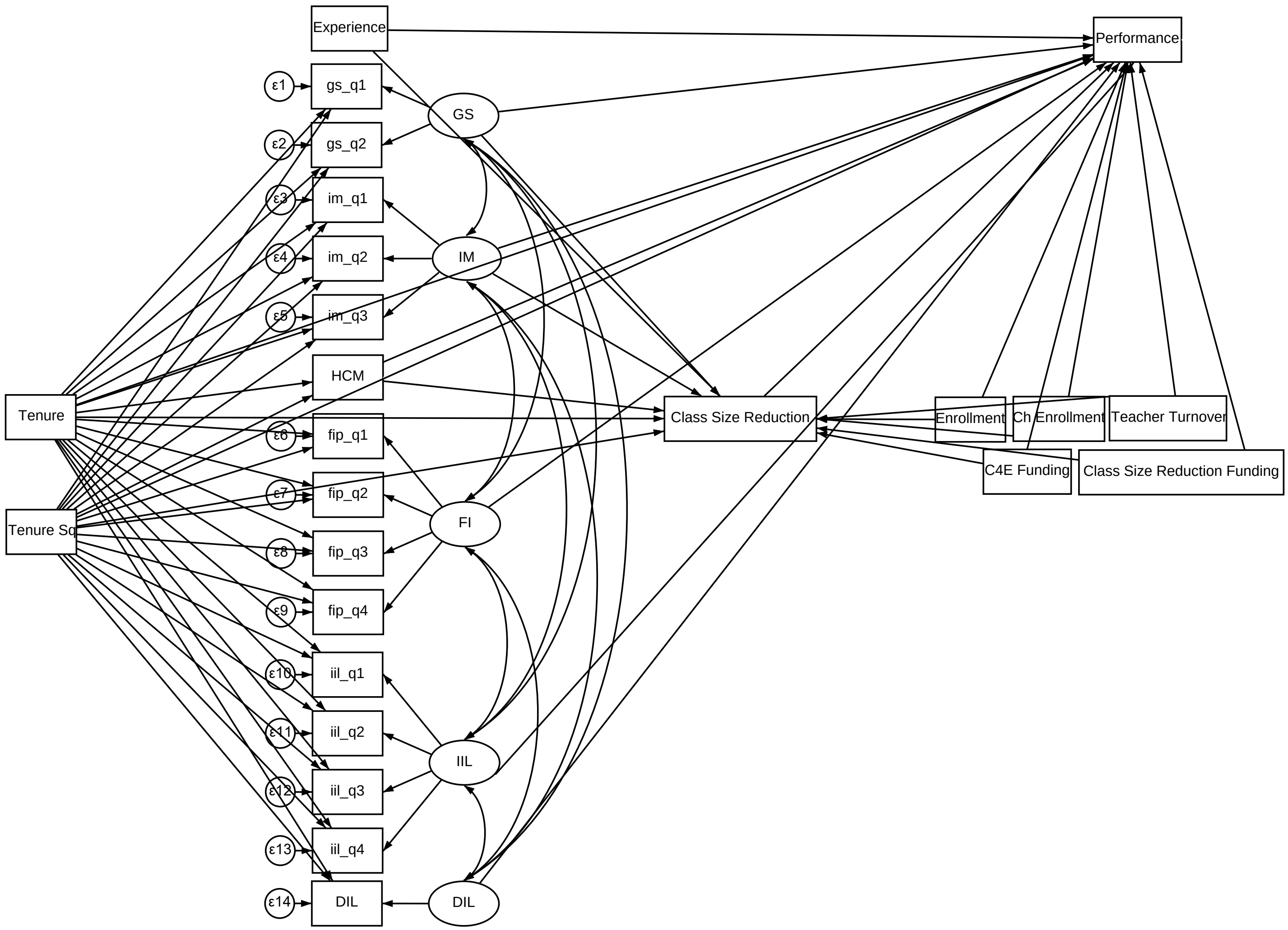
Equation for Random Effects Regression with Point Estimates for Human Capital Variables[83]

Performance = βTenure + βTenure_Sq + βExperience + βGShat + βIMhat + βHCM + βFIhat + βIILhat+ βDIL + βEnrollment + βCh_Enrollment + βTeacher_Turnover + βC4E_Funding + βClass_Size + *e*

[83] *hat denotes latent variable measures derived from point estimates for the human capital skills as described in Chapter 4.

Figure A.8

Structural Model for Effects of Principal Human Capital on School Performance Through the Class Size Reduction Program



The equations for this model are as follows:

Structural Equations for Effects of Tenure on Human Capital Skills:

$gs\_q1 = \beta Tenure + \beta Tenure\_Sq + \beta GS + \zeta 1$

$gs\_q2 = \beta Tenure + \beta Tenure\_Sq + \beta GS + \zeta 2$

$im\_q1 = \beta Tenure + \beta Tenure\_Sq + \beta IM + \zeta 3$

$im\_q2 = \beta Tenure + \beta Tenure\_Sq + \beta IM + \zeta 4$

$im\_q3 = \beta Tenure + \beta Tenure\_Sq + \beta IM + \zeta 5$

$HCM = \beta Tenure + \beta Tenure\_Sq + \zeta 6$

$fip\_q1 = \beta Tenure + \beta Tenure\_Sq + \beta FI + \zeta 7$

$fip\_q2 = \beta Tenure + \beta Tenure\_Sq + \beta FI + \zeta 8$

$fip\_q3 = \beta Tenure + \beta Tenure\_Sq + \beta FI + \zeta 9$

$fip\_q4 = \beta Tenure + \beta Tenure\_Sq + \beta FI + \zeta 10$

$iil\_q1 = \beta Tenure + \beta Tenure\_Sq + \beta IIL + \zeta 11$

$iil\_q2 = \beta Tenure + \beta Tenure\_Sq + \beta IIL + \zeta 12$

$iil\_q3 = \beta Tenure + \beta Tenure\_Sq + \beta IIL + \zeta 13$

$DIL = \beta Tenure + \beta Tenure\_Sq + \zeta 14$

Structural Equation for Effects of Explanatory Variables on C4E Implementation:

$Class\_Size\_Reduction = \beta Tenure + \beta Tenure\_Sq + \beta Experience + \beta GS + \beta IM + \beta HCM +$

$\beta Enrollment + \beta Ch\_Enrollment + \beta Teacher\_Turnover + \beta C4E\_Funding + \beta CSR\_Funding + \zeta 15$

Structural Equation for Effects of C4E Implementation on School Performance:

$Performance = \beta Tenure + \beta Tenure\_Sq + \beta Experience + \beta GS + \beta IM + \beta HCM + \beta Enrollment +$

$\beta Ch\_Enrollment + \beta Teacher\_Turnover + \beta C4E\_Funding + \beta CSR\_Funding + \zeta_1 16$

Structural Equation for Effects of Explanatory Variables on Performance (Other Than Through C4E Implementation):

Performance = βTenure + βTenure_Sq + βExperience + βGS + βIM + βHCM + βFI + βIIL+

βDIL + βEnrollment + βCh_Enrollment + βTeacher_Turnover + βC4E_Funding + βClass_Size +

$\zeta_2$16

Equation for Random Effects Regression with Point Estimates for Human Capital Variables (Dependent Variable of C4E Implementation):

Class_Size_Reduction = βTenure + βTenure_Sq + βExperience + βGShat + βIMhat + βHCM +

βEnrollment + βCh_Enrollment + βTeacher_Turnover + βC4E_Funding + βCSR_Funding + e

Equation for Random Effects Regression with Point Estimates for Human Capital Variables (Dependent Variable of School Performance):

Performance = βTenure + βTenure_Sq + βExperience + βGShat + βIMhat + βHCM + βFIhat +

βIILhat+ βDIL + βEnrollment + βCh_Enrollment + βTeacher_Turnover + βC4E_Funding +

βCSR_Funding + e

APPENDIX B

ADDITIONAL TABLES AND FIGURES: EFFECTS OF PRINCIPAL HUMAN CAPITAL QUALITIES ON SCHOOL PERFORMANCE

Table B.1

Principal Human Capital Variables and Other Explanatory Variables – Pooled SEM (Student Progress Scores)

	Student Progress Scores			
	Elementary / Middle Schools (N=5,144)		**High Schools (N=1,339)**	
	Coef./Std. Err.	Z	Coef./Std. Err.	Z
Experience Variables				
Tenure	0.95 (.935)	1.01	2.43 (1.354)	1.79
Tenure-sq	-0.42 (.348)	-1.21	-0.93 (.533)	-1.75
Experience	-0.12 (.068)	-1.80	-0.09 (.098)	-0.97
Human Capital Skills				
Goal Setting	-2.25 (1.168)	-1.93	-2.15 (1.704)	-1.26
Internal Manager	2.36 (.495)	4.77**	4.00 (.945)	4.24**
Manager of Family Involvement	-2.08 (.509)	-4.08**	0.98 (.826)	1.19
Indirect Instructional Leader	0.31 (.660)	0.48	-0.87 (1.093)	-0.80
Direct Instructional Leader	0.48 (.338)	1.41	0.45 (408)	1.12
Human Capital Manager	-0.06 (.029)	-2.09*	0.04 (.036)	1.20
Other Explanatory Variables				
Enrollment	1.42 (.429)	3.31**	-1.69 (.587)	-2.87**
Change in Enrollment	-0.03 (.017)	-1.91	0.10 (.033)	3.11**
Class Size	-0.44 (.056)	-7.80**	0.08 (.122)	0.64
*p<.05, **p<.01 (two-tailed)				

Table B.2

Principal Human Capital Variables and Other Explanatory Variables – Pooled SEM (Student Performance Scores)

	Student Performance Scores			
	Elementary / Middle Schools (N=5,144)		**High Schools (N=1,339)**	
	Coef./Std. Err.	Z	Coef./Std. Err.	Z
Experience Variables				
Tenure	0.80 (.451)	1.78	1.26 (.601)	2.10*
Tenure-sq	-0.08 (.168)	-0.45	-0.40 (.227)	-1.76
Experience	-0.05 (.041)	-1.24	-0.05 (.053)	-0.94
Human Capital Skills				
Goal Setting	-0.23 (.620)	-0.38	0.55 (.841)	0.65
Internal Manager	1.56 (.267)	5.83**	1.14 (.437)	2.62**
Manager of Family Involvement	-2.67 (.262)	-10.20**	-0.62 (.408)	-1.52
Indirect Instructional Leader	-1.11 (.346)	-3.22**	-1.33 (.558)	-2.38*
Direct Instructional Leader	0.45 (.166)	2.68**	-0.23 (.211)	-1.07
Human Capital Manager	-0.06 (.013)	-5.06**	0.03 (.018)	1.76
Other Explanatory Variables				
Enrollment	0.33 (.215)	1.52	-1.18 (.306)	-3.86**
Change in Enrollment	0.02 (.009)	2.59*	0.08 (.021)	3.92**
Class Size	0.02 (.031)	0.66	0.10 (.061)	1.71
*p<.05, **p<.01 (two-tailed)				

Table B.3

Principal Human Capital and School Progress and Performance Scores – Random Effects Regression

	Student Progress Scores				Student Performance Scores			
	Elementary / Middle Schools (N=5,144)		**High Schools (N=1,339)**		**Elementary / Middle Schools (N=5,144)**		**High Schools (N=1,339)**	
	Coef./Std. Err.	Z	Coef./Std. Err.	Z	Coef./Std. Err.	Z	Coef./Std. Err.	Z
Experience Variables								
Tenure	**1.53 (.749)**	**2.05***	**2.72 (.931)**	**2.92****	**1.39 (.349)**	**3.97****	**1.94 (.461)**	**4.21****
Tenure-sq	**-0.82 (.246)**	**-3.10****	**-1.59 (.382)**	**-4.18****	**-0.34 (.126)**	**-2.68****	**-1.06 (.190)**	**-5.58****
Experience	*-0.14 (.069)*	*-2.06**	*-0.12 (.077)*	*-1.52*	-0.06 (.034)	-1.86	*-0.11 (.040)*	*-2.86***
Human Capital Skills								
Goal Setting	-2.15 (1.188)	-1.81	*-3.53 (1.331)*	*-2.65*	-0.56 (.554)	-1.02	-0.98 (.663)	-1.48
Internal Manager	**2.29 (.478)**	**4.79****	**3.06 (.585)**	**5.23****	**1.45 (.226)**	**6.40****	**1.05 (.293)**	**3.59****
Manager of Family Involvement	*-2.60 (.469)*	*-5.55***	-0.28 (.566)	-0.49	**-3.29 (.221)**	**-14.88****	**-0.83 (.283)**	**-2.93****
Indirect Instructional Leader	0.46 (.686)	0.67	0.58 (.764)	0.76	**-0.76 (.318)**	**-2.38***	0.13 (.380)	0.34
Direct Instructional Leader	0.30 (.311)	0.96	**0.83 (.330)**	**2.51***	**0.39 (.145)**	**2.71****	-0.03 (.164)	-0.20
Human Capital Manager	*-0.06 (.025)*	*-2.51**	**0.06 (.024)**	**2.03***	*-0.06 (.012)*	*-5.57***	**0.02 (.014)**	**5.11****
	R-sq=.03 χ^2 = 195.18		R-sq =.17 χ^2 = 115.62		R-sq=*.08* χ^2 = 425.74		R-sq =.09 χ^2 = 122.92	

*p<.05, **p<.01 (two-tailed)

Bold indicates significant finding in the predicted direction

Italics indicates significant finding against the predicted direction

Table B.4

Principal Human Capital and Student Progress and Performance Scores – Pooled SEM (Without Tenure Effects on Skills)

	Student Progress Scores				Student Performance Scores			
	Elementary / Middle Schools (N=5,144)		**High Schools (N=1,339)**		**Elementary / Middle Schools (N=5,144)**		**High Schools (N=1,339)**	
	Coef./Std. Err.	Z	Coef./Std. Err.	Z	Coef./Std. Err.	Z	Coef./Std. Err.	Z
Experience Variables								
Tenure	1.19 (.909)	1.31	**3.30 (1.276)**	**2.59***	**1.13 (.428)**	**2.64****	**1.49 (.584)**	**2.55***
Tenure-sq	-0.64 (.337)	-1.90	**-1.55 (.480)**	**-3.22****	-0.25 (.159)	-1.58	**-0.57 (.219)**	**-2.61****
Experience	-0.12 (.068)	-1.80	-0.09 (.098)	-0.96	-0.05 (.041)	-1.23	-0.05 (.053)	-0.95
Human Capital Skills								
Goal Setting	-2.28 (1.171)	-1.95	-2.18 (1.720)	-1.27	-0.25 (.621)	-0.41	0.55 (.847)	0.65
Internal Manager	**2.37 (.495)**	**4.80****	**4.02 (.943)**	**4.26****	**1.56 (.266)**	**5.87****	**1.14 (.437)**	**2.62****
Manager of Family Involvement	*-2.07 (.509)*	*-4.08***	0.92 (.829)	1.11	**-2.68 (.262)**	**-10.22****	-0.67 (.397)	-1.68
Indirect Instructional Leader	0.32 (.659)	0.48	-0.84 (1.100)	-0.76	**-1.11 (.345)**	**-3.21****	**-1.32 (.561)**	**-2.35***
Direct Instructional Leader	0.48 (.339)	1.43	0.45 (.406)	1.10	**0.45 (.167)**	**2.71****	-0.23 (.210)	-1.08
Human Capital Manager	*-0.06 (.029)*	*-2.09**	0.04 (.036)	1.21	*-0.07 (.013)*	*-5.06***	0.03 (.018)	1.77
Fit Statistics	SRMR: 0.090 AIC: 293918.8 BIC: 294246.1		SRMR: 0.086 AIC: 81127.8 BIC: 81387.8		SRMR: 0.090 AIC: 286120.5 BIC: 286447.7		SRMR: 0.087 AIC: 79345.8 BIC: 79605.8	

*p<.05, **p<.01 (two-tailed)

Bold indicates significant finding in the predicted direction
Italics indicates significant finding against the predicted direction

Table B.5

Principal Human Capital and School Progress Scores – Pooled SEM (Alternate Measure of Human Capital Management)

	Student Progress Scores				**Student Performance Scores**			
	Elementary / Middle Schools (N=5,147)		**High Schools (N=1,339)**		**Elementary / Middle Schools (N=5,147)**		**High Schools (N=1,339)**	
	Coef./Std. Err.	Z	Coef./Std. Err.	Z	Coef./Std. Err.	Z	Coef./Std. Err.	Z
Experience Variables								
Tenure	0.96 (.937)	1.02	2.34 (1.345)	1.73	0.80 (.452)	1.77	**1.22 (.602)**	**2.02***
Tenure-sq	-0.42 (.349)	-1.20	-0.89 (.531)	-1.67	-0.07 (.168)	-0.42	-0.38 (.227)	-1.66
Experience	-0.11 (.068)	-1.67	-0.10 (.094)	-1.03	-0.06 (.040)	-1.38	-0.05 (.052)	-0.99
Human Capital Skills								
Goal Setting	-1.87 (1.246)	-1.50	-1.78 (1.636)	-1.09	-0.39 (.668)	-0.59	0.70 (.827)	0.85
Internal Manager	**2.39 (.521)**	**4.58****	**3.97 (.922)**	**4.31****	**1.63 (.283)**	**5.59****	**1.15 (.435)**	**2.64****
Manager of Family Involvement	*-1.97 (.512)*	*-3.85***	1.17 (.794)	1.47	**-2.95 (.268)**	**-11.01****	-0.44 (.381)	-1.15
Indirect Instructional Leader	0.45 (.672)	0.67	-0.78 (1.067)	-0.73	**-1.18 (.355)**	**-3.34****	**-1.19 (.546)**	**-2.18***
Direct Instructional Leader	0.49 (.340)	1.45	0.50 (.409)	1.22	**0.40 (.168)**	**2.39***	-0.20 (.214)	-0.93
Human Capital Manager	*-1.67 (.480)*	*-3.48***	-1.41 (.837)	-1.68	**0.51 (.239)**	**2.14***	*-0.98 (.415)*	*-2.37**

*p<.05, **p<.01 (two-tailed)

Bold indicates significant finding in the predicted direction

Italics indicates significant finding against the predicted direction

Table B.6

Principal Human Capital and School Progress Scores – Pooled SEM (Alternate Measure of Managing Family Involvement)

	Student Progress Scores				**Student Performance Scores**			
	Elementary / Middle Schools (N=5,143)		**High Schools (N=1,339)**		**Elementary / Middle Schools (N=5,143)**		**High Schools (N=1,339)**	
	Coef./Std. Err.	Z	Coef./Std. Err.	Z	Coef./Std. Err.	Z	Coef./Std. Err.	Z
Experience Variables								
Tenure	1.00 (.931)	1.07	2.25 (1.327)	1.69	0.83 (.450)	1.83	**1.33 (.597)**	**2.22***
Tenure-sq	-0.42 (.348)	-1.22	-0.85 (.518)	-1.64	-0.09 (.168)	-0.54	-0.43 (.225)	-1.93
Experience	-0.11 (.064)	-1.71	-0.10 (.100)	-0.95	-0.05 (.040)	-1.35	-0.05 (.051)	-1.03
Human Capital Skills								
Goal Setting	-1.30 (1.164)	-1.12	-1.81 (1.651)	-1.09	0.07 (.612)	0.12	0.39 (.800)	0.48
Internal Manager	**2.63 (.495)**	**5.30****	**3.99 (.905)**	**4.40****	**1.52 (.260)**	**5.84****	**0.97 (.399)**	**2.44***
Manager of Family Involvement	*-2.71 (.449)*	*-6.03***	-0.26 (.666)	-0.39	**-1.12 (.230)**	**-4.86****	0.42 (.315)	1.32
Indirect Instructional Leader	0.97 (.664)	1.46	-0.84 (1.071)	-0.79	**-0.89 (.352)**	**-2.53***	**-1.42 (.558)**	**-2.54***
Direct Instructional Leader	0.35 (.344)	1.01	0.410 (.407)	1.00	**0.42 (.171)**	**2.46***	-0.19 (.211)	-0.88
Human Capital Manager	*-0.07 (.027)*	*-2.37**	0.05 (.036)	1.34	*-0.08 (.013)*	*-6.45***	0.03 (.018)	1.53

*p<.05, **p<.01 (two-tailed)

Bold indicates significant finding in the predicted direction
Italics indicates significant finding against the predicted direction

Table B.7

Principal Human Capital and School Progress Scores (Schools Implementing Class Size Reduction Program)

	Student Progress Scores				**Student Performance Scores**			
	Elementary / Middle Schools (N=706)		**High Schools (N=203)**		**Elementary / Middle Schools (N=706)**		**High Schools (N=203)**	
	Coef./Std. Err.	Z	Coef./Std. Err.	Z	Coef./Std. Err.	Z	Coef./Std. Err.	Z
Experience Variables								
Tenure	3.06 (1.988)	1.54	**13.49 (2.991)**	**4.51****	-0.54 (.874)	-0.61	**5.36 (1.282)**	**4.18****
Tenure-sq	-0.70 (.749)	-0.94	**-4.67 (1.064)**	**-4.39****	0.54 (.331)	1.62	**-1.62 (.419)**	**-3.87****
Experience	0.12 (.098)	1.24	-0.07 (.144)	-0.50	0.08 (.065)	1.22	-0.09 (.119)	-0.82
Human Capital Skills								
Goal Setting	-1.95 (1.631)	-1.20	-2.84 (2.482)	-1.14	*-2.08 (.871)*	*-2.39**	-0.92 (1.252)	-0.73
Internal Manager	**2.67 (.818)**	**3.26****	**4.13 (1.578)**	**2.62****	**1.87 (.442)**	**4.24****	**1.62 (.670)**	**2.41***
Manager of Family Involvement	1.22 (1.524)	0.80	0.34 (1.874)	0.18	0.62 (.664)	0.94	-0.95 (1.946)	-0.49
Indirect Instructional Leader	-0.49 (1.107)	-0.44	0.03 (1.734)	0.02	-0.17 (.547)	-0.31	-0.22 (.983)	-0.22
Direct Instructional Leader	0.69 (.921)	0.75	0.58 (.906)	0.64	**1.52 (.384)**	**3.96****	-0.27 (.519)	-0.52
Human Capital Manager	-0.07 (.078)	-0.88	0.09 (.066)	1.44	-0.003 (.027)	-0.13	**0.07 (.033)**	**2.12***
Fit Statistics	SRMR: 0.054 AIC: 37682.3 BIC: 38010.6		SRMR: 0.083 AIC: 12130.1 BIC: 12368.6		SRMR: 0.054 AIC: 38225.1 BIC: 38553.4		SRMR: 0.084 AIC: 9870.1 BIC: 10105.4	

*p<.05, **p<.01 (two-tailed)

Bold indicates significant finding in the predicted direction

Italics indicates significant finding against the predicted direction

Table B.8

Principal Human Capital and School Progress & Performance Scores – Pooled SEM

	Progress Scores All Schools (N=6,220)		**Performance Scores All Schools (N=6,220)**	
	Coef./Std. Err.	Z	Coef./Std. Err.	Z
Experience Variables				
Tenure	0.12 (.074)	1.59	**0.16 (.073)**	**2.21***
Tenure-sq	-0.05 (.028)	-1.74	-0.03 (.028)	-0.91
Experience	-0.01 (.006)	-1.61	-0.01 (.007)	-0.91
Human Capital Skills				
Goal Setting	-0.14 (.099)	-1.46	0.04 (.106)	0.36
Internal Manager	**0.24 (.045)**	**5.30****	**0.27 (.047)**	**5.78****
Manager of Family Involvement	*-0.10 (.039)*	*-2.49**	**-0.37 (.040)**	**-9.23***
Indirect Instructional Leader	-0.04 (.057)	-0.76	**-0.25 (.060)**	**-4.09****
Direct Instructional Leader	0.02 (.025)	0.89	0.02 (.026)	0.89
Human Capital Manager	-0.003 (.002)	-1.45	*-0.01 (.002)*	*-2.85***
Fit Statistics	SRMR: 0.065		SRMR: 0.065	
	AIC: 343817.8		AIC: 327265.7	
	BIC: 344302.7		BIC: 327750.7	

*p<.05 **Bold** indicates significant finding in the predicted direction
**p<.01 (two-tailed) *Italics* indicates significant finding against the predicted direction

Figure B.1

Marginal Effects of Managing Family Involvement by Student Poverty Level and School Type – Teacher Assessments of a Principal's Skill at Managing Family Involvement

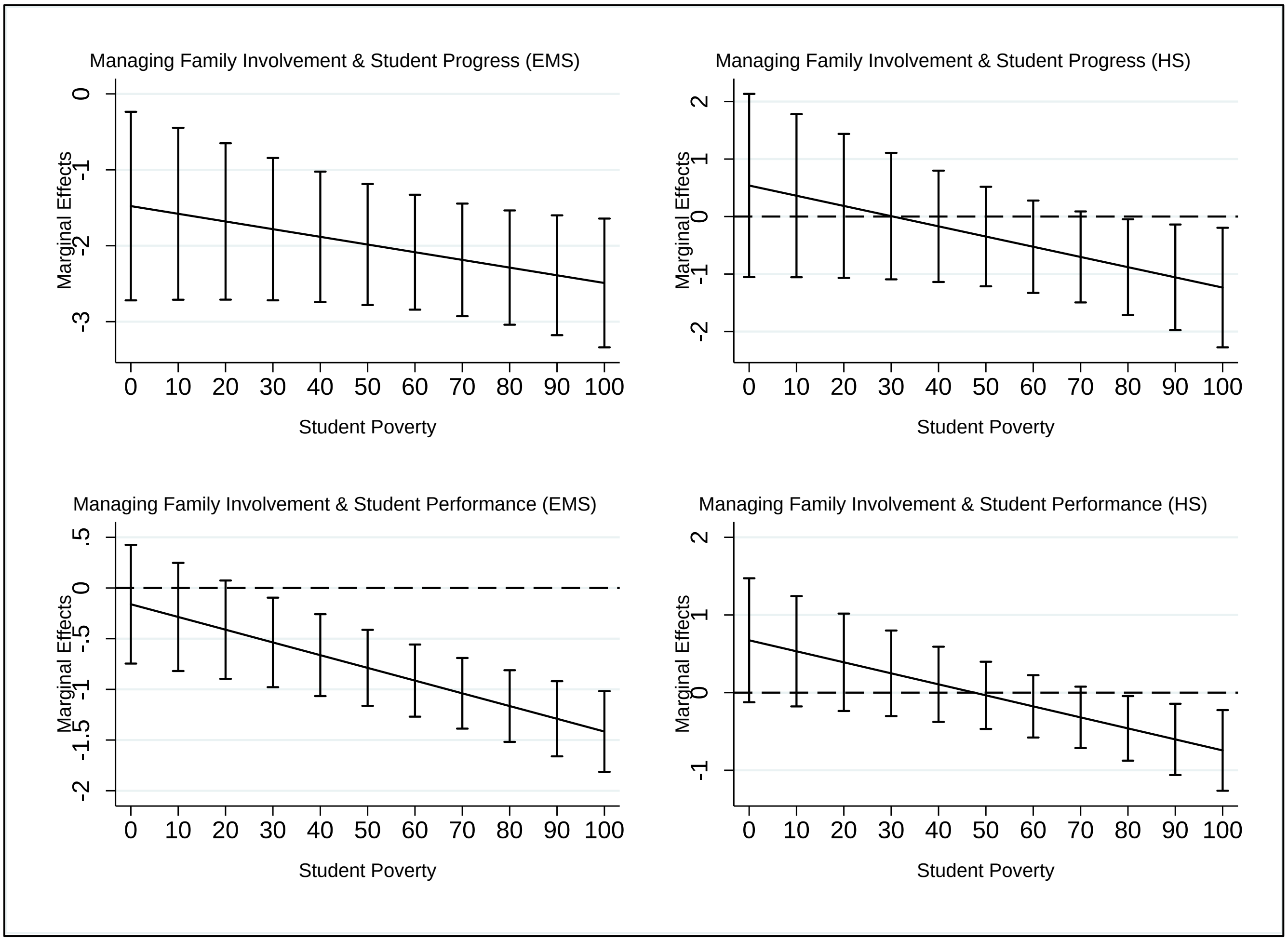


Figure B.2

Marginal Effects of Managing Family Involvement by Student Poverty Level and School Type – Schools Implementing the Class Size Reduction Program

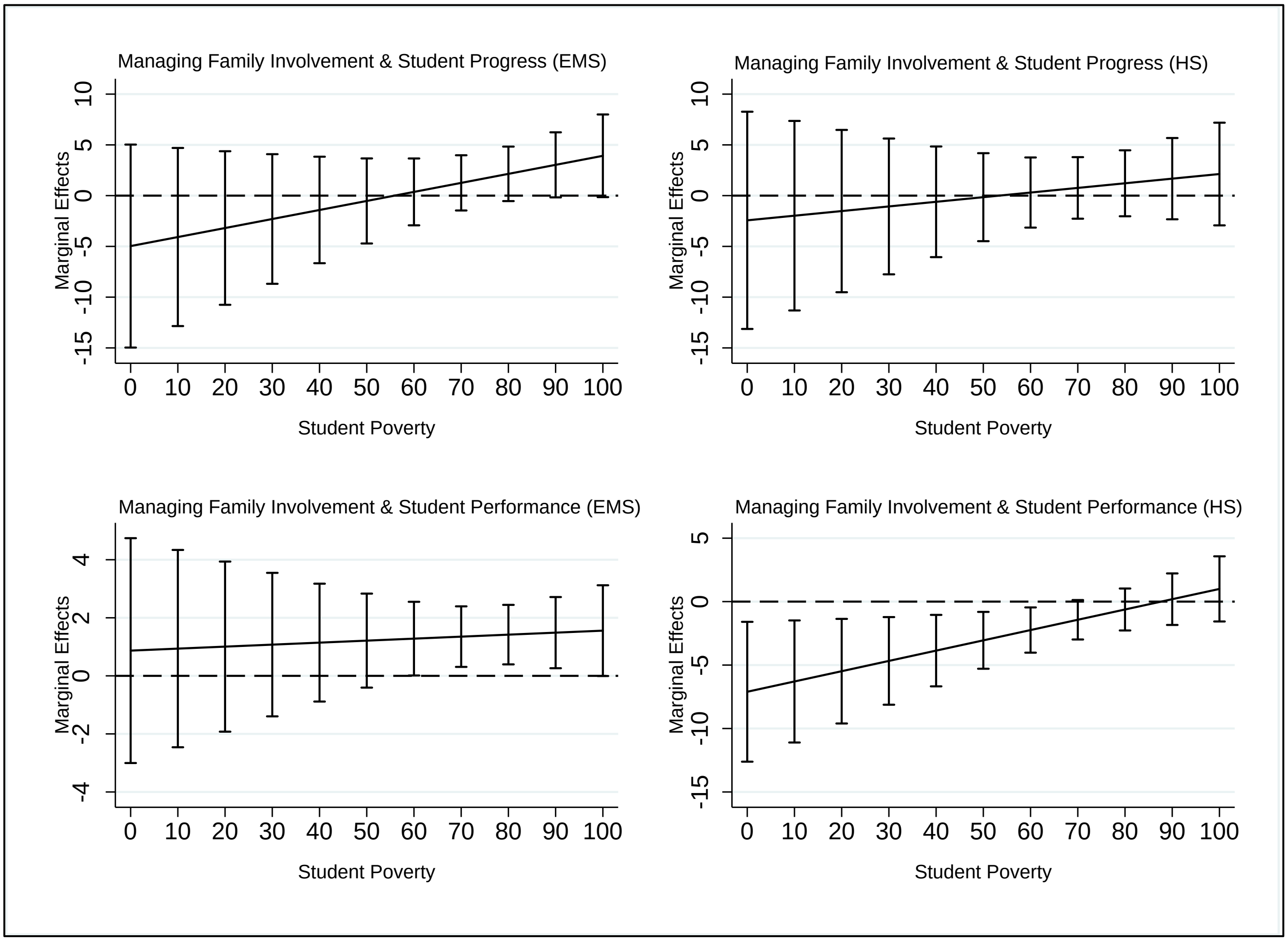


Figure B.3

Marginal Effects of Instructional Leadership on Student Progress Scores by Poverty Level – Schools Implementing the Class Size Reduction Program

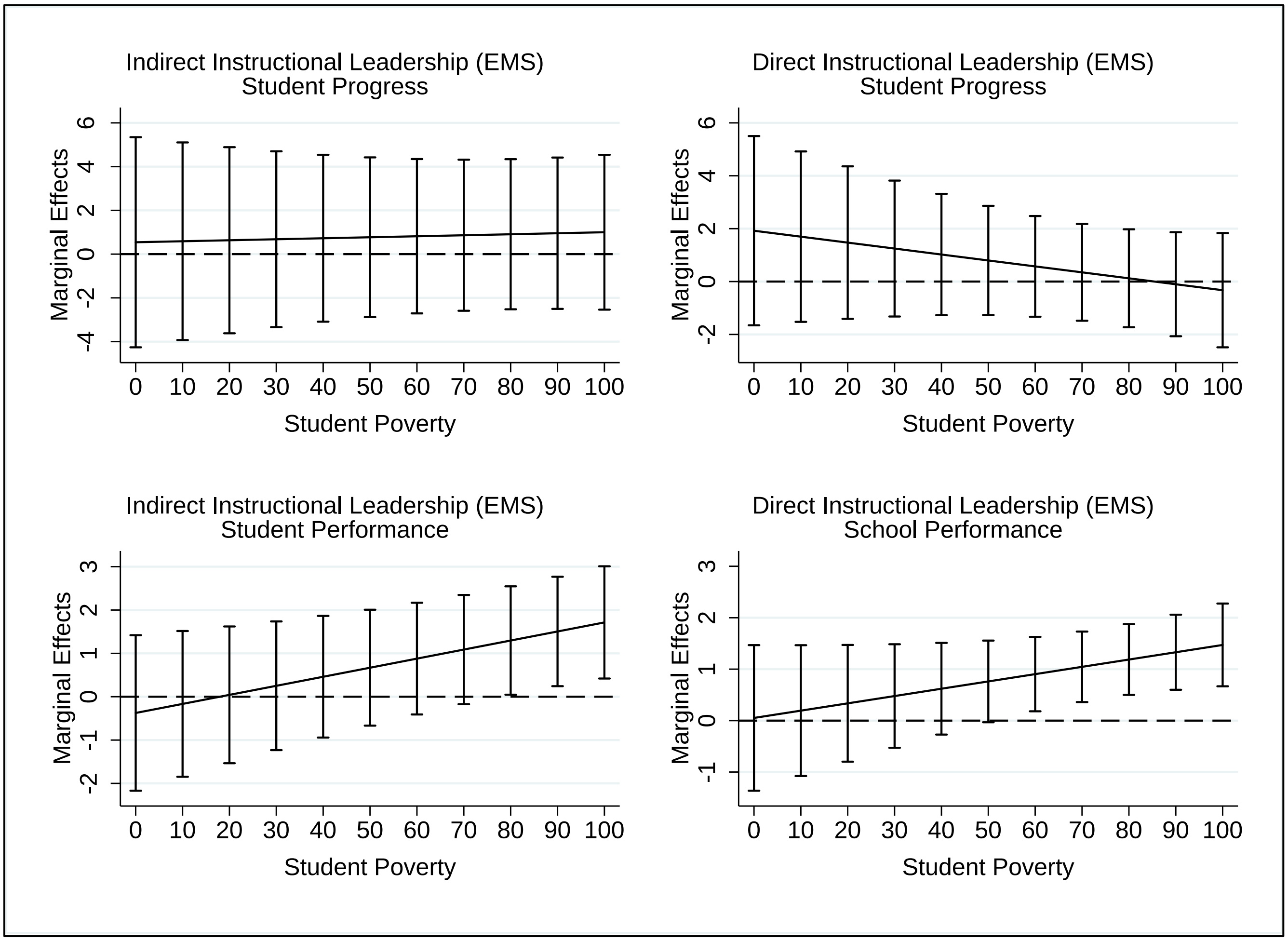


Figure B.4

Marginal Effects of Principal Tenure by Principal Age and School Type

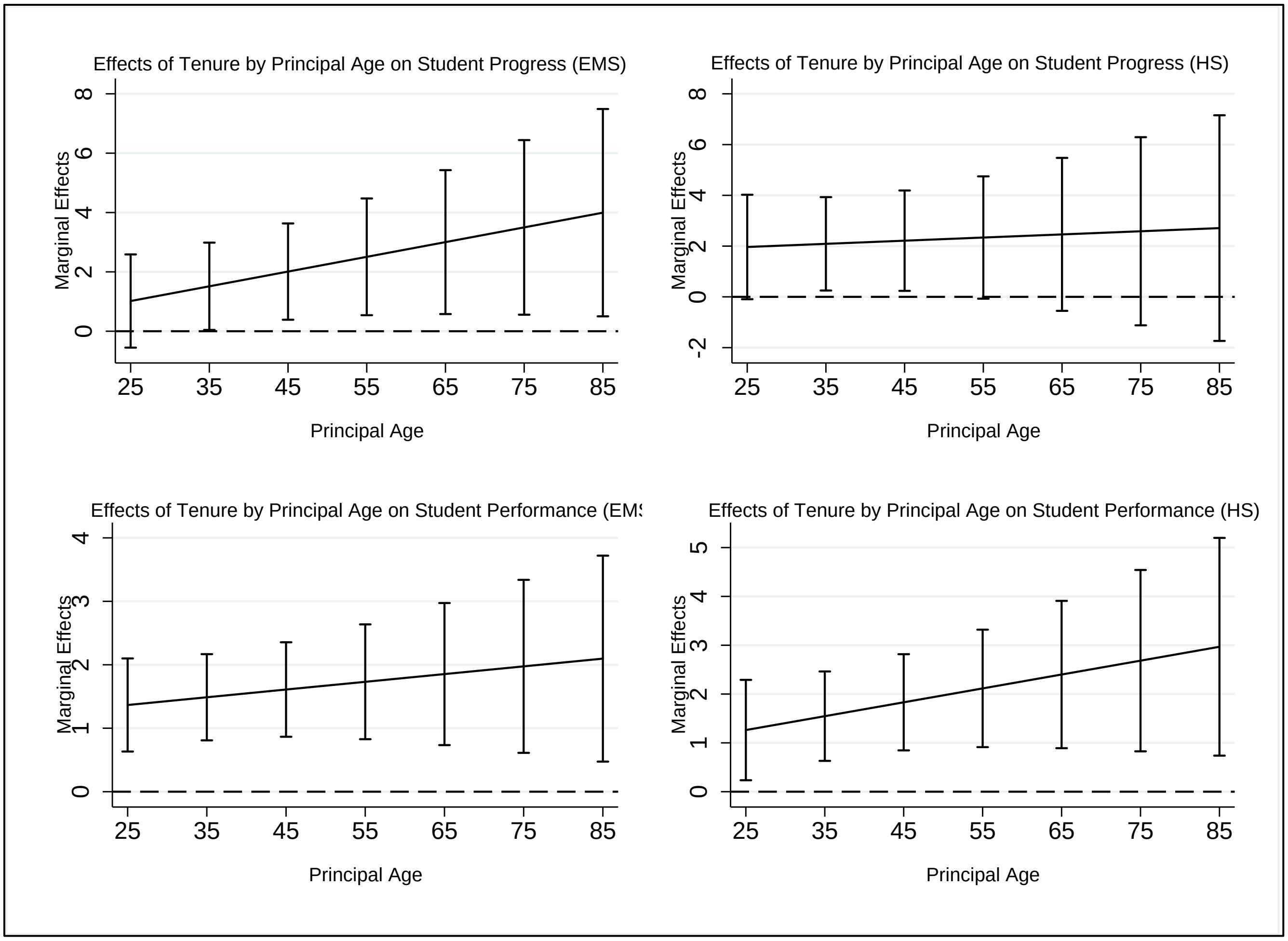


Figure B.5

Marginal Effects of Principal Tenure by Non-Principal Experience in NYC Public Schools and School Type

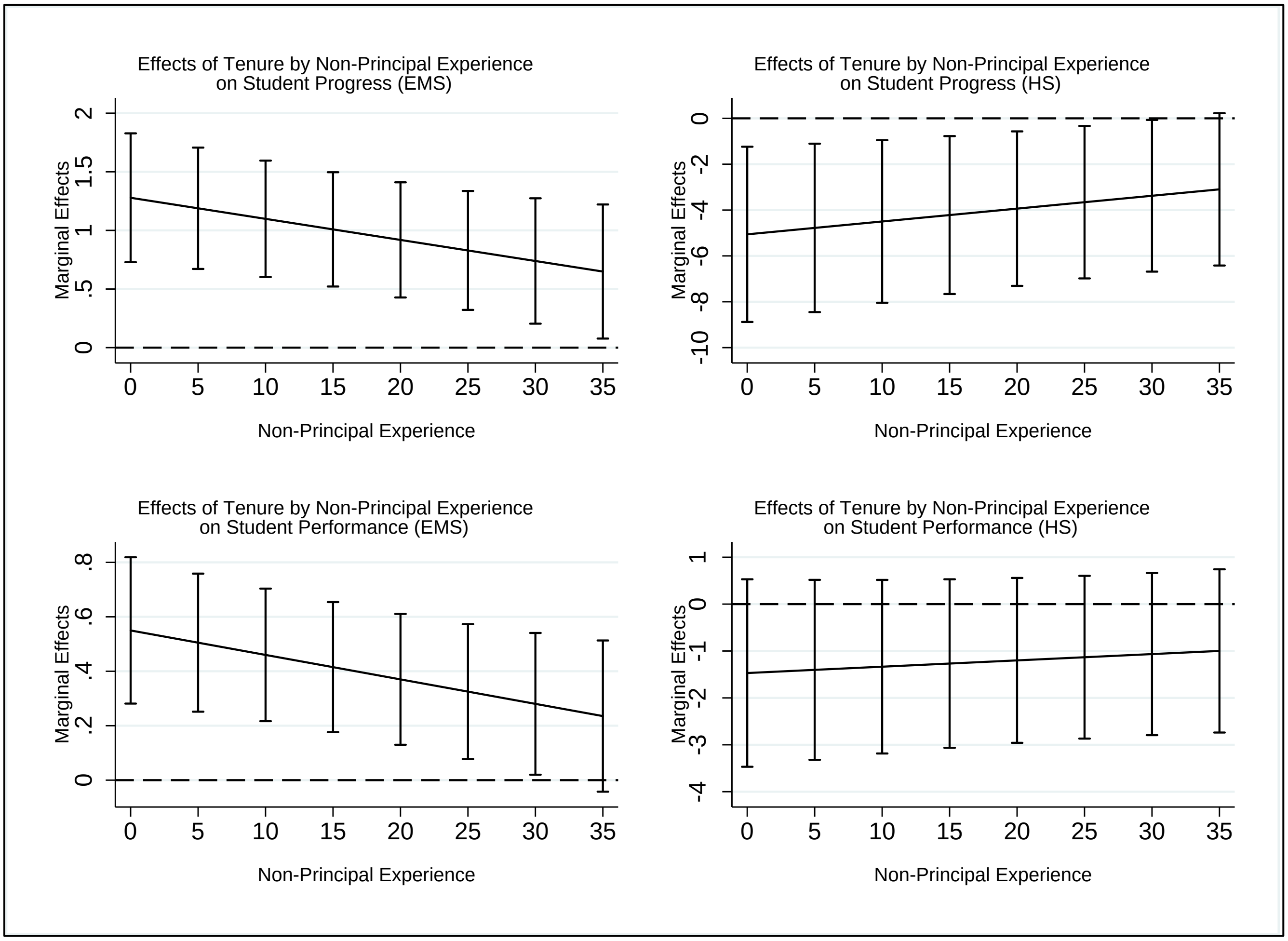


Figure B.6

Marginal Effects of Managing Family Involvement by Student Poverty Level and School Type – Estimation Without Other Human Capital Skills

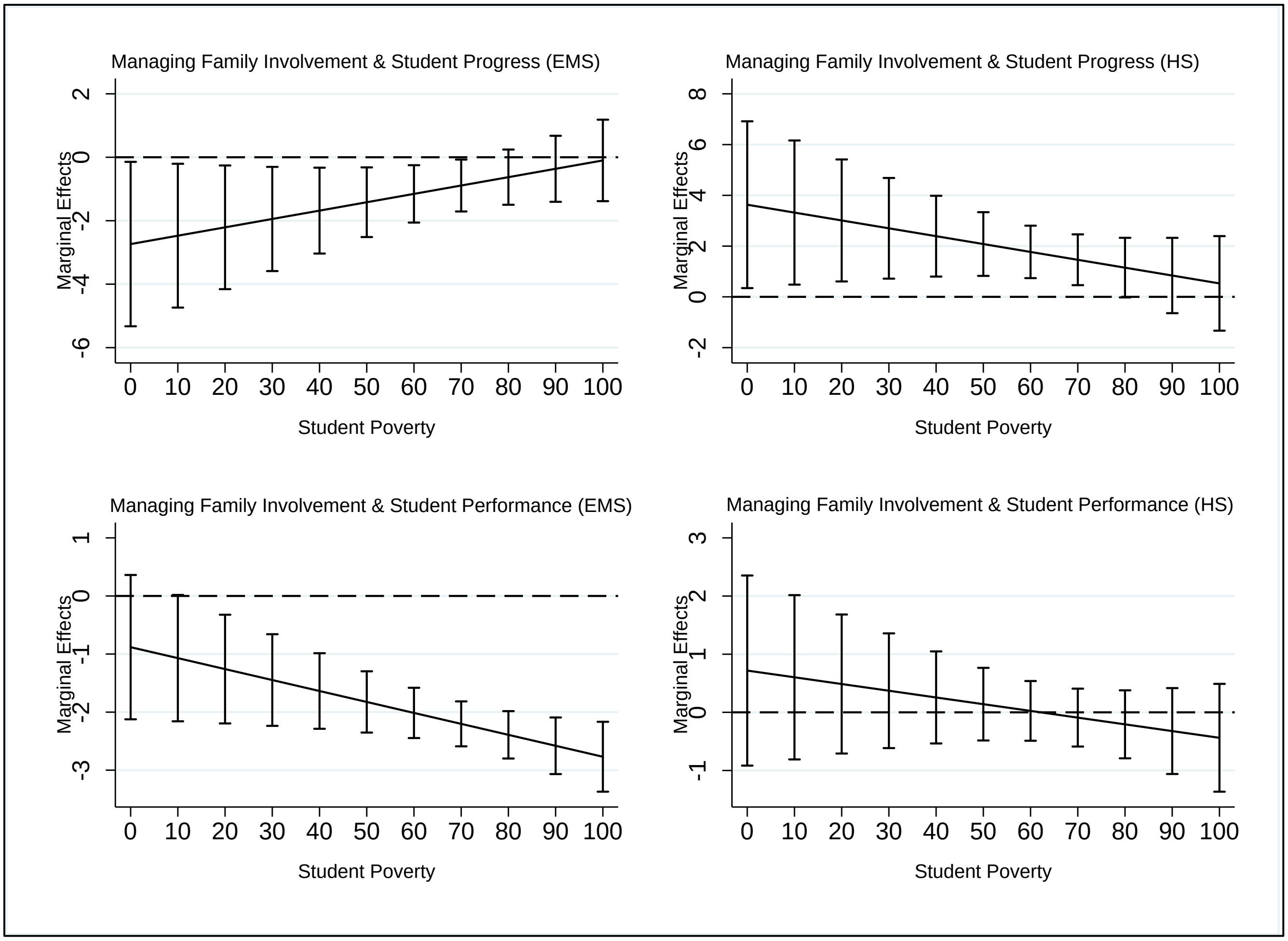


Figure B.7

Marginal Effects of Instructional Leadership for Student Progress by Student Poverty Level and School Type – Estimation Without Other Human Capital Skills

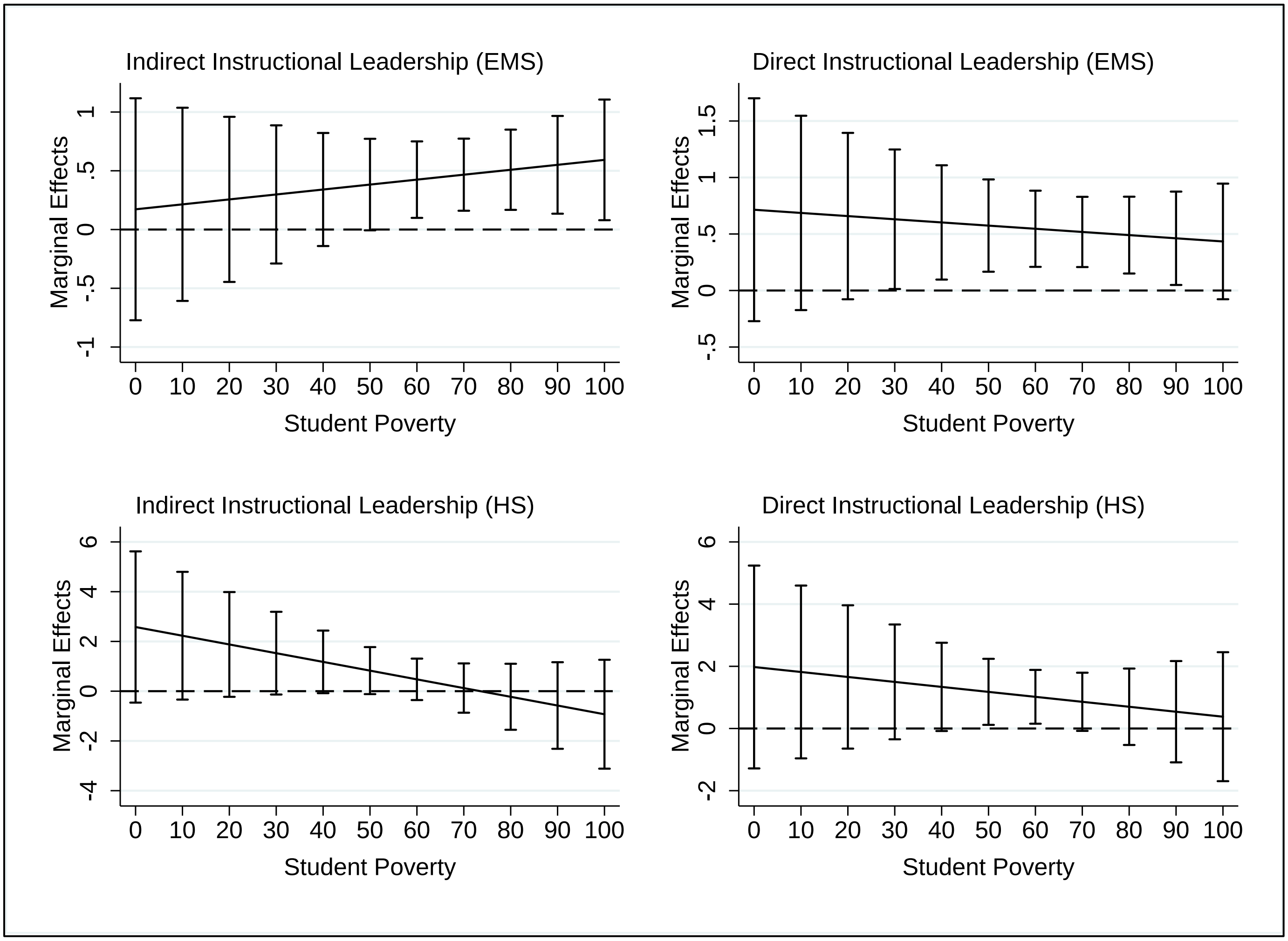
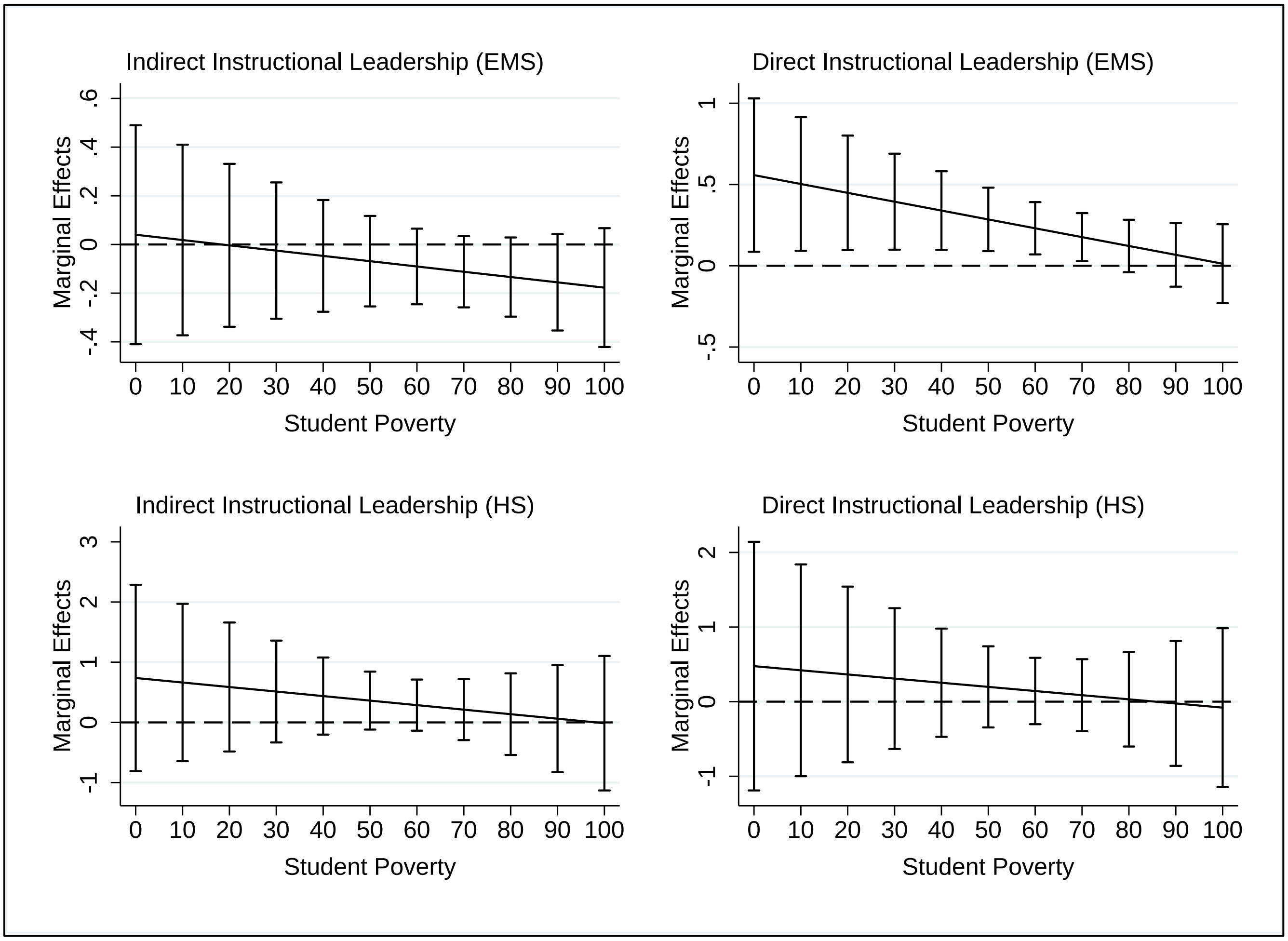


Figure B.8

Marginal Effects of Instructional Leadership for Student Performance by Student Poverty Level and School Type – Estimation Without Other Human Capital Skills



APPENDIX C

ADDITIONAL TABLES AND FIGURES FOR EFFECTS OF PRINCIPAL HUMAN CAPITAL QUALITIES ON SCHOOL PERFORMANCE: IMPLEMENTATION OF THE CLASS SIZE REDUCTION PROGRAM

Table C.1

Principal Human Capital Variables and Other Explanatory Variables on Class Size Reduction Program Implementation – Pooled SEM

	Elementary / Middle Schools (N=651)		**High Schools (N=183)**	
	Coef./Std. Err.	Z	Coef./Std. Err.	Z
Experience Variables				
Tenure	-0.13 (.716)	-0.18	-0.29 (1.162)	-0.25
Tenure-sq	0.09 (.208)	0.43	0.13 (.353)	0.37
Experience	-0.003 (.022)	-0.15	*0.07 (.033)*	*2.19**
Human Capital Skills				
Goal Setting	*0.35 (.146)*	*2.42**	-0.04 (.146)	-0.29
Internal Manager	**-0.30 (.120)**	**-2.51***	0.05 (.171)	0.30
Human Capital Manager	0.03 (.016)	1.80	-0.02 (.020)	-1.11
Other Explanatory Variables				
Enrollment	0.28 (.222)	1.26	-0.27 (.187)	-1.46
Change in Enrollment	0.06 (.016)	4.00**	0.06 (.015)	4.09**
C4E Funding	0.001 (.001)	1.75	0.003 (.001)	1.91
Class Size Reduction Funding	0.001 (.0005)	2.36*	-0.002 (.001)	-2.51*

*p<.05 **Bold** indicates significant finding in the predicted direction
**p<.01 (two-tailed) *Italics* indicates significant finding against the predicted direction

Table C.2

Principal Human Capital and Program Implementation– Linear Regression with Point Estimates for Latent Variables

	Elementary / Middle Schools (N=651)		High Schools (N=185)	
	Coef./Std. Err.	Z	Coef./Std. Err.	Z
Experience Variables				
Tenure	0.05 (.848)	0.06	0.23 (1.377)	0.17
Tenure-sq	0.04 (.247)	0.14	-0.01 (411)	-0.03
Experience	-0.003 (.031)	-0.09	0.07 (.038)	1.85
Human Capital Skills				
Goal Setting	*0.52 (.218)*	*2.37**	-0.014 (.256)	-0.56
Internal Manager	**-0.44 (.182)**	**-2.42***	0.10 (.230)	0.44
Human Capital Manager	0.03 (.015)	1.68	-0.02 (.019)	-1.24
	R^2=.06 χ^2 = 38.89		R^2=.07 χ^2 = 12.09	

*p<.05, **p<.01 (two-tailed)

Bold indicates significant finding in the predicted direction

Italics indicates significant finding against the predicted direction

Table C.3

Principal Human Capital and Program Implementation – Pooled SEM (All Schools)

	All Schools (N=799)	
	Coef./Std. Err.	Z
Experience Variables		
Tenure	0.04 (.623)	0.07
Tenure-sq	0.04 (.181)	0.23
Experience	0.01 (.018)	0.49
Human Capital Skills		
Goal Setting	*0.23 (.116)*	*-2.02**
Internal Manager	**-0.22 (.097)**	**-2.26***
Human Capital Manager	*0.03 (.012)*	*2.51**

*p<.05, **p<.01 (two-tailed)

Bold indicates significant finding in the predicted direction
Italics indicates significant finding against the predicted direction

Table C.4

Principal Human Capital and Program Implementation – Human Capital Variables Evaluated Separately

	Coef. / Std. Err	Coef. / Std. Err	Coef. / Std. Err	Coef. / Std. Err
Experience Variables	EMS	HS	EMS	HS
Tenure	-0.12	-0.30	-0.12	-0.30
	(.716)	(1.161)	(.716)	(1.159)
Tenure-sq	0.09	0.13	0.09	0.13
	(.207)	(.353)	(.208)	(.352)
Experience	-0.002	*0.07**	-0.001	*0.07**
	(.022)	*(.033)*	(.022)	*(.033)*
Human Capital Skills				
Goal Setting	0.04	0.002	-	-
	(.084)	(.091)		
Internal Manager	-	-	-0.06	0.02
			(.070)	(.104)
Human Capital Manager	0.03	-0.02	0.03	-0.02
	(.016)	(.020)	(.016)	(.020)

*p<.05, **p<.01 (two-tailed)

Bold indicates significant finding in the predicted direction
Italics indicates significant finding against the predicted direction

Table C.5

Principal Human Capital and Program Implementation– Pooled SEM (Alternate Measure of Human Capital Management)

	Elementary / Middle Schools (N=674)		High Schools (N=179)	
	Coef./Std. Err.	Z	Coef./Std. Err.	Z
Experience Variables				
Tenure	-0.11 (.716)	-0.16	-0.34 (1.166)	-0.29
Tenure-sq	0.08 (.208)	0.41	0.14 (.354)	0.41
Experience	0.001 (.022)	0.05	*0.07 (.033)*	*2.07**
Human Capital Skills				
Goal Setting	*0.46 (.180)*	*2.58**	-0.03 (.185)	-0.18
Internal Manager	**-0.31 (.134)**	**-2.32***	0.03 (.169)	0.16
Human Capital Manager	-0.25 (.242)	-1.01	0.04 (.336)	0.13

*p<.05, **p<.01 (two-tailed)

Bold indicates significant finding in the predicted direction
Italics indicates significant finding against the predicted direction

Table C.6

Principal Human Capital and Program Implementation for Pupil Teacher Ratio Reduction – Pooled SEM

	Elementary / Middle Schools (N=424)		**High Schools (N=92)**	
	Coef./Std. Err.	Z	Coef./Std. Err.	Z
Experience Variables				
Tenure	0.17 (.390)	0.44	0.49 (.866)	0.56
Tenure-sq	-0.02 (.111)	-0.16	-0.15 (.272)	-0.55
Experience	0.01 (.016)	0.59	*0.04 (.016)*	*2.49**
Human Capital Skills				
Goal Setting	-0.09 (.089)	-1.00	-0.03 (.280)	-0.10
Internal Manager	0.05 (.075)	0.72	0.13 (.218)	0.59
Human Capital Manager	0.01 (.009)	1.20	0.02 (.015)	1.07

*p<.05, **p<.01 (two-tailed)
Bold indicates significant finding in the predicted direction
Italics indicates significant finding against the predicted direction

Table C.7

Principal Human Capital Variables and Other Explanatory Variables on Student Progress – Pooled SEM

	Student Progress Scores			
	Elementary / Middle Schools (N=651)		**High Schools (N=183)**	
	Coef./Std. Err.	Z	Coef./Std. Err.	Z
Experience Variables				
Effects Through Class Size Reduction Program				
Tenure	0.06 (.075)	0.86	-0.31 (.638)	-0.48
Tenure-sq	0.01 (.052)	0.19	0.12 (.195)	0.61
Experience	0.0004 (.003)	0.15	0.01 (.020)	0.69
Total Effects				
Tenure	5.64 (4.265)	1.32	-0.29 (1.162)	-0.25
Tenure-sq	-1.40 (1.334)	-1.05	0.13 (.353)	0.37
Experience	0.15 (0.110)	1.33	**0.07 (.033)**	**2.19***
Human Capital Skills				
Effects Through Class Size Reduction Program				
Goal Setting	-0.04 (.055)	-0.74	-0.008 (.029)	-0.29
Internal Manager	0.03 (.047)	0.73	0.01 (.034)	0.29
Human Capital Manager	-0.003 (.005)	-0.67	-0.004 (.007)	-0.59
Total Effects				
Goal Setting	-1.75 (1.759)	-0.99	-1.95 (2.476)	-0.79
Internal Manager	**2.39 (.817)**	**2.93****	**3.90 (1.561)**	**2.50****
Manager of Family Involvement	1.52 (1.605)	0.95	-0.04 (1.875)	-0.02
Indirect Instructional Leader	-0.53 (1.145)	-0.46	-0.08 (1.768)	-0.04
Direct Instructional Leader	0.79 (1.120)	0.70	0.11 (1.074)	0.10
Human Capital Manager	-0.06 (.082)	-0.74	0.11 (.072)	1.50
Class Size Reduction Effects				
Change in Class Size	-0.11 (.153)	-0.75	0.20 (.273)	0.72
Other Explanatory Variables				
Enrollment	2.69 (.941)	2.86*	-0.76 (.832)	-0.91
Change in Enrollment	-0.11 (.065)	-1.68	0.27 (.091)	3.00**
C4E Funding	-0.007 (.004)	-1.92	-0.003 (.005)	-0.67
Class Size Reduction Funding	-0.001 (.002)	-0.39	-0.002 (.003)	-0.71

*p<.05 **Bold** indicates significant finding in the predicted direction

**p<.01 (two-tailed) *Italics* indicates significant finding against the predicted direction

Table C.8

Principal Human Capital Variables and Other Explanatory Variables on Student Performance – Pooled SEM

	Student Performance Scores			
	Elementary / Middle Schools (N=651)		**High Schools (N=183)**	
	Coef./Std. Err.	Z	Coef./Std. Err.	Z
Experience Variables				
Effects Through Class Size Reduction Program				
Tenure	-0.04 (.083)	-0.53	-0.07 (.252)	-0.29
Tenure-sq	0.01 (.020)	0.57	0.26 (.080)	0.33
Experience	-0.0002 (.001)	-0.15	-0.006 (.010)	-0.63
Total Effects				
Tenure	2.02 (1.754)	1.15	3.66 (2.586)	1.42
Tenure-sq	-0.12 (.547)	-0.23	-1.08 (.725)	-1.49
Experience	0.05 (0.063)	0.83	-0.04 (.096)	-0.45
Human Capital Skills				
Effects Through Class Size Reduction Program				
Goal Setting	0.02 (.024)	0.96	0.003 (.013)	0.20
Internal Manager	-0.02 (.021)	-0.97	-0.003 (.015)	-0.21
Human Capital Manager	0.002 (.002)	0.89	0.002 (.004)	0.52
Total Effects				
Goal Setting	*-2.22 (.949)*	*-2.34**	-0.34 (1.161)	-0.29
Internal Manager	**1.70 (.445)**	**3.83****	**1.30 (.567)**	**2.30***
Manager of Family Involvement	0.86 (.684)	1.25	**-1.82 (.697)**	**-2.61****
Indirect Instructional Leader	0.19 (.554)	0.34	-0.24 (.920)	-0.26
Direct Instructional Leader	**1.54 (.462)**	**3.33****	-0.42 (.570)	-0.74
Human Capital Manager	-0.01 (.027)	-0.51	0.05 (.036)	1.35
Class Size Reduction Effects				
Change in Class Size	0.07 (.058)	1.12	-0.09 (.136)	-0.63
Other Explanatory Variables				
Enrollment	0.75 (.422)	1.78	-1.08 (.387)	-2.79**
Change in Enrollment	0.02 (.026)	0.62	0.21 (.042)	4.95**
C4E Funding	-0.003 (.001)	-2.40*	-0.001 (.002)	-0.30
Class Size Reduction Funding	-0.002 (.001)	-2.26*	-0.005 (.002)	-1.90

*p<.05 **Bold** indicates significant finding in the predicted direction
**p<.01 (two-tailed) *Italics* indicates significant finding against the predicted direction

Table C.9

Program Implementation and School Progress and Performance Scores – Linear Regression with Point Estimates for Latent Variables

	School Progress Scores				School Performance Scores			
	Elementary / Middle Schools (N=651)		**High Schools (N=185)**		**Elementary / Middle Schools (N=651)**		**High Schools (N=185)**	
	Coef./Std. Err.	Z	Coef./Std. Err.	Z	Coef./Std. Err.	Z	Coef./Std. Err.	Z
Experience Variables								
Tenure	4.13 (3.807)	1.09	**11.03 (5.348)**	**2.06***	1.36 (1.466)	0.93	**7.01 (2.789)**	**2.51***
Tenure-sq	-1.21 (1.123)	-1.08	**-4.42 (1.650)**	**-2.68****	0.13 (.442)	0.31	**-2.53 (.871)**	**-2.90****
Experience	0.16 (.143)	1.12	-0.18 (.168)	-1.05	*0.12 (.059)*	*2.08**	-0.11 (.094)	-1.14
Human Capital Skills								
Goal Setting	*-3.99 (3.101)*	*-1.29*	-6.54 (3.579)	-1.83	*-4.27 (1.114)*	*-3.84***	*-4.75 (1.878)*	*-2.53**
Internal Manager	**3.37 (1.206)**	**2.79****	**5.36 (1.562)**	**3.43****	**2.17 (.456)**	**4.77****	**2.94 (0.844)**	**3.49****
Manager of Family Involvement	2.34 (1.385)	1.69	-0.13 (1.595)	-0.08	**1.68 (.522)**	**3.22****	**-1.77 (.835)**	**-2.12***
Indirect Instructional Leader	0.94 (1.822)	0.51	2.13 (2.077)	1.02	**1.92 (.643)**	**2.98****	1.78 (1.085)	1.64
Direct Instructional Leader	0.54 (1.040)	0.52	0.64 (.977)	0.66	**1.21 (.384)**	**3.15****	0.31 (.506)	0.62
Human Capital Manager	*-0.05 (.069)*	*-0.76*	0.13 (.075)	1.75	-0.003 (.025)	-0.11	0.10 (.039)	2.48*
Program Implementation								
Change in Class Size	-0.18 (.163)	-1.09	0.12 (.271)	0.45	0.02 (.051)	0.35	-0.04 (.134)	-0.30
	R^2=.07 χ^2 = 41.21		R^2=.32 χ^2 = 60.82		R^2=.23 χ^2 = 186.01		R^2=.28 χ^2 = 72.86	

*p<.05, **p<.01 (two-tailed)

Bold indicates significant finding in the predicted direction

Italics indicates significant finding against the predicted direction

Table C.10

Principal Human Capital and School Progress & Performance Scores – Pooled SEM

	Student Progress Scores- All Schools (N=799)		**Student Performance Scores- All Schools (N=799)**	
	Coef./Std. Err.	Z	Coef./Std. Err.	Z
Experience Variables				
Effects Through Class Size Reduction Program				
Tenure	-0.01 (.014)	-0.38	-0.01 (.017)	-0.64
Tenure-sq	-0.0003 (.003)	-0.08	0.001 (.005)	0.16
Experience	-0.0001 (.0002)	-0.43	0.00002 (.0001)	0.20
Total Effects				
Tenure	1.98 (1.754)	1.13	**0.66 (.295)**	**2.25**
Tenure-sq	-0.12 (.547)	-0.22	-0.13 (.089)	-1.50
Experience	0.04 (0.062)	0.63	0.01 (.012)	0.75
Human Capital Skills				
Effects Through Class Size Reduction Program				
Goal Setting	-0.003 (.003)	-0.93	0.001 (.003)	0.21
Internal Manager	0.003 (.003)	0.93	-0.001 (.003)	-0.21
Human Capital Manager	-0.0004 (.0004)	-0.91	-0.0001 (.0004)	0.21
Total Effects				
Goal Setting	-0.20 (.148)	-1.32	*-0.42 (.163)*	*-2.56*
Internal Manager	**0.26 (.071)**	**3.66****	**0.35 (.075)**	**4.66****
Manager of Family Involvement	0.05 (.114)	0.40	-0.07 (.114)	-0.66
Indirect Instructional Leader	-0.06 (.093)	-0.68	0.047 (.107)	0.41
Direct Instructional Leader	0.07 (.087)	0.80	**0.17 (.081)**	**2.11***
Human Capital Manager	-0.004 (.006)	-0.64	-0.01 (.005)	-1.64
Class Size Reduction Effects				
Change in Class Size	-0.01 (.013)	-1.00	0.003 (.012)	0.21
Fit Statistics	SRMR: 0.054		SRMR: 0.054	
	AIC: 60412.4		AIC: 60314.3	
	BIC: 60815.2		BIC: 60717.1	

*p<.05 **Bold** indicates significant finding in the predicted direction
**p<.01 (two-tailed) *Italics* indicates significant finding against the predicted direction

Table C.11

Principal Human Capital and Student Progress Scores – Pooled SEM (Alternate Measure of Human Capital Management)

	Student Progress Scores			
	Elementary / Middle Schools (N=651)		**High Schools (N=183)**	
	Coef./Std. Err.	Z	Coef./Std. Err.	Z
Experience Variables				
Effects Through Class Size Reduction Program				
Tenure	0.01 (.086)	0.15	-0.06 (.216)	-0.26
Tenure-sq	-0.01 (.029)	-0.33	0.02 (.071)	0.33
Experience	-0.0001 (.003)	-0.05	0.01 (.020)	0.57
Total Effects				
Tenure	5.61 (4.262)	1.32	-0.29 (1.162)	-0.25
Tenure-sq	-1.39 (1.332)	-1.05	0.13 (.353)	0.37
Experience	0.14 (0.111)	1.25	**0.07 (.033)**	**2.19***
Human Capital Skills				
Effects Through Class Size Reduction Program				
Goal Setting	-0.05 (.071)	-0.74	-0.006 (.031)	-0.18
Internal Manager	0.04 (.049)	0.72	0.004 (.028	0.16
Human Capital Manager	0.03 (.045)	0.62	0.007 (.057)	0.12
Total Effects				
Goal Setting	-2.03 (1.896)	-1.07	-2.20 (2.631)	-0.84
Internal Manager	**2.56 (.918)**	**2.79****	**4.10 (1.671)**	**2.45****
Manager of Family Involvement	1.45 (1.555)	0.93	0.33 (1.901)	0.18
Indirect Instructional Leader	-0.49 (1.304)	-0.37	0.91 (2.105)	0.43
Direct Instructional Leader	0.79 (1.120)	0.67	0.12 (1.019)	0.12
Human Capital Manager	0.19 (1.269)	0.15	-2.59 (1.937)	-1.34
Class Size Reduction Effects				
Change in Class Size	-0.11 (.153)	-0.75	0.16 (.278)	0.59

*p<.05 **Bold** indicates significant finding in the predicted direction
**p<.01 (two-tailed) *Italics* indicates significant finding against the predicted direction

Table C.12

Principal Human Capital and Student Performance Scores – Pooled SEM (Alternate Measure of Human Capital Management)

	Student Performance Scores			
	Elementary / Middle Schools (N=651)		**High Schools (N=183)**	
	Coef./Std. Err.	Z	Coef./Std. Err.	Z
Experience Variables				
Effects Through Class Size Reduction Program				
Tenure	-0.01 (.056)	-0.15	0.03 (.115)	0.29
Tenure-sq	0.01 (.017)	0.38	-0.14 (.037)	-0.39
Experience	-0.0001 (.002)	0.05	-0.007 (.009)	-0.75
Total Effects				
Tenure	1.98 (1.754)	1.13	3.66 (2.586)	1.42
Tenure-sq	-0.12 (.547)	-0.22	-1.08 (.725)	-1.49
Experience	0.04 (0.062)	0.63	-0.04 (.096)	-0.45
Human Capital Skills				
Effects Through Class Size Reduction Program				
Goal Setting	0.04 (.033)	1.10	0.002 (.018)	0.11
Internal Manager	-0.02 (.022)	-1.08	-0.002 (.016)	-0.12
Human Capital Manager	-0.02 (.024)	-0.78	-0.002 (.032)	-0.05
Total Effects				
Goal Setting	*-2.24 (1.006)*	*-2.23**	3.15 (2.643)	1.19
Internal Manager	**1.72 (.485)**	**3.55****	-0.92 (.744)	-1.24
Manager of Family Involvement	0.74 (.672)	1.10	**-1.44 (.716)**	**-2.01***
Indirect Instructional Leader	-0.07 (.643)	-0.11	0.77 (1.054)	0.73
Direct Instructional Leader	**1.35 (.491)**	**2.75****	-0.35 (.520)	-0.67
Human Capital Manager	1.08 (.573)	1.89	*-3.07 (.972)*	*-3.16***
Class Size Reduction Effects				
Change in Class Size	0.07 (.058)	1.33	-0.10 (.132)	-0.74

*p<.05 **Bold** indicates significant finding in the predicted direction

**p<.01 (two-tailed) *Italics* indicates significant finding against the predicted direction

Table C.13

Principal Human Capital and Student Progress Scores – Pooled SEM (Pupil Teacher Ratio Reduction)

	Student Progress Scores			
	Elementary / Middle Schools (N=424)		**High Schools (N=92)**	
	Coef./Std. Err.	Z	Coef./Std. Err.	Z
Experience Variables				
Effects Through Pupil Teacher Ratio Reduction Program				
Tenure	-0.01 (.104)	-0.11	0.003 (.630)	0.01
Tenure-sq	0.001 (.022)	0.05	0.004 (.192)	0.02
Experience	- 0.001 (.005)	-0.12	-0.001 (.034)	-0.04
Total Effects				
Tenure	0.71 (4.995)	0.14	-2.80 (7.506)	-0.37
Tenure-sq	0.20 (1.482)	0.14	1.06 (2.248)	0.47
Experience	0.07 (0.149)	0.47	-0.18 (.218)	-0.83
Human Capital Skills				
Effects Through Pupil Teacher Ratio Reduction Program				
Goal Setting	0.01 (.045)	0.12	0.001 (.031)	0.03
Internal Manager	-0.003 (.026)	-0.12	-0.005 (.115)	-0.04
Human Capital Manager	-0.001 (.006)	-0.12	-0.001 (.014)	-0.04
Total Effects				
Goal Setting	-3.06 (3.132)	-0.98	2.62 (3.849)	0.68
Internal Manager	**2.74 (1.051)**	**2.60****	1.82 (2.604)	0.70
Manager of Family Involvement	0.24 (1.584)	1.60	-1.34 (2.163)	-0.62
Indirect Instructional Leader	0.87 (1.888)	0.46	-2.20 (1.904)	-1.15
Direct Instructional Leader	1.05 (1.487)	0.71	1.02 (1.466)	0.69
Human Capital Manager	-0.001 (.097)	-0.01	0.09 (.159)	0.54
Pupil Teacher Ratio Reduction Effects				
Change in Pupil Teacher Ratio	-0.07 (.545)	-0.12	-0.04 (.875)	-0.04
Fit Statistics	SRMR: 0.068		SRMR: 0.105	
	AIC: 34192.9		AIC: 7386.7	
	BIC: 34541.1		BIC: 7590.9	

*p<.05 — **Bold** indicates significant finding in the predicted direction
**p<.01 (two-tailed) — *Italics* indicates significant finding against the predicted direction

Table C.14

Principal Human Capital and Student Performance Scores – Pooled SEM (Pupil Teacher Ratio Reduction)

	Student Performance Scores			
	Elementary / Middle Schools (N=424)		**High Schools (N=183)**	
	Coef./Std. Err.	Z	Coef./Std. Err.	Z
Experience Variables				
Effects Through Pupil Teacher Ratio Reduction Program				
Tenure	-0.01 (.064)	-0.09	-0.02 (.477)	-0.04
Tenure-sq	0.01 (.017)	0.30	0.01 (.146)	0.06
Experience	- 0.001 (.003)	-0.30	-0.003 (.020)	-0.14
Total Effects				
Tenure	-0.14 (2.163)	-0.06	1.15 (3.578)	0.32
Tenure-sq	0.51 (.664)	0.78	-0.20 (1.072)	-0.19
Experience	0.01 (0.070)	0.15	*-0.18 (.090)*	*-2.01**
Human Capital Skills				
Effects Through Pupil Teacher Ratio Reduction Program				
Goal Setting	0.01 (.018)	0.31	0.01 (.061)	0.09
Internal Manager	-0.003 (.012)	-0.29	-0.01 (.102)	-0.12
Human Capital Manager	-0.001 (.002)	-0.34	-0.001 (.008)	-0.14
Total Effects				
Goal Setting	-0.68 (1.274)	-0.53	0.55 (3.032)	0.18
Internal Manager	**1.37 (.479)**	**2.86****	1.61 (2.436)	0.66
Manager of Family Involvement	0.84 (.525)	1.60	0.25 (1.090)	0.23
Indirect Instructional Leader	-0.35 (.760)	-0.47	-1.30 (.932)	-1.39
Direct Instructional Leader	0.36 (.503)	0.72	-0.21 (.624)	-0.33
Human Capital Manager	0.02 (.035)	0.54	0.07 (.056)	1.23
Pupil Teacher Ratio Reduction Effects				
Change in Pupil Teacher Ratio	-0.06 (.186)	-0.34	-0.07 (.511)	-0.14
Fit Statistics	SRMR: 0.069		SRMR: 0.103	
	AIC: 33264.8		AIC: 7265.3	
	BIC: 33613.1		BIC: 7469.6	

*p<.05 — **Bold** indicates significant finding in the predicted direction
**p<.01 (two-tailed) — *Italics* indicates significant finding against the predicted direction