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ESTIMATING THE FIRM'S DEMAND FOR HUMAN RESOURCE MANAGEMENT PRACTICES

BY

BENJAMIN ISRAEL MILLER

A Dissertation Submitted in Partial Fulfillment
of the Requirements for the Degree
of
Doctor of Philosophy
in the
Andrew Young School of Policy Studies
of
Georgia State University

GEORGIA STATE UNIVERSITY
2008

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ACCEPTANCE

This dissertation was prepared under the direction of the candidate's Dissertation Committee. It has been approved and accepted by all members of that committee, and it has been accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Economics in the Andrew Young School of Policy Studies of Georgia State University.

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ABSTRACT

This dissertation investigates two related aspects of firms' choice of HRM practices. The first is why some firms expend a great deal of resources on HRM practices for each employee while others spend very little; the second is the extent to which firms' bundles of HRM practices sort into general discrete employment systems. In order to empirically address these issues, this dissertation uses an economics-based theoretical approach. The key theoretical link to economics is to treat HRM as a separate factor input in the production process, which allows me to derive an HRM input demand function. This function expresses the firm's per employee expenditures on HRM and their choice of HRM system as a function of prices and internal and external firm characteristics. Ordinary least squares, two-stage least squares and linear quantile analysis are used to empirically estimate the HRM demand function using a unique dataset of several hundred firms collected by the Bureau of National Affairs (BNA). The regression equation is found to be statistically significant, implying firms do have an identifiable demand for HRM practices. Second, there are nine independent variables which are found to be stable determinants of the demand for per employee expenditures on HRM practices. Regarding the existence of discrete employment systems, cluster analysis is used to determine if the sets of HRM practices adopted by these firms sort into identifiable types of HRM systems. The results show that there is a discrete set of four HRM systems; however, the HRM demand function does not predict which system a firm will choose.

CHAPTER I

INTRODUCTION

Firms use human resource management (HRM) to coordinate their employees and administer personnel policies and practices. HRM is implemented in firms through a variety of methods such as selection, training, compensation and employee relations. By utilizing these HRM practices, firms are able to staff and organize their workforces so that they can function as the labor input in their production processes. While the labor input is a standard element of every firm's production process, the level and configuration of HRM used to coordinate the labor input typically varies considerably among firms.

One way of quantifying the variation in the firm's use of HRM practices is by observing its per capita expenditures on HRM. For instance, all firms make expenditures on HRM practices to recruit, select, train and compensate each of their employees. However, some firms' production processes require a labor input that can be coordinated by spending relatively little on these HRM practices, while others require large expenditures. These differences in expenditure arise from a variety of internal and external factors. Examples of the former include the level of firm-specific training required by the technology of production and the degree to which creating incentives through compensation policies can improve employee productivity; an example of the latter includes the supply of workers with needed skills and cognitive abilities in the external labor market.

A second dimension of variation in the use of HRM is the composition of the bundle of practices chosen by firms. That is, firms have numerous choices among specific selection, training, compensation, and employee relations techniques and they must decide how to optimally mix and match them. Specific HRM practices may be substitutes, complements or unrelated, and the actual case will strongly influence the configuration of the HRM package. In general we expect the HRM bundle chosen by each firm to depend on many of the same internal and external factors that influence its choice of HRM expenditures per person. For example, if one firm's production process necessitates on the job training while another firm's does not, then there is reason to think that the one firm will not only spend more on training, but also emphasize recruitment and compensation practices that promote long tenure and organizational commitment.

Theorizing the choices firms make with regard to HRM has interested researchers for many years in several disciplines and fields, including management, psychology, economics and industrial relations. However, at present, no model or theory of this choice process has been developed that is either analytical or commands widespread acceptance. As a consequence, the purpose of this dissertation is to fill this void. The primary contribution is to provide an empirical test of an economics-based approach to understanding cross-sectional differences in HRM expenditures among firms. The theoretical link to economics is to treat HRM expenditures as a separate factor input in the firm's production process, which allows for the derivation of an HRM demand curve and input demand function. An approximation of the HRM demand curve will be estimated using linear regression analysis; if the coefficients on key variables are statistically significant then we will have made progress in identifying stable

determinants of this particular demand relationship. Additionally, these results will provide support for a deductive, economic theory of demand for HRM. Finally, the sign and magnitude of the estimated coefficients on the specified independent variables predict both the firm's aggregate demand for HRM as well as its demand for expenditures on individual HRM practices.

The second contribution of this dissertation is to empirically examine whether firms adopt distinguishable bundles of HRM practices. To date, the literature only has studies that develop theoretical presentations on the choice of optimal HRM configurations. Part of my contribution in this dissertation is to empirically test some of these theoretical predictions. To do so, we use cluster analysis to determine if sets of HRM practices among a large group of firms sort into identifiable types of employment systems. We also attempt to provide evidence of the firm-specific and environmental characteristics that lead firms to choose a particular system of HRM practices.

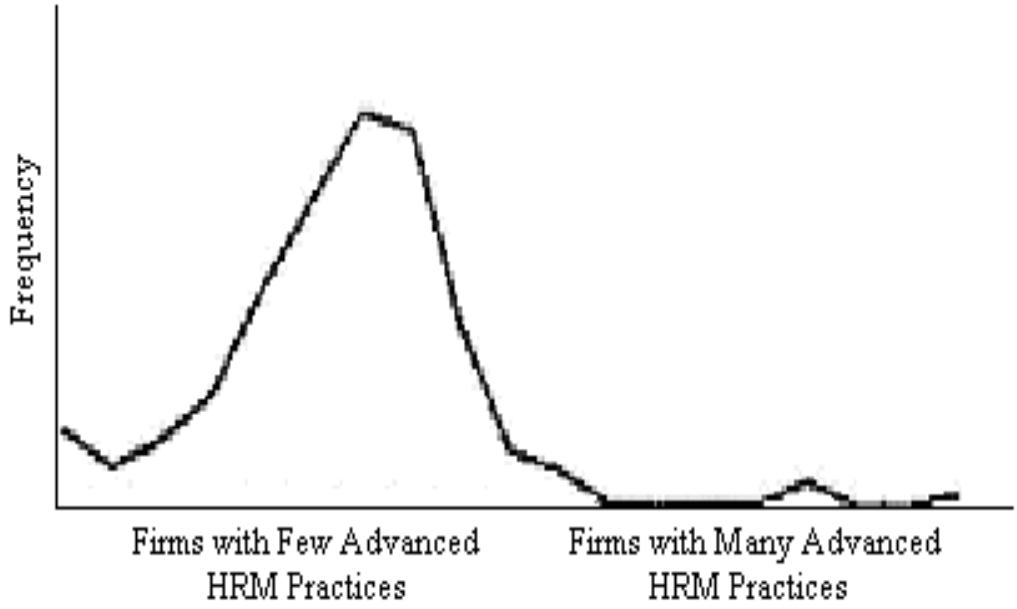
The Research Questions

This dissertation explores both lines of inquiry outlined above, the one being examining firm differences in demand for HRM and the other identifying the more common clusters of HRM practices. The inspiration motivating this research comes from observing frequency distributions describing the use of HRM practices in firms. As will be demonstrated below, the two topics are complementary since they describe different dimensions of the HRM frequency distribution.

The Firm's Demand for HRM

In practice there is considerable variation in the number of HRM practices used by firms as well as the level of expenditures that firms choose to allocate to such practices. The first illustration of this cross-sectional variation is found in *What Workers Want* (Freeman and Rogers 1999). Here, the authors present the firm-level usage of ten HRM practices obtained from a 1994 survey of a nationally representative sample of over two thousand workers. In the survey, the respondents provide information on whether or not their organization utilizes each of a large and diverse set of HRM practices. Then the authors create an index reflecting a ratio of the number of practices found in the firm out of the possible ten. The frequency distribution generated by plotting this measure of the use of HRM in firms using their dataset is shown Figure 1.

Figure 1. Frequency Distribution of the Demand for HRM Practices

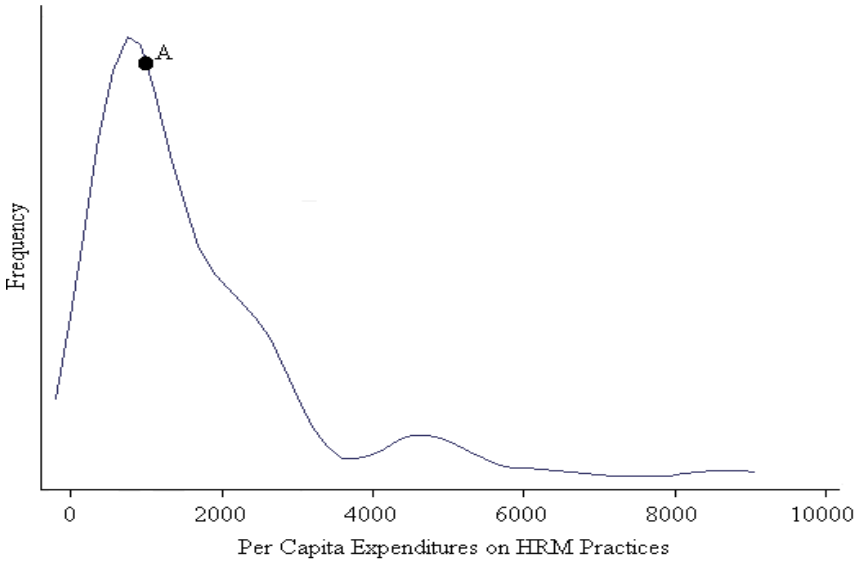


Source: (Freeman and Rogers 2006,124)

We immediately notice in Figure 1 that the surveyed firms made different choices concerning their use of these ten HRM practices. In fact, the distribution of the use of HRM practices in firms demonstrates a bell shape with considerable skewness in the right-hand tail. Some firms use zero of the HRM practices; others use all of them, but most lie somewhere in between the two extremes, in the center of the distribution.

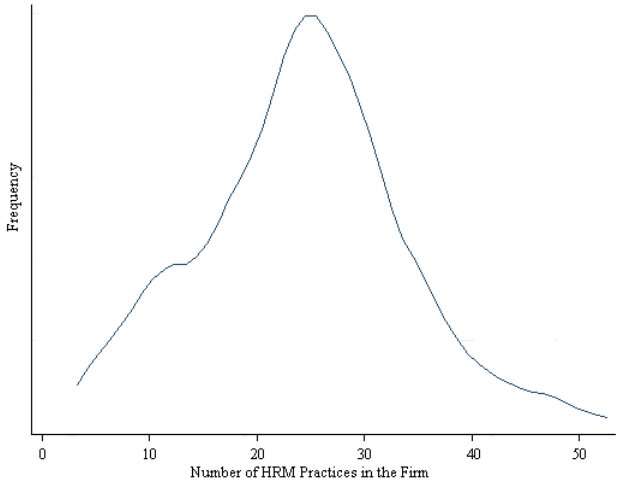
The notion that firms differ in their HRM choices is confirmed by a more recent dataset collected by the Bureau of National Affairs (BNA). This unique dataset, which is integral in conducting the empirical analyses in my dissertation, also provides information that allows me to plot a slightly different specification of the HRM frequency distribution. Instead of plotting a summation of individual HRM practices, the BNA dataset allows me to plot data on each firm's HRM expenditures per capita. This is shown in Figure 2. Like Figure 1, it also generates a bell-shaped frequency distribution with a skewed right-hand tail. As is shown in Figure 2, expenditures for human resource activities and programs range from a low of $152 per employee to a high of $8,709 per employee among the surveyed organizations. However, these small or very large outlays are the exception. Roughly half of employers—those in the middle range between the 25th percentile and the 75th percentile—spend between $615 per employee and $2,069 per employee for HR activities. The choice to focus on expenditures as the method of quantifying the utilization of HRM is detailed in the next section of this chapter; however, it should be noted that if one plots the number of formalized HRM practices in the firm using BNA data, it also shows a wide range of demand. Figure 3 plots the frequency distribution of HRM practices in firms in the BNA dataset. As can be seen in this diagram, the distribution is bell shaped, without being skewed to the right.

Figure 2. Frequency Distribution of the Firm Demand for HRM Expenditures



Source: (Joseph 2005; Joseph 2006)

Figure 3. Frequency Distribution of the Number of HRM Practices Used in Each Firm



Source: (Joseph 2005; Joseph 2006)

A third data source, the 1998 British Workplace Employment Relations Surveys, also yields a frequency distribution with a bell-shape suggesting this empirical pattern is

general and robust even across countries. Here, the use of HRM is measured by an index variable in the same way as Freeman and Rogers, with the exception that thirteen practices are surveyed rather than ten. The frequency distribution plotted with these data demonstrates a bell-shaped distribution, as is the case in the previous two figures albeit without noticeable skewness in the right-hand tail. The frequency distribution is shown in Figure A.1 of this dissertation's Appendix.

From observing these HRM frequency distributions, it is reasonable to infer that firms choose to vary the level of HRM they use to coordinate their labor input. This implies that there is unlikely to be a universal 'best practice' HRM bundle upon which firms are converging. Rather, firms appear to make a conscious decision to use HRM at low, intermediate and high levels. One such point is illustrated by point A in Figure 2. The associated question that the author addresses in this dissertation is: what determines why the firm locates at point A and not at some other point on the distribution?

From an economics perspective, one presumes that this distribution is an outcome of the firm's profit maximization decision, and in particular, its benefit/cost calculation with respect to the HRM factor input. Surprisingly, this straightforward and rather obvious application of standard microeconomic production theory has not yet been utilized in the HRM literature, and not even in the more analytically advanced literature of Personnel Economics (although the latter does emphasize the adoption of profit maximizing personnel practices). Using a profit maximizing framework, the author will show that it is possible to derive an HRM input demand curve and input demand function, and that these can be used to locate the point on the HRM frequency distribution where the firm chooses to position itself.

In practice, HRM demand curves are likely to vary among firms because most organizations have unique internal and environmental characteristics that influence the benefits/costs of HRM practices. As the demand curve shifts from firm to firm, it creates variation in the optimal use of HRM, allowing me to identify points on the HRM frequency distribution and, hence, its overall shape.[1] Thus, one purpose of this dissertation is to derive the input demand function and HRM demand curve and then estimate them empirically through the use of linear regression analysis. Using those results, one can explain the frequency distribution that describes the observed use of HRM in firms by using a few key firm-specific internal and environmental factors, for example firm size and industry, to predict the optimal level of demand on HRM practices.[2]

Identifying Alternative HRM Systems in Firms

Even if one is able to predict the location of a firm on the HRM frequency distribution, this result does not fully characterize the firm's demand for HRM. The reason is because firms can choose different bundles of specific HRM practices even though they are located at the same point on the distribution. The implication of this shortcoming is best explained using the following demonstrative example. What if there is a group of firms that choose to spend roughly the same amount on HRM practices in aggregate, but implement different HRM systems by focusing these expenditures on different HRM practices? In this case, measuring the demand for HRM using the level of

[1] One advantageous attribute of this method of modeling the demand for HRM expenditures is that it can explain the variation of demand for a single firm over time or among many firms at a given point in time.
[2] The specific variables that explain the firms' demand for expenditures on HRM practices are detailed in Chapter IV of this dissertation.

expenditures would imply that these firms are equivalent (e.g., low, moderate or high demand), yet the HRM systems that they use vary. As a result, one would err in assuming that firms with the same level of expenditures always make the same choices when it comes to their management of human resources.

Using the BNA dataset it is possible to demonstrate the existence of this situation. To illustrate, suppose we choose point A on the frequency distribution shown in Figure 2. At point A, there are three firms in the dataset that have nearly the exact same expenditure on HRM practices ($1,010, $1,013 and $1,014); however, each of these organizations chooses to allocate funds to its specific HRM practices differently, as shown below in Table 1. In this table, the HRM systems of the three firms are compared. In order to make this comparison, the percentage of a firm's HRM expenditures that go to each of nine HRM practices are compared to the average rates for the entire dataset. If the percentage of expenditures allocated to an HRM practice is within half a standard deviation of the dataset's mean percentage of expenditures, then the firm is characterized as having a moderate demand for the HRM practice in question. If the percentage of the firm's expenditures on the HRM practice is half of a standard deviation greater (less) than the mean for the dataset, then the firm is identified as having a high (low) demand for the HRM practice in question.

Table 1. The Allocation Resources by Firms with Similar Total HRM Expenditures

Type of HRM Practice	Firm 1 ($1,010)	Firm 2 ($1,013)	Firm 3 ($1,014)
Recruitment	High	Moderate	Moderate
Training	Moderate	High	Moderate
Compensation	Low	Low	Moderate
Benefits	High	Moderate	High
Employee Relations	Moderate	High	Moderate

External Relations	Low	Low	Moderate
Performance Management	Low	High	High
OSHA	Moderate	Low	Moderate
Strategic Planning	Low	Low	Moderate

Source: Author's calculations using data collected from (Joseph 2005; Joseph 2006).

In examining this table it is clear that all three firms have selected different HRM bundles (employment systems). For example, Firm 1 and Firm 2 choose to spend a small proportion of their HRM budgets on some HRM practices, a moderate amount on others, and a large proportion on the rest; however, their systems of HRM practices are clearly not the same. In fact, these two firms only share a common level of expenditures for three HRM practices; administering compensation, external relations and performance management. In contrast to these firms, Firm 3 chooses a pattern of expenditures in which all HRM practices receive a moderate percentage of expenditures, except for benefits administration and performance management activities. Relative to the other firms, these two HRM practices receive a high proportion of the total HRM budget indicating that they are relatively important to the successful management of the firm's human resources. Thus, from observing the decisions of the three firms located at point A in Figure 2, it becomes apparent that firms that share a common level of expenditures on HRM practices may adopt quite different systems of HRM practices.

This observation provides the second line of empirical inquiry in this dissertation. In particular, the author seeks to answer two related issues regarding HRM bundles. First, is there a common HRM system that all firms use, or do they choose different systems? Second, what factors lead a firm to select one of these HRM systems over the rest? In order to answer the first of these two questions, this dissertation utilizes a cluster

analysis that classifies firms based on how they choose to apportion their total HRM expenditures to the various practices they select. In the end, the results of this analysis identify a set of HRM systems into which all firms can be categorized. Using this information, it is possible to answer the second question stated above by identifying the firm-specific and environmental characteristics that are associated with each cluster of firms. Thus, the findings from this analysis complement the information gained from answering the first of my empirical research questions. With the results from both lines of inquiry it is possible to predict a firm's level of expenditures on HRM, as well as the way in which the firm's expenditures aggregate into distinct HRM bundles.

Research Design

This dissertation relies heavily upon a unique dataset containing detailed firm level information from 2005 on 381 firms collected by the Bureau of National Affairs (BNA). The quality and depth of information on firms' HRM activities in the BNA dataset is superior to other sources, and is integral to estimating the empirical models that in this dissertation. A more thorough explanation of the dataset is found in Chapter IV.

The Firm's Demand for HRM

One notable aspect of this study is that it analyzes the demand for HRM as a factor input in the standard neoclassical model of production, just as labor demand has traditionally been evaluated (Hamermesh 1993). This approach to evaluating the research question is quite different than prior research in management which was focused

on the HRM-firm performance relationship (Paauwe and Boselie 2005). Indeed, it changes the line of causality from that which is used in management models. That is, management studies look at HRM as a predictor of differences in firm profits while this dissertation looks at differences in prices as well as firm and environmental characteristics as a predictor of a firm's demand for HRM.

In order to empirically estimate the firm's HRM input demand function correctly, the first issue which must be addressed is how to quantify the demand for HRM. While an index reflecting the number of practices used in a firm has traditionally been the way of communicating its use of HRM, the dependent variable used in this model specification is the log of a firm's HRM expenditures. There is no doubt that the number of practices and the level of expenditures are both able to indicate the level of demand for HRM in an organization; however, the latter measure is preferable. By lumping all HRM practices into a single composite score with each practice taking the same value, it is possible to overstate the presence of HRM in some firms while not recognizing the efforts of others. For example, assuming that placing an anonymous complaints box in the lunch area is the same as implementing a formal employee involvement program where workers meet regularly with managers could be as erroneous as treating two capital goods such as a tractor and a horse-drawn plow the same way.

As for the independent variables used in the HRM demand function, this dissertation specifies variables such as the size of the firm's workforce, wages, non-labor operating costs, the demographic, occupational and knowledge characteristics of the workforce, the sector in which the firm operates (public/non-profit/private), the level of the surveyed department in the organization, union activity, labor and product market

characteristics, the strategic role of the HR department within the firm, and the degree to which a firm's ideology favors the provision of a high level of HRM activities for its employees.[3]

Regression and quantile analyses are used to empirically estimate the demand for HRM demand in this dissertation. Both of these methods are employed as they work together to give a thorough evaluation of the firm's demand for expenditures on HRM practices. In particular, the quantile analysis is able to check to see if the OLS estimates are correct for the entire sample population. When the OLS estimates are not valid, they are replaced by the results from the quantile analysis. The reason that the results from the quantile analysis are not used exclusively in this dissertation is that OLS results are more precise and it is more straightforward to draw inference based on OLS.

Thus, the first step taken in the empirical evaluation of the HRM input demand function is to estimate it using ordinary least squares (OLS) linear regression. In OLS the estimated coefficients connote the behavioral responses of a sample-weighted average or typical firm to changes in the explanatory variables. While informative, OLS results are not necessarily representative of all firms. In contrast to OLS which only evaluates the covariates at the conditional mean, the key aspect of quantile analysis is that the influence of the covariates on the demand for HRM is evaluated at different points along the conditional distribution, called quantiles. This method begins by breaking down the dataset into one hundred groups that categorize firms according to their level of

[3] Several of these variables (i.e., wages and skill of workers, occupational composition of the workers) are arguably outcome variables that are determined in conjunction with HRM practices. However, here these are treated sequentially, with the structure of the workforce being determined first and then the HRM practices.

expenditures on HRM practices. Then, once this has been done, OLS is used to evaluate the behaviors of each group on its own.

In doing this, it is possible to see if the covariate has a stronger or weaker impact on the demand for HRM in a given region of the distribution by observing if the coefficients are getting larger or smaller in magnitude across quantiles (i.e., as the HRM expenditures increase). If the magnitudes of the coefficients do not have an increasing or decreasing trend, then one can say that the OLS results are reasonable for all firms. However, if the opposite is true, then the OLS results only predict the HRM expenditures of firms whose expenditures are similar to the conditional mean of the sample population. In the latter situation, the estimated results of the quantile analysis are utilized since they are able to explain the behavior of all firms whereas OLS cannot. Thus, the quantile analysis complements the explanatory power of OLS results in that it identifies which independent variables in the HRM input demand function have coefficients that are estimated correctly by OLS. In addition, quantile analysis provides reliable estimates on the explanatory variables on interest when those produced using OLS do not fully characterize all of the firms in the sample population.

After, estimating a model that predicts the firm's aggregate expenditures on HRM practices, this dissertation also disaggregates the analysis by looking at expenditures on individual HRM practices. The purpose of this is to investigate whether the influence of the independent variables varies across HRM practice types. For instance, is the change in effort from a marginal increase in the level of education of a firm's workforce different for training expenditures relative to benefits administration? To determine if such relationships exist, nine regressions are estimated where the dependent variable is defined

as the percentage of total per capita expenditures on each of the following HRM practices: recruitment, training, compensation administration, benefits administration, employee relations, external relations, personnel management, health and safety activities, and strategic planning.

Identifying the HRM Systems Used in Firms

The second course of inquiry explored in this dissertation aims to identify specific systems or bundles of HRM practices across firms. To do this type of analysis, we perform a cluster analysis that groups firms according to their observed use of various HRM practices. The methodology used to perform the cluster analysis in this dissertation is conducted in a similar, albeit more sophisticated, fashion to other studies such as *Manufacturing Advantage: Why High-Performance Work Systems Pay Off* (Appelbaum, Bailey, et al. 2000).[4]

In this dissertation, firms are clustered according to the percentage of their HRM budget that they allocate to each of the nine categories of HRM practices mentioned above using a method that combines hierarchical and K-clustering (non-hierarchical) techniques. Even though the K-clustering procedure is more precise, both techniques are needed because they work together to produce the final results. Performing K-clustering requires the researcher to manually define a point of reference that serves as the starting point of each cluster, called a centroid, and the number of clusters that should be formed. The preferred way to specify centroids and the number of clusters is through the use of a hierarchical technique like agglomeration clustering. Agglomeration clustering works by starting with the assumption that each firm is its own cluster. Next, a measure of

[4] See Chapter V for an outline of the research method used in this analysis.

dissimilarity is calculated between each cluster; based on these measures the two most similar clusters are combined. This procedure continues until all firms are partitioned into a single group that classifies all firms. After this process is complete, a centroid is defined by observing the characteristics of the mean firm in each cluster. That is, the centroid is a vector of nine percentages that show the way firms in each cluster distribute their HRM budget on average. Using these centroids as points of reference, a mathematical K-clustering procedure that minimizes intra-cluster dissimilarity called the K-means technique is used to cluster firms according to their system of HRM. In the end, the combination of these two clustering methodologies identifies a handful of systems of HRM practices that can be used to characterize all firms.

By using a cluster analysis to neatly place firms into a small number of generalized groups we are able to derive insights into the types of HRM systems that firms adopt. This is done by observing, in each category, which HRM activities are implemented with relatively high, moderate, and low intensity. By grouping the elements of HRM that are implemented with a high level of intensity, we can identify which types of practices have complementary properties in each cluster of firms. Next, once the analysis is completed, an evaluation of the internal and external characteristics typical of the firms found in each cluster provides added information on their demand for a particular HRM system.

Plan of Study

The rest of this dissertation is organized into the following chapters. Chapter II provides a review of theoretical approaches to understanding firm HRM choices already found in the literature. Chapter III presents a detailed account of the theoretical model that is used to explain the firm's demand for expenditures on HRM practices and its choice of HRM system. Then, Chapter IV describes the dataset and methodology used to estimate the factor input model and presents results from estimating the model. Following this, Chapter V details the methodology used to perform the cluster analysis and presents its results. Finally, Chapter VI will present conclusions as well as suggested avenues for furthering this body of research.

CHAPTER II

THE FIRM'S USE OF HUMAN RESOURCE MANAGEMENT PRACTICES: A REVIEW OF THE LITERATURE

The previous chapter described the two empirical research questions that are explored in this dissertation: first, explanation of the individual firm's position in the HRM frequency distribution and, second, evaluation of the extent to which firms' HRM practices cluster into distinct "employment systems". To address these issues, this dissertation will present and use a theoretical framework derived from the microeconomic theory of production. To better appreciate the contribution of this model, and the empirical analysis we conduct based on it, one needs some knowledge and perspective on the existing literature as it bears on employment systems and the firm's choice of HRM practices. Accordingly, this chapter presents a summary review of the relevant literature.

Personnel Economics

Personnel Economics (PE) emerged in the 1980s and has grown into a substantial subfield of labor economics. The goal of PE is to use traditional microeconomics to explain various factors of firm's people management policies, practices and systems. In effect, PE extends economics from the operation of external labor markets (ELMs) to the operation of internal labor markets (ILMs). In all cases PE assumes that agents attempt to optimize, although their behavior need not be super-rational. Worker output is not fixed, but varies with effort and worker interaction in different ways depending on a

firm's output and production process. For example, optimal pay may be compressed relative to marginal products in production processes requiring cooperation among workers, while being dispersed relative to marginal products in firms where competition among workers produces highly valued outputs. Pay, promotion, and other workplace outcomes are often based on relative rather than absolute performance. And PE attempts to be not only descriptive but also proscriptive (normative); that is, it both helps explain how firms differ in the way they structure workplace governance and compensation and provides advice on how they should structure these based on their circumstances. To get a better sense of how PE addresses the firm's HRM choices it makes sense to summarize several of the literature's leading theories.

One aspect of the employment relationship that commands sizeable attention in the literature is the way in which a firm chooses to compensate its managerial workers. For instance, many large companies currently give employees large increases in pay and benefits when they are promoted to the upper echelons of the firm's hierarchy. One implication of this trend is that an employee's salary can increase dramatically due to a promotion even though the value they add to the firm may not change much from one day to the next. This seems to violate standard human capital theory which has traditionally predicted that employees' wages reflect their marginal productivity to the firm. In contrast to Human Capital theory, PE uses Tournament theory to explain the large discrete increases in pay that accompany promotions to the top levels of a firm's hierarchy (Lazear and Oyer 2007).

Tournament theory argues that the compensation structure for large firms is similar to a golf or tennis tournament where the earnings structure is used to motivate

athletes to perform at the highest level possible. This is done by making the winnings of the top performer notably higher than for athletes that finish in sixth or seventh place, and far greater than the winnings of the people whose performance leaves them in the middle of the pack. Relating this framework to the business environment, Tournament theory suggests that the level of compensation received by executives/upper management in large firms is used to motivate employees at lower levels to aspire to be promoted to such a position. By making the reward for being promoted very high, firms are able to create a competitive environment that motivates young managers to work very hard in hopes of being chosen for promotion. This leads to higher firm performance as the firm receives a higher level of output from all the young managers who are vying for the promotion, but only has to reward a few of them in the future with costly executive compensation packages (Neilson 2007).

A second aspect of compensation that is explained by PE is the compression of wages in non-managerial positions in firms. Standard neoclassical microeconomics predicts that employers offer prospective employees a wage during the hiring process that reflects their predicted value to the firm; however, in practice, some firms choose to pay highly productive workers less than their share of the output while over-compensating workers with low productivity. To be more specific, pay compression occurs when firms maintain a variance in their payroll which is less than the variance in the performance of their workers. To explain this aspect of firm behavior, PE theorizes that a compressed schedule of wages are chosen purposefully by firms to create an environment that fosters employee teamwork and cooperation and thus improves productivity and profit (Lazear and Shaw 2007). Lazear (1999) tests this theory by looking at the variance in the wages

and performance of firms. The results of the regressions in his empirical study show suggestive proof that firms promote compressed wages to develop a work environment characterized by compliance and coordination, which leads to increased profits.

The main contribution of PE to evaluating the behavior of firms is that it uses the fundamental principles of neoclassical microeconomics, most fundamentally profit maximization, to address the ways in which individual HRM practices such as compensation are and are not structured by firms based on differing benefits and costs. While this does provide both a general framework for analysis and helps researchers understand the specific choices that firms make when dealing with a particular HRM practice, PE researchers have not evaluated the firm's aggregate use of HRM. Therefore, one significant contribution of this dissertation is that it adds to PE by empirically justifying a theory that can address the firm's overall use of all its HRM practices, and predict the firm's location on the HRM frequency distribution shown in Figure 2.[5]

Human Resource Management and Organizational Performance

Traditionally, management research assumes that investing in HRM improves organizational performance which, in turn, earns additional profits for the firm. This line of thinking implies a line of causality from HRM to performance (i.e., HRM→Performance) (Huselid 1995; Ichniowski, Shaw, et al. 1997; Becker and Huselid 1998; Marsden 1999; Boselie, Dietz, et al. 2005; Hesketh and Fleetwood 2006). As a

[5] This conclusion assumes that the HRM categorical expenditure data from the BNA survey provides (at a minimum) ordinal measures of HRM adoption within each category. Because PE scholars focus on the specific structure of personnel policies (say the sequencing of pay over a career for a *given* present value), some might argue that analysis of the BNA expenditure data do not specifically address many of the issues addressed by PE.

result of this assumption, the empirical literature is dominated by articles which seek to test its implication by using a measure of firm performance as the dependent variable while specifying various HRM practices and relevant control variables as independent explanatory covariates.

Since the mid-1990s, some trends have emerged in this burgeoning literature. For example, researchers tend to define firm performance using measures such as labor productivity, turnover, profits and the scrap rate (Boselie, Dietz, et al. 2005). In some studies, the HRM practice variables are entered individually, while in other studies some form of aggregated measure is used as is done in this study. In addition, certain control variables have become standard in this literature, some of which are used in the estimating equation specified in Chapter IV. Table 2 lists the most popular control variables, and includes information on the frequency with which the control variable was used in the literature between 1994 and 2003.

Table 2. Commonly Used Control Variables

Control Variable	Incidence*
Firm size**	62%
Industry or Sector**	39%
Union presence/coverage**	31%
Firm Age	24%
Gender of Workforce**	19%
Technology**	14%
Employee Age	13%
Worker Tenure/Experience	12%
Capital Intensity**	10%
Education**	9%
Foreign Ownership	9%
Subsidiary**	9%
*Incidence is calculated at the proportion of the 104 studies written in this field between 1994 and 2003 that use the control variable. **Used as a covariate in the model evaluated in this dissertation	

Source: (Boselie, Dietz, et al. 2005)

For over a decade, the theoretical core of HRM research has assumed that investing in HRM practices leads to outcomes which improve the performance of firms. Consequently, empirical evaluations of the HRM-Performance relationship have specified models where HRM is an independent variable that serves as a predictor of firm performance. This approach, however, begs a fundamental question which an economist is trained to spot. That is, it would appear that the HRM variables are, in fact, choice variables for the firm, making it illegitimate to put them on the right-hand side of the profit regression equation as exogenous independent variables. Restated, standard micro theory suggests that the goal of firms is to maximize profits, and therefore, firms accordingly choose their optimal amount of HRM much the same way that they choose their capital and labor inputs. This perspective suggests that the Performance = f (HRM) type regression is mis-specified, as the HRM variables are themselves endogenous choice variables. One serious consequence of the HRM variables being endogenously specified is that the regressions will yield biased results. This calls into question the conclusions based on the results of past studies which have hypothesized a positive relationship between HRM and firm performance. That is, it may well be the case that firms using particular HRM practices perform at higher levels, but it need not follow that other firms should adopt such practices. If HRM choices are endogenous then one cannot reject the hypothesis that most firms are adopting (or have a tendency to adopt) HRM practices that are optimal for their specific circumstances, only some of which can be observed (controlled) by researchers.

A second weakness in this field is that researchers tend to make conclusions using theories that are inductive and normatively driven. Most management studies, for

example, claim that a "high performance" HRM approach (e.g., teams, employee involvement, pay for performance, etc.) is the profit maximizing approach, but this is often asserted more on the basis of what successful firms have done rather than what a value-free theory predicts a firm will do. Following the suggestions of Friedman (1953), a preferred method for conducting research in the field of HRM is to take a positive approach where a canonical model is used to deduce and derive hypotheses.

Pfeffer (1994) is one example of an inductive study in the HRM literature. In his oft-cited book, Pfeffer identifies the HRM practices used in a few of the most successful companies from 1972-1992, and then generalizes from these cases to propose the best HRM practices for all firms based on these observations. The broad conclusions which are reached by interviewing executives from a handful of firms in Becker and Huselid (1999) is a second example of inductive reasoning in the HRM literature. A more recent study that continues the trend of inductive reasoning is found in Farndale and Paauwe (2007). In this study, the authors establish how institutional and competitive factors impact the use of HRM in multinational firms using data from fourteen firms that operate in a total of seventeen countries. The main problem with using an inductive approach is that it uses individual observations to make generalizations which might not actually be appropriate for all firms in the economy. In practice, consultants from Mercer's human capital strategy group validate this problem. They find that a system of 'best practices' "…works perfectly in some types of businesses, [though] other sectors are simply not suited to it" (Cooper 2000, 30).

The above identified problems notwithstanding, the HRM literature has valuable insights we can learn from and use in this dissertation. To this end, this section provides

a closer review of several lines of inquiry that have been developed within the HRM literature.

Strategy and the Resource Based View

Within the HRM literature, the *Resource Based View* (RBV) of the firm is a commonly used theory which explains how firms choose their inputs. Edith Penrose's 1959 article on *The Theory of the Growth of the Firm* was a 'coming out' of sorts for identifying firm resources as a source of competitive advantage (Fahy and Smithee 1999). However, it was a quarter century later when Wernerfelt (1984) first provided a concrete theoretical assertion of a RBV which incorporated HRM practices as 'firm resources'. Rather than focusing on the external characteristics of the industry in which firms operate, Wernerfelt proposes a shift in the research paradigm governing the analysis of firm behavior and comparative advantage towards the study of the internal resources used by the organization in production (Wright, Dunford, et al. 2001).

In his oft-cited article on this subject, Barney (1991) provides the benchmark explanation of the school of thought behind the RBV of the firm. He notes that firm resources (e.g., assets, capabilities, organizational processes, firm attributes, information and knowledge) can be a sustainable source of competitive advantage for firms as long as the resource meets four conditions. First, the resource should provide the firm with value by improving efficiency and effectiveness in production. Next, the resource should be rare among competitors since there is no competitive advantage gained by firms if they are all doing the same thing. The third required characteristic of the resource is that it be perfectly inimitable. The inimitability of the resource can be due to historical conditions,

causal ambiguity or social context. Finally, the resource must be unable to be substituted by any other product found in the market.

Using this definition of the RBV of the firm, it is reasonable to think that HRM practices can work to improve profits and provide sustained competitive advantage in both the short and long run (Becker and Huselid 1998; Lockett and Thompson 2001). The germane aspect of the RBV to this dissertation is that firms that make HRM a true 'resource' (i.e., source of competitive advantage) will necessarily use HRM in different ways because of the specific requirements outlined by Barney (1991). Since systems of HRM are rare, inimitable and have no substitutes, there have to be differences in the systems used between firms by definition. In addition, it is logical to expect that firm expenditures will fluctuate according to the specific package of HRM practices chosen by each firm. Thus, the RBV provides a theoretical foundation that predicts the variation in firm expenditures on HRM and the use of specific practices between firms; however, this is only true for those firms whose labor input comprises a true source of competitive advantage. Unfortunately, the RBV does not explain the variation in demand for HRM expenditures or the choice of HRM system for those firms whose competitive advantage is found in their technology of production, differentiated products, or a scarce natural resource.

Contingency Theory

While the RBV is one basis for HRM theorizing, there are also other theoretical frameworks used within the HRM literature. The next most popular way of explaining the firm's use of HRM is contingency theory, which is more consistent with economic

theory and the approach in this dissertation. It maintains that a firm's choice of HRM practices is contingent on its internal organizational characteristics and its external economic, political and social environment. Based on these characteristics, firms make HRM choices so that their HRM practices fit well into the firm's internal and external environment.

The key concept in contingency theory is *fit*. There are two components of fit that influence the firm's choice of HRM practices: vertical fit and horizontal fit. Achieving vertical fit requires firms to complement their overall strategic plan by designing HRM practices in a way that best aligns the interests and behaviors of workers with the values and needs of the company (Werbel and DeMarie 2005; Lepak and Snell 2007, 219) . On the other hand, horizontal fit is attained when HRM practices are implemented in a complementary way so that they work together towards a common goal.

A firm's HRM strategy should also be geared towards the economic, political and social conditions of the external environment in which it operates. The key aspect of external fit is to make HRM choices that allow the firm to remain flexible so that it can accommodate for changes in these conditions should they occur (Wright and Snell 1998). Some external contingencies which firms might consider when choosing their demand for HRM include the availability and variability of qualified workers in the labor market, employee turnover, social norms, and the degree of government intervention and/or oversight.

Rather than viewing contingency theory and the RBV of the firm as being separate entities, some authors have attempted to integrate the two views of the firm into a single model. They postulate that there exists some equilibrium "level of fit" for each

firm and its HRM practices, and this fit is contingent on how the HRM practices create and/or support the firm's competitive advantage (Wright and McMahan 1992; Wright and Snell 1998; Wright, Dunford, et al. 2001; Boselie, Dietz, et al. 2005; Werbel and DeMarie 2005).

As it pertains to this dissertation, the most important implication drawn from contingency theory is the role that a firm's internal and external characteristics play in its HRM decisions. By observing these firm and environmental attributes, it is possible to predict if a firm will choose to make large, moderate or small investments in HRM practices. In some firms, the internal and external characteristics of the firm will allow it to profitably engage in a very broad range of HRM activities. In these types of firms it is rational to expect a very high level of HRM expenditures. As a result, these firms would find themselves in the right-hand tail of a frequency distribution that plots the level of firm expenditures on HRM, as shown in Figure 2. Other workforces will justify little or no investments in HRM and find themselves in the left-hand tail of the frequency distribution. Of course, most of firms employ a diverse workforce that caters to a moderate level of expenditure, which causes these firms to be located in the middle of the distribution.

Ability, Motivation and Opportunity to Participate

A third theory which has received much attention is *Ability, Motivation and Opportunity* (AMO) theory. This theory claims that firms will choose HRM practices that improve employees' motivation, and their knowledge, skills and abilities (KSAs) since these lead to higher productivity and profit (Appelbaum, Bailey, et al. 2000; Bailey,

Berg, et al. 2001). However, AMO does not address the choices made by firms where there is no capacity or opportunity for additional worker effort to improve profits. In these situations, firms may find it most profitable to administer and coordinate their labor input through HRM practices that do not increase the KSAs or motivation of employees such as direct managerial supervision. Therefore, it appears that AMO cannot stand on its own as a theory that adequately evaluates the HRM decisions of all firms.

Nonetheless, there is a valuable implication of AMO that can contribute to a more general theory of HRM. When the human element of production substantially influences the output of the firm, firms will find advanced HRM policies and practices more profitable; however, if the technology of production (e.g., assembly lines or machinery) or the supply of raw materials drives the production process, then there is less incentive for firms to make significant HRM investments.[6] Instead, firms will adopt other HRM strategies and systems, such as a "low involvement" or even sweatshop employment system (Lepak and Snell 2007). As it pertains to explaining the frequency distribution, shown in Figure 2, the former group of firms is more likely to be located to the right of the center of the distribution, while firms in the latter group are generally located to the left of the center. When the influence of AMO on a firm's profit position is more moderate it will tend to locate itself in the center of the frequency distribution.

[6] In the PE literature this type of decision is characterized as a tradeoff between monitoring costs of worker effort and product quality – the firm can have low pay but carefully monitor easily measured outputs, or the firm can pay more and monitor less if the worker output quality cannot be readily measured and depends on workers effort and motivation.

A Systems Based Approach

Historically, a large share of the HRM literature has focused on evaluating the adoption of individual HRM practices as an isolated choice rather than as part of an overall package or system (Hempel 1996). However, it is not totally evident that using single practices as the standard unit of analysis for research is the best avenue for predicting this aspect of firm behavior. Rather, it is becoming increasingly apparent that firm decisions focus on HRM systems in practice because firms can earn above normal profits by exploiting complementarities between HRM practices. As a consequence, evaluating firms' HRM decisions should focus on predicting the HRM systems that they choose instead of concentrating on individual practices (Huselid, Jackson, et al. 1997; Luthans and Sommer 2000).

Empirical support for the presence of complementarities between individual practices in the HRM production function is found in (Black and Lynch 2001). This study evaluates the decisions of over 3000 US firms in the late 80s and early 90s by specifying several HRM practices and a vector of control variables as right hand side covariates that predict variation in the dependent variable, labor productivity. To see if synergies exist in the production function, Black and Lynch include interaction terms in their model that integrate the marginal effects of two HRM practices on productivity. Standing alone, none of the HRM variables are statistically significant in the estimated regressions. However, the authors discover that certain synergies of HRM initiatives do have a positive and significant complementary impact on a firm's productivity. Specifically, Black and Lynch comment that the most productive bundle of HRM practices would be to use benchmarking, TQM profit sharing for non-managerial workers

and have 50% of its workers meeting on a regular basis. The combination of these actions in a nonunion firm implies a 4.5% increase in productivity compared to all other nonunion plants according to the data.

Guthrie (2001) is a second study which shows that combining complementary HRM practices has a significant positive impact on firm performance. In his analysis of firms from New Zealand, Guthrie shows the increased performance that comes from the interaction of two complementary HRM practices using an identical methodology to that of Black and Lynch. Here, the labor productivity of the firm is predicted by variables that represent the firm's participation in turnover and employment practices, an interaction term that equals one if the firm participates in both practices and zero otherwise, and a vector of control variables including size, age, unionization, primary industry and the firm's tendency to pay wages that are higher than the market level (e.g., efficiency wages). The estimated coefficient on the interaction term created by combining these HRM practices is found to have a statistically significant and positive influence on firm performance. This indicates that there is an additional positive benefit that accrues to the firm's labor productivity when the two practices are implemented simultaneously versus when they are used in isolation. Thus, Guthrie empirically supports the claim that it is more beneficial from a productivity perspective for firms to implement systems of HRM practices versus unrelated individual practices.

The results of these two studies highlight the existence of synergies that are created by implementing systems of complementary HRM systems versus using unrelated practices. While the evidence that the most logical unit of analysis for evaluating firm decisions in the HRM system is clear, this concept is still under-theorized

(but see Begin 1991, Marsden 1999). A substantial contributing factor to this trend in the analysis of firm choice is that it is hard to categorize the various HRM systems found in modern day U.S. organizations succinctly into a few discrete groups. This issue is inherent to an evaluation of HRM systems because each firm chooses a system that addresses its own specific needs, imparting significant firm-by-firm heterogeneity.

This problem, called the classification problem, has been a serious constraint on the development of a systems-based approach to studying HRM. To make headway on the classification problem, some authors have inductively formulated a few classes of systems which they suggest are able to successfully categorize firms into discrete groups. One example is *Structure in Fives: Designing Effective Work Systems*, by Mintzberg (1983). In his book, Mintzberg argues it is possible to classify the HRM systems found in all firms into five categories. He states that "…a great many organizations…tend to design structures rather close to one of the [five] configurations. No structure matches any one configuration perfectly, but some come remarkably close…" (1983, 288). He explains that organizations select their system of HRM based on situational factors[7] and the condition of the environment in which they operate. The proposed HRM systems include: 1) the simple structure where workers are managed through the use of direct supervision; 2) a machine bureaucracy in which a standardized technological process controls worker output; 3) a professional bureaucracy where firms hire workers with accredited skills and then give them freedom to practice their trade with little supervision or direction; 4) the adhocracy system where firms are only focused on innovation; and 5)

[7] Mintzberg states that the key factors describing organizational structure are job specialization, behavior formalization, training and indoctrination, unit grouping, unit size, type of planning and control system, liaison services, vertical decentralization of authority and horizontal decentralization of authority.

the divisionalized form used by large organizations where each division has its own specific needs and is delegated the power to manage its own HRM activities.

These five theorized HRM systems can help explain the distribution of firm expenditures on HRM practices in the economy. Two identifiable systems are proposed that use HRM practices with moderate intensity (machine bureaucracy and professional bureaucracy); two other systems are on the opposite sides of the spectrum–a high intensity system (adhocracy system) and a low intensity system (simple structure). The fifth system has intensities ranging from low to high (divisionalized form).[8] Thus, if firms randomly drawn from a population are distributed uniformly across these groups, then the aggregate bell-shaped frequency distribution may be partly explained by the individual HRM systems having firms placed toward the middle of their respective distributions (i.e., in bell-shape form within systems).

Following the work of Mintzberg, Begin (1997) continues to develop the theoretical foundations which describe and predict the HRM systems used in organizations. While there are several significant contributions found in his book, the key with respect to this dissertation is that he outlines the firm specific and environmental traits that are characteristic of the firms for each of the five proposed HRM systems. Later in this dissertation, a cluster analysis is performed to see if the observed use of different types of HRM practices in firms empirically validates the proposed HRM systems detailed above, with the exception of the divisionalized form.

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[8] Unfortunately, the variation in intensity within the divisionalized category means that it can not be easily distinguished using cluster analysis and, as a result, this dissertation focuses on the other proposed systems when conducting the cluster analysis. In the end, this assumption should have little bearing on the final placement of firms into clusters since the divisionalized firms are most likely distributed somewhat equally across each of the HRM systems excluding the simple structure. This is a result of the divisionalized system being nothing more than the addition of two other systems being implemented simultaneously in separate divisions of one firm.

To date, discussion of HRM systems in the management literature has remained largely theoretical and few quantitative studies have examined the issue. One exception is by Appelbaum, Bailey, et al. (2000). Here, the authors investigate the organizational practices of steel mills in the mid-1990s. The authors find that the HRM practices used in these firms during this time period unambiguously fall into four distinct categories of HRM systems: traditional, incentive, participatory and high performance work systems (HPWS). The traditional system is characterized by little or no participatory work, or incentive practices. Next, incentive systems use employment security and quality/performance incentives to enhance the profitability of the firm. Third, participatory systems offer workers increased voice and empowerment to increase motivation and effort in the workplace. Finally, the organizations with HPWSs employ both participatory and incentive based practices in their systems.

One interesting observation which can be made from these results is that if firms were randomly distributed in a uniform way across these four work systems, then the resulting frequency distribution of HRM practices in firms would be quite similar to the frequency distributions of interest shown in the previous chapter. A minority of firms would have very few practices (traditional system), about half the firms would have moderate amount of practices (incentive and participatory systems), and the remaining 25% of the firms would be out on the right hand tail (HPWS). An additional important aspect of this study is that it provides the basis for the clustering methodology used in this dissertation. A detailed description of this clustering methodology is discussed in Chapter V of this dissertation.

Labor Process

A third theoretical perspective on the use of HRM in firms, the "labor process" theory (LP), comes from sociology, management control studies and radical economics. According to Marx's perspective on firm operations, there are three elements which are common to the production function of all firms: output, capital and labor. Output and capital are inert, but labor is 'living labor' in that it is embedded in human beings. Thus, in the LP model a distinction is made between "labor" and "labor power" (this is not "bargaining power"). Labor is the time of the worker the firm purchases for a wage, whereas labor power is the actual amount of effort ('work') done by the labor. Obviously, labor can be 40 hours per week, but labor power can be zero if the worker sleeps every day on the job or, for that matter, negative if there is sabotage or high error costs in the production process (say, a serious accident resulting from a sleeping worker).

When there is some doubt as to the labor power that each employee will regularly contribute, it becomes difficult for firms to correctly predict the optimal, profit-maximizing number of workers that they should employ. Thus, when labor power is uncertain there is a higher probability that firms will be producing their output inefficiently because they employ too few or too many workers. On the other hand, when firms are relatively sure of the level of productivity that their workers will realize on the job, it is easier to operate at the profit maximizing level. As a consequence, firms will try to deskill, or mechanize the labor input in the production process to the degree that their technology of production will allow so that they can control and thereby predict labor productivity with more certainty (Braverman 1974). In addition to deskilling, a second

method by which firms influence and/or control the actions of workers is through the use of HRM (Nordhaug 2004). Hence, the pertinent aspect of the LP theory to this dissertation is that firms adopt HRM practices/strategies depending on the degree that such activities are needed to control and manage the labor power they obtain from their employees.

One source of evidence in support of this prediction is found in (Bernie and Ramsay 1988). In this study, the authors evaluate the changes to employee behavior that result from firms introducing new computer systems to improve communications in an office setting. By controlling the channels through which employees can communicate and monitoring such communications, the results show that the new computer systems have the effect of deskilling the workforce, improving performance and shifting the locus of control in the employee-manager relationship towards management.

Aguiar (2001) is a second study that finds that managers seek to mechanize the labor input to increase their control over the production process. This study investigates the practices of firms in the commercial building cleaning industry in Toronto. In the past, the employees in this industry were responsible for cleaning an entire area of an office building; however, at present, they only perform a particular task. For example, rather than one person being responsible for an entire office, a team of employees work together to clean several offices where each person is assigned to a different aspect of cleaning including vacuuming, dusting and washing windows. Over time, the workers become specialists in their field of cleaning and develop a high level of competency in a small number of skills. Aguilar concludes that this shift in the work environment of commercial building cleaners has caused employees to lose discretion over how to

perform their tasks, but he also finds that the new method of cleaning has led to increased firm performance as offices are being cleaned at a faster rate than was true under the old system. Thus, observations taken from the cleaning industry of Toronto show that firms do mechanize their labor input to improve productivity, just as is predicted by LP.

As it relates to the firm's expenditures on HRM practices, when the job roles of a firm are deskilled the production process requires a less sophisticated labor input than would be the case if no deskilling had occurred. This implies that the firm's need to augment the knowledge and skills of its workers with training will decrease with deskilling. In addition, by causing the firm to require fewer skills in its labor input deskilling increases the supply of qualified labor in the external labor market. That is, as the level of knowledge or skills required by the firm decreases the scarcity of qualified applicants will certainly not increase, *ceteris paribus*. As a result, firms are less concerned with retaining employees and will invest less in HRM practices aimed at retention. Thus, when a firm's technological process leads to a highly deskilled labor force, the firm will have a relatively low level of expenditures on HRM practices geared towards training and retention, and choose to locate itself in the left hand side of the HRM frequency distribution. On the other hand, it is also possible that firms will take an opposite approach to deskilling and choose to motivate their workers using a strategy that places a high degree of emphasis on "skill variety" (Noe, Hollenbeck, et al. 2005). These firms will be located in the right-hand tail of the HRM frequency distribution. Firms that take a more moderate approach to deskilling will find themselves located in the middle of the HRM frequency distribution.

The idea that firms use HRM practices as a method for controlling the labor input is also found in the management literature. While not explicitly citing LP in his book, Mintzberg (1983) asserts a LP perspective by claiming that it is possible to classify the HRM systems of all firms according to the amount of monitoring and/or motivation that their employees require. The descriptions earlier in this chapter of Mintzberg's five proposed HRM systems clearly show that firm's use of HRM to control their workers. For example, firms that use an employment system similar to the "simple structure" use very little HRM since they control and motivate workers through direct managerial interaction. Thus, these firms tend to be located in the left hand portion of the HRM frequency distribution. Next, firms that use an employment system resembling the "machine bureaucracy" will use a lot of HRM and be located towards the right-hand side of the HRM frequency distribution for several reasons including the need to appease the demands of unions, train employees how to use the firm's specific equipment and establish extensive benefits plans. Third, firms that use a "professional bureaucracy" employment system will tend to spend some resources on HRM practices like performance management to control the output of their employees; however, in general, these types of firms tend concentrate their HRM expenditures on recruitment practices. Then, when the firm finds qualified employees it gives them freedom to practice their trade with little supervision or direction. Because these firms use relatively few HRM practices they are located in the left-hand portion of the HRM frequency distribution. Finally, firms that find it optimal to use the "adhocracy system" place a large emphasis on having a workforce that is happy, motivated and able to innovate. To achieve these wanted outcomes for their workforces, these firms choose to allocate a large amount of

expenditures on HRM practices like recruitment, training, benefits administration and employee relations. Hence, firms that use this system are located on the right-hand side of the frequency distribution. Furthermore, the high degree of use of HRM in this employment system leads one to believe that the outliers in the right-hand tail of the frequency distribution can be explained by firms that find it advantageous to use "adhocracy" employment systems (Begin 1997).

Assuming a profit maximization framework, LP suggests that firms have an incentive to employ HRM programs that will improve the predictability of labor productivity. In this framework, the profitability of investing in HRM depends in part on whether or not the other inputs in the production function control the productivity of labor. For example, in situations where labor productivity is constrained by a machine's requirements or the availability of raw materials, investments into HRM are less able to positively impact the firm's bottom line. This is also the case in firms where the behavior of workers is difficult to modify using traditional HRM techniques because employees are intrinsically motivated. These types of firms will be observed to have a very small demand for HRM and are found in the left-hand tail of the distributions shown above. As the control that physical capital, raw materials and/or worker traits have over labor productivity wanes, the marginal benefit of using HRM to control the labor input will increase causing the firm to choose higher levels of demand for HRM.

In the end, LP has very similar conclusions to the HRM literature when it comes to the probability that firms will engage in HRM. The RBV, AMO and LP all imply that expenditures on HRM are increasing with the degree to which labor productivity and firm performance are correlated. On the other hand, all three theories predict that there will be

relatively low expenditures on HRM by firms whose performance is not constrained by the productivity of its labor. The benefit of the economic approach used in this dissertation is that it can largely accommodate and is not inconsistent with previous strands of literature, many of which provide helpful insights into the use of HRM practices in firms.

CHAPTER III

MODELING THE FIRM'S DEMAND FOR HUMAN RESOURCE MANAGEMENT PRACTICES

The theoretical model used in this dissertation is based on the work of my dissertation advisor, Bruce Kaufman (2004; 2008). His articles on HRM theory provide a new conceptual framework for understanding firms' HRM choices. Kaufman's approach advances the HRM literature by providing an economics-based *deductive* theory of the use of HRM practices that is applicable to *all* firms in the economy. In the last chapter, a review of the literature was given to provide a synopsis of existing models and theories of HRM choice as a point of reference. The purpose of this chapter is to outline this alternative economics-based theoretical approach as it applies to the firm's demand for HRM practices. Then the reader will understand how the same theory can be extended to evaluate the firm's choice of entire employment systems.

In developing his model, Kaufman (2004; 2008) includes HRM as an third input in the firm's production function, in addition to the standard input variables, capital (K) and number of employees (L). Thus, the output (Q) of goods and services by a firm is expressed using the following production function.

$$Q = f(K, L, HRM) \qquad (1)$$

In this framework, HRM provides potential productivity enhancing benefits to the firm by increasing output. HRM can be a complement or substitute for L and K. Like L and K, HRM also entails costs. These costs (formalized shortly) include the labor, capital and

intermediate goods required to produce the HRM practices and the amount of lost productivity that results from workers and managers taking part in HRM practices rather than spending their time producing output. To depict this relationship between benefits and costs that a firm must consider when making HRM choices, Kaufman uses the standard economic theory of profit maximization. By analyzing HRM choices in this way, we can derive the firm's HRM demand curve and input demand function which predict its equilibrium level of HRM practices and choice of employment system.

Theoretically speaking, the HRM demand curve and input demand function assume that firms choose different profit-maximizing levels of HRM practices due to heterogeneity in their firm-specific benefits and costs of HRM. Thus, this economic model of the demand for HRM predicts dispersion in the use of HRM across firms and therefore provides a theoretical foundation for explaining the observed bell-shaped HRM frequency distribution. An additional advantage of this model is that it can be extended to show that firms do not make choices about an individual HRM practice in isolation of other HRM practices, or in isolation from their choice of L and K (or, more generally, their choices of the types of labor and capital). Rather, the model predicts that firms will demand HRM systems that benefit from complementarities between practices. Furthermore, they will use different bundles of HRM practices (i.e., employment systems) that reflect firm differences in the marginal revenue product of HRM practices per unit cost.

In the end, this economic model of the demand for HRM practices provides a deductive theory that can address both of the research questions outlined in Chapter I of this dissertation. To gain a better appreciation of the theory, the subsequent sections of

this chapter present a detailed derivation the HRM demand curve and input demand function, and extend the model to the firm's choice of employment system.

The Firm's Demand for HRM Practices

To properly develop the model that is used to derive the HRM demand curve and input demand function, the first step is to provide an in depth view of the way that HRM influences the productivity of the firm. While the other factor inputs, L and K, directly influence production, HRM effects production through two channels: a *direct* effect and an *indirect* effect. The direct effect of HRM includes activities that increase output independent of the use of K and L, such as investments in job evaluation (achieving a better person/job fit) or employee involvement (achieving greater coordination through information sharing).

HRM practices also indirectly influence production by increasing the "effective" amount of labor or labor power, L(e), where e represents the level of effort provided by workers in a firm. In this dissertation, effective labor is calculated by taking the product of the hours of labor input and the level of effort: $L(e) = e*L$. According to this relationship, employees' labor power can be zero if they don't put forth any effort on the job. This makes sense considering that an idle or sleeping worker produces no output. To improve the effort of workers, firms have the option of implementing HRM practices to motivate employees to be more productive members of the firm. In fact, there are many ways that firms can use HRM to get a higher level of effort from workers, including policies that give employees monetary incentives to increase their productivity

(i.e., piece-rate compensation plans, commission programs), raise the level of morale by addressing procedural justice, outcome fairness and/or interactional justice (e.g., dispute resolution program or just-cause termination policy), and improve job satisfaction (e.g., job rotation, increased task identity and/or autonomy) (Noe, Hollenbeck, et al. 2007). Thus, we can model effort as a function of HRM; that is: e(HRM).[9]

By introducing the HRM variable into the production function, this model is able to delineate the *direct* and *indirect* effects of HRM, and thereby contribute to the HRM literature by clarifying the previously obscure relationship between HRM and firm performance called the "black-box" problem. To see this, we can take equation 1 and expand it, as given in equation 2.

$$Q = f[K, e(HRM)*L, HRM] \qquad (2)$$

The variable HRM on the right part of the production function represents the direct effect; the term e(HRM)*L represents the indirect effect.

In addition to introducing the HRM input variable in this fashion, there are two further modifications that can be made to the standard, simplistic economic model of production so that it is more representative of the processes that are used by firms in practice. The first is to add a parameter to the model that reflects the way in which the factor inputs are combined to produce output (i.e., the organizational composition and managerial philosophy of the firm). Here, this measure is represented using the standard designation for technology in the economics literature, A.

[9] If we remove the ceteris paribus condition, then we must acknowledge that some profit maximizing HRM practices may decrease effort and lower morale but be offset by a lower wage

The final step taken in making this model more realistic is to acknowledge that firms do not use a simple labor input. In fact, firms often rely on several types of labor that collectively work together to produce goods and services. To incorporate this notion into the economic model of production specified above, we must enrich the L variable by transforming it into a composite measure that accounts for all the different types of employees that comprise the firms' final labor input. Mathematically this is done by changing L to a vector **L** such that $\mathbf{L} = \sum_i L_i$. After adding these two modifications to the model, the augmented production function takes the following form shown in equation 3.

$$Q = f[A, K, \sum_i e_i(HRM)^* L_i, HRM] \qquad (3)$$

In this model of production, the firm must choose the level of HRM that best achieves its organizational performance objective(s). In order to model this choice, the theory used in this dissertation assumes that all firms have the objective of maximizing long-run profits (the present value of the firm). Given this, the firm's behavior can be evaluated using the standard profit maximization framework in economics which assumes that firms choose their inputs in a way that maximizes the difference between revenues and costs. In this dissertation, the revenues of the firm are given by (the present value of) P*Q where P is the price of each unit of output produced by a competitive firm and Q is replaced by the production function shown in equation 3. The other element of the profit equation, the cost function (C), is formed by multiplying K, L and HRM by their respective prices. Specifically, this includes the cost of capital (*r*), wages (*w*) and the price of HRM (*v*), respectively. In this model, *v* comprises the explicit costs of labor

and capital as well as any intermediate goods and services that are required to produce and deliver the HRM practices.

To simplify this model it makes sense to assume that capital and labor (i.e., the number of employees) are fixed when making HRM choices. In addition, by assuming that *v* is fixed by the market one can further simplify the model by attributing all the variation in the use of HRM in firms to the location of their demand curves (i.e., a parametric *v* makes the HRM supply curve to the firm perfectly elastic). This assumption considerably simplifies the model, and does not materially affect the results; further, it broadly accords with reality since firms can usually obtain additional trainers, job evaluations, payroll processing, etc. at a more or less going market price.

Analytically, the cost equation is shown by equation 4. Combining revenues and costs we get the profit equation 5 that is used to derive the firm's HRM input demand function.

$$C = r*K + w*\ell + v*HRM \qquad (4)$$

$$\prod = P*f[A, K, \sum_i e_i(HRM)*L_i, HRM] - (r*K + w*L + v*HRM) \qquad (5)$$

Using equation 5, the demand for HRM is derived by differentiating the profit function with respect to HRM, setting the differential equal to zero, and solving the first order condition. The result of this process is shown in equation 6:

$$\frac{\partial \Pi}{\partial HRM} = A * P\left[\underbrace{\left(\frac{\partial Q}{\partial e}\frac{de}{dHRM}\right)}_{\substack{Indirect \\ Effect}} * \mathbf{L} + \underbrace{\frac{\partial Q}{\partial HRM}}_{\substack{Direct \\ Effect}}\right] = v \qquad (6)$$

The middle term of this expression shows that the marginal benefit of an incremental increase in the use of HRM practices is represented by its marginal revenue product (i.e., $v = \mathrm{MRP}_{\mathrm{HRM}}$). Here, we explicitly see both the *direct* and *indirect* channels through which changes in HRM influence firm performance. The direct effect is shown at the change in Q that comes from an incremental change in HRM holding L constant, and the indirect effect relates the additional output that comes from increases in "effective" labor caused by an incremental change in HRM. The indirect effect can be positive if the labor input and HRM are complements, or it can be negative if the inputs are substitutes (e.g., a labor-saving information technology HRM system).

In equation 6, we can see that the classical marginal-decision rule found throughout economics also applies to the optimal use of HRM practices. That is, the optimal choice of HRM practices occurs when the profitability of an additional unit of an HRM practice is equal to its price (i.e., the marginal benefit equals the marginal cost). According to the marginal-decision rule, if the marginal revenue product of an additional unit of HRM is greater than its price, v, then the firm should invest more resources into HRM because it improves profitability. Additional HRM practices will continue to be integrated into the firm until their marginal benefits fall due to diminishing returns to the point where they equal the marginal costs. On the other hand, a firm knows that it has over invested in HRM when the marginal benefit from an incremental increase in HRM

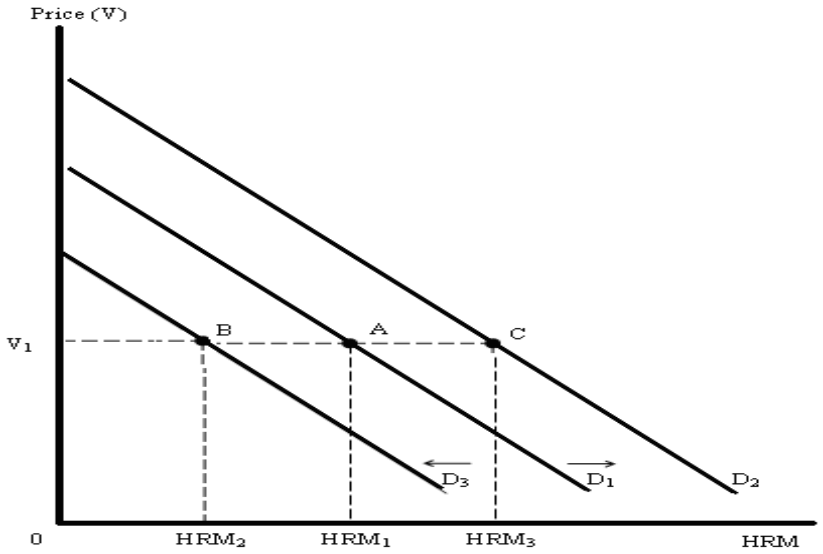
practices is less than the cost of the practice. When a firm experiences this type of situation, it will reduce its utilization of HRM practices until the marginal revenue product of HRM and its price equilibrate.

One significant contribution of this method of conceptualizing the firm's decision to invest in HRM practices is that it can explain the shape of the HRM frequency distribution (see, for example, Figure 2). Holding the price of HRM constant, equation 6 indicates that firms that have relatively large potential benefits from using an additional unit of HRM will find that they can maximize profits by having a high level of HRM practices (e.g., as in an HPWS or an adhocracy employment system). With respect to the HRM frequency distribution, these firms will be located on the right hand side of the curve. But there are some firms that derive little or no benefit from using HRM practices and maximize profits with zero or close-to-zero HRM practices. These types of firms will tend to use an 'externalized' or 'market' type employment system, as described by Delery and Doty (1996), where demand and supply set pay rates, motivate employees (through threat of unemployment), and provide new recruits and training opportunities. As a result, these firms find themselves on the left hand portion of the HRM frequency distribution. The middle of the distribution, therefore, is comprised of firms that have more moderate potential benefits of using HRM (e.g., as in professional bureaucracy or machine bureaucracy employment systems).

One implication of this model is that the HRM demand curve (i.e., the potential productivity and revenue benefits from using HRM) is the key to placing a firm on the HRM frequency distribution. To make this method of conceptualizing firms' HRM choices more transparent, equation 6 is used to derive the HRM demand curve shown in

Figure 4. Here, the demand curve for HRM is derived by plotting the firm's marginal revenue product for each level of HRM that the firm could potentially utilize (i.e., the bracketed part of equation 6).

Figure 4: The Demand for HRM



This graphical representation of this demand relationship is helpful in that it clarifies the relationship between firms' potential benefits from using HRM practices and their position in the HRM frequency distribution. The HRM demand curve shows the firm's preferred quantity of HRM at particular price such as v_1. Assuming that HRM practices have non-negative costs and HRM exhibits diminishing marginal returns, a firm's demand curve will be downward sloping as is shown in Figure 4.[10] Using this

[10] A caveat to this prediction is that firms may have an upward sloping demand curve when HRM is very close to zero. However, Figure 4 omits this portion of the demand curve for the simplicity of exposition. Overall, this should be of little concern because the firm's chosen level of HRM will never be in the portion of the HRM curve that is upward sloping. This is because any upward sloping demand curve will become negative at some point due to diminishing marginal returns and terminate at the level of HRM where the marginal benefit is nil. As a result, for every price where there is a point on the upward sloping potion of the demand curve there is also a point on the downward sloping potion of the curve. Because more HRM is

schedule of demand for HRM, it is possible to predict any firm's use of HRM just as was the case with equation 6.

As a result of the fixed-price assumption, it is possible to predict the firm's HRM decisions by focusing on their demand curves. The position of the demand curve in the graph is dependent on the characteristics which influence the firm's marginal benefits from HRM practices. When the marginal benefits are high it indicates that the returns to a particular HRM investment are large. This implies that one would expect for it to have a demand curve in the neighborhood of D_2 of Figure 4. On the other hand, a firm with little to gain from instituting HRM practices would have a demand curve close to D_3.

The crucial implication of this diagram comes from observing the equilibrium level of HRM that is demanded by firms who have each of these demand curves. Facing a constant price of HRM of v_1, the optimal use of HRM varies according the location of the firms' HRM demand curve. Thus, the model of demand for HRM shown in this dissertation is able to explain the wide distribution of use of HRM by plotting the equilibrium level of HRM chosen by each firm. That is, this model predicts that the majority of firms have intermediate demand curves (D_1) and thus bunch together in the middle of the frequency distribution, while as we go toward either tail of the distribution there are successively fewer firms, such as those with curves D_2 and D_3.

The location of the firm's demand curve is predicted by a set of internal and environmental characteristics that determine the firm's marginal benefits from using HRM. These factors include the firms' technology of production (determined in large part by the nature of the good or service it is producing), degree of unionization, the

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better, *ceteris paribus*, this implies that the firm will always choose an equilibrium value on the downward sloping portion of its demand curve. As such, there is no added benefit to graphing the upward sloping portion of the curve.

demographic and knowledge/skill characteristics of the workforce, and so on. Changes in these factors that cause the firm's marginal benefits to increase shift the demand curve to the right, while changes in these factors that reduce the marginal benefits from HRM shift the demand curve to the left. In all, there are a relatively large set of shift variables suggested by the theoretical model, however there are also a few additional shift variables suggested by the literature which must be added to the model to make it more representative of the firm's decision making process. In the following section of this chapter all of these determinants of demand are outlined, including a short description their proposed relationships with the demand for HRM and whether or not they are derived from the theory.

The next logical step in evaluating the firms' demand for HRM practices is to transform the input demand function into a format that more closely resembles the HRM demand function. To accomplish this, one need only invert the profit maximization equation in equation 6 to create an HRM demand function. By doing this we can see that demand for the HRM input is a function of technology, the labor input, output prices and the prices of factor inputs as is shown in equation 7.

$$\frac{HRM}{\boldsymbol{L}} = f(\mathrm{A}, \mathrm{P}, \mathbf{L}, v, r, w) \qquad (7)$$

The next step in deriving the HRM demand function is to remove v to reflect the assumptions of a fixed price of HRM. In addition, we assume that after controlling for size all firms have equal access to acquiring funds through assuming debt, and thus there is no variation in the interest rate (cost of capital) across firms. As a result, this variable,

r, is dropped from the equation. Finally, the equation is augmented by including the capital input variable and the aforementioned shift variables which are not part of the theoretical model. In the end, we are left with equation 8 - the *HRM demand function*.

$$\frac{HRM}{\boldsymbol{L}} = f(\mathrm{A}, \mathrm{P}, \mathbf{L}, \mathrm{K}, w, \mathrm{X_i}) \qquad (8)$$

At this point, it makes sense to identify some of the implications and strengths of the economics-based approach to predicting the firm's use of HRM described above. In total, the method of modeling the firm's use of HRM is preferable to the incumbent theories in the literature for six main reasons.

First, as was explained previously, this model is able to shed light on the "black-box" problem in the HRM literature by clearly illustrating the link between HRM and firm performance. This is accomplished in equation 6 which shows the derived *indirect* and *direct* effects of HRM on firm performance.

Next, in the past, the there was no single theory which could explain the HRM choices of all firms. For example, the conclusions of the resource-based view of the firm, labor process theory, and ability, motivation and opportunity (AMO) theory are applicable to firms who can use HRM to substantially improve their performance by increasing their labor productivity. However, these theories do not apply to firms in which profits are driven by their technology of production or their access to raw materials or for which HRM has little productivity effect. In this regard, Schneider, Hanges, et al. (2003) identify several ways in which the HRM→Performance model cannot be generalized. They find that the theory doesn't apply to small organizations, that the

outcomes of interest to which it can be applied are limited, and that factors associated with the organizational climate cannot be integrated into the model. In contrast to this, Kaufman (2004) identifies the general nature of a model built on economic foundations as one of his theory's main advantages. Using his theoretical framework, the use of HRM in any firm is predictable using the HRM input demand curve and input demand function.

Third, this model redefines what constitutes "best practice" HRM. Numerous HRM studies have argued that more HRM leads to higher firm performance, implying "lots" of HRM is "best practice." For instance, Huselid and Becker (2006) argue that a one standard deviation increase in the use of HRM leads to a 10-20% increase in an average firm's market value and a 4.6% increase in their return on assets (ROA). This line of thinking implies that the long-run equilibrium HRM frequency distribution should be narrow and centered about a high level of HRM (i.e., as in an HPWS). As a result, this theory suggests that the actually observed bell-shaped frequency distribution with skewness in the right-hand tail (as in Figure 2) must represent a huge state of disequilibrium (because many firms remain in the left hand tail of low HRM use). However, in practice it does not appear that Figure 2 is a state of disequilibrium; rather data from the period 1994-2005 shows that the HRM frequency distribution has not narrowed much over time, nor have firms gravitated towards a universal "best practice" HRM level such as an HPWS (Freeman and Rogers 1999; Joseph 2005; Joseph 2006; Bryson, Gomez, et al. 2007).

Alternatively, the model presented here argues that Figure 2 shows a stable equilibrium of the use of HRM practices in firms. Given v, the HRM demand curve

determines the firms' choice of HRM and, once made, this selection of HRM leaves the firms with no incentive to change their use of HRM (i.e., the chosen level of HRM maximizes profits). Alternatively stated, the economic model of the demand for HRM outlined in this chapter contradicts the incumbent HRM theories, arguing that the reason that firms have not chosen to adopt "best practice" HRM practices like a HPWS is because it does not pay–i.e., that it is not in fact "best practice" (as evaluated by the only long run metric that really counts: profit).

The fourth reason that this model is a good analytical tool for evaluating the HRM decisions of firms is that it reveals shortcomings in the existing theoretical and empirical models. For example, the common assumption in the management literature is that the HRM practice variables are independent (exogenous) variables that determine firm performance (profits). But the economics-based model shows that this specification is in serious error since the HRM practices are themselves endogenous choice variables determined in the profit maximizing calculus (see equation 6).[11] By specifying the HRM variable as the dependent variable of the estimating equation and not as an independent variable, the HRM input demand function is able to avoid this issue. Just to provide an obvious example, the dramatic decline in the price of IT and disseminating company information on computer networks (represented here by a decline in price v of implementing types of HRM systems), has led to numerous changes in the practices of human resource departments.

A fifth advantage of this approach to explaining the firm's use of HRM is that it is based on a theory that uses deductive rather than inductive reasoning. This theory is deductive in that it uses a few general assumptions about firm behavior to derive the

[11] See Gerhart (2007) for a full review of the issues with estimating the HRM-Performance relationship.

HRM demand curve and input demand function. In the past, inductive theories have been developed in the HRM literature that observe a firm's HRM practices and performance, and then make conclusions using these observations. In general, these studies focus on what firms *should do*, rather than identifying and explaining what they are most likely *to do* in practice (Pfeffer 1994; Becker and Huselid 1999; Farndale and Paauwe 2007).

A final benefit of modeling firm behavior using the HRM input demand function is that there are several ways in which this framework for understanding firm's HRM choices can be applied in practice. The model can be used to examine the firm's choice of expenditures on HRM as is done in this dissertation. In addition, this model can be used to evaluate factors that influence the firm's demand for a particular HRM system if the bundle of HRM practices which comprise the system are known. Thus, one purpose of the cluster analysis performed in Chapter V of this dissertation is to identify a few HRM systems that classify all firms so that the use of each of these systems can be evaluated using this model of demand.

The Equilibrium Mix of HRM Practices

In the previous section of this chapter an economics-based model is developed that explains the shape of the HRM frequency distribution. This approach argues that there are specific internal and environmental characteristics that cause heterogeneity in the equilibrium level of HRM across firms. In this section, the model is extended to provide a theoretical basis for predicting the optimal mix of HRM practices chosen by firms (i.e., their choice of employment system). Analytically, this extension requires that

we treat the HRM variable as a vector representing broad functional areas of HRM practices (rather than as a single aggregated input). For instance, the HRM variable in equations 5 and 7 should be replaced by HRM_i (i = 1, …, *n*) where HRM_1 = recruitment, HRM_2 = selection, HRM_3 = training, and so on. The second step in extending this model is to disaggregate the per unit cost of HRM (i.e., v_i (i = 1, …, *n*) so that v_1 = per unit cost of recruitment practices, v_2 = per unit cost of selection practices, HRM_3 = per unit cost of selection practices training, etc…

By making these changes, we transform the first order condition that results from optimizing the profit equation from a single equation to *n* equations as is shown by comparing equation 6 to the following system of equations 9.

$$\frac{\partial \Pi}{\partial HRM_{recruitment}} = P\left[\left(\frac{\partial Q}{\partial e}\frac{de}{dHRM_{recruitment}}\right).\mathbf{L} + \frac{\partial Q}{\partial HRM_{recruitment}}\right] = v_{recruitment} \qquad (9)$$

$$\frac{\partial \Pi}{\partial HRM_{selection}} = P\left[\left(\frac{\partial Q}{\partial e}\frac{de}{dHRM_{selection}}\right).\mathbf{L} + \frac{\partial Q}{\partial HRM_{selection}}\right] = v_{selection}$$

…

$$\frac{\partial \Pi}{\partial HRM_i} = P\left[\left(\frac{\partial Q}{\partial e}\frac{de}{dHRM_i}\right).\mathbf{L} + \frac{\partial Q}{\partial HRM_i}\right] = v_i$$

…

$$\frac{\partial \Pi}{\partial HRM_n} = P\left[\left(\frac{\partial Q}{\partial e}\frac{de}{dHRM_n}\right).\mathbf{L} + \frac{\partial Q}{\partial HRM_n}\right] = v_n$$

Assuming that all HRM practices have positive costs, the firm will maximize profits at the point where the ratio of the marginal revenue product of any two HRM inputs are equal to the ratio of their prices (Jehle and Reny 2001). Intuitively, this approach makes

sense in that it mimics the way that consumers maximize utility by equating the marginal utility per dollar spent on each item purchased (Kaufman 2008). Mathematically, this relationship is shown in equation 10.

$$MRP_{rec.}/v_{rec.} = MRP_{selection}/v_{selection} = MRP_i/v_i, \qquad \forall\ i = 1,\ldots,n \qquad (10)$$

Equation 10 states in words that firms adjust their levels of each HRM practice until there is equality among all practices in the revenue gained per dollar of expenditure.

This extension of the economics-based approach to understanding HRM choices is useful in that it theorizes that the investments in each of the firms' individual HRM practices are interrelated. The individual HRM practices used by firms can interact with one another in three possible ways: they can be complements, substitutes or unrelated. Mathematically this is shown by taking the second derivative of the profit function shown in equation 11 with respect to two HRM practices (i.e., $\delta\Pi^2/\ \delta HRM_i\ \delta HRM_j$).[12]

$$\prod = \sum_{ij} P*f[A, K, e_j(HRM_i)*\ L_j, HRM_i] - (r*K + w*\ \mathbf{L}_j + v*HRM_i) \qquad (11)$$

If the second derivate is positive then the two HRM practices are complementary, meaning that an increase in the use of one HRM practice increases the marginal benefit and use of the other, and vice versa. If it is negative, the use of one of the HRM practices causes the demand for a second HRM practice to decrease, indicating that they are substitutes. Third, if the second derivative of the profit function with respect to two individual HRM practices is equal to zero then the two practices are separable and

[12] The difference between equation 4 and 10 is that the HRM variable is now indexed (i.e., HRM_i).

additive (since even our measures of "individual" HRM practices are aggregated, zero interaction between two HRM practices could likewise imply that substitution and complementarity effects cancel out).

One implication of this model that differentiates it from past theories in the HRM literature is that it predicts that firms will consider their entire system of HRM practices when making HRM choices rather than focusing on a single HRM practice. To the extent that HRM practices are complementary, then we should observe firms' choosing those *bundles* of HRM practices that are profit maximizing.

HRM Demand Shift Factors

In the first two sections we used the standard economic model of profit maximization to develop the HRM demand curve as an analytical tool for predicting the firm's location in the HRM frequency distribution and subsequently utilize the model to predict how firms will bundle practices into HRM systems. Using this framework, differences in HRM demand curves among firms explain the observed variation in their use of HRM practices (i.e., the bell-shape of the HRM frequency distribution). Thus, the key question that follows is: What factors cause firms to have different demand curves? To answer this question, this section identifies a set of "shift variables" comprised of internal and environmental factors that differentiate the benefits per unit cost that a firm receives from using HRM. Many of these variables are included in the present economic model; however, there are also a few additional variables that are believed to influence the firms' demand for HRM, and so they are included as control variables in the model

specification. With respect to the HRM demand function shown in equation 8, the first two shift factors explained below pertain to technology, A, as they all reflect the way in which the factor inputs are coordinated to produce a good or service. Next, the third and fourth shift factors pertain to the capital input, K, and prices, P, respectively. Factors five to eight all reflect the size and composition of the labor force and therefore pertain to **L.** The ninth factor corresponds to wages, *w*, and the rest of the independent variables are those which are subsumed in the X vector as control variables. The hypothesized relationship each of these independent variables with the use of HRM for is found under each subheading.

Organizational Characteristics. Three organizational characteristics that influence a firm's use of HRM are the degree of centralization of operations, whether it is a government entity, and its profit/non-profit status. First, highly centralized companies, particularly those with many branches or divisions, tend to require more formal HRM practices since they have to consistently apply corporate policy to many groups of workers (Kaufman 2008). Next, organizations that are non-profits are expected to have a low demand for HRM compared to for-profit private businesses. As compared to other organizations, people that are attracted to non-profits tend to be intrinsically motivated by factors such as a belief in the organization's mission, opportunity to realize individual values and participation in decision-making. Thus, the mix of HRM may differ between for-profit and non-for-profit companies. For example, as a result of this intrinsic motivation, firms can use relatively less HRM to recruit, retain and motivate their employees (Brown and Yoshioka 2003). However, they will most likely utilize more employee relations activities since they provide more employee voice and participation

which "mission" employees tend to want. With respect to governmental organizations, the use of HRM is thought to be relatively high since it is not subject to a profit constraint and due to its public nature has greater need to promote fairness, standardize practices and so on.

Management Philosophy. In general, the profit maximization framework used in this dissertation assumes that firms make HRM decisions with the strategic objective of maximizing profit. While this business strategy does apply to many firms' choice processes, there are also cases where the firms' decisions are driven by managers' beliefs and ideals (Begin 1997). These "ideology-based" firms gain utility from pursuing their mission in addition to profits. As a result, it is possible that they will choose a demand for HRM that differs from that chosen by firms whose only strategic goal is profit maximization, *ceteris paribus*. Thus, this factor is very similar to the "taste/preference" factor in the traditional microeconomic theory of demand in that it explains the non profit maximizing behavior of firms. As it relates to the HRM demand function, if there are firms that have an ideology that caters to investments that motivate, control and/or improve the abilities of its employees, then it will probably make the firm more likely to invest in HRM practices since HRM practices address these wanted outcomes. Thus, a management philosophy favoring an HPWS will, for example, unequivocally lead to higher demand for HRM.

Aside from the individual beliefs of the firm's founders or managers, a second potential source of a firm's "ideology" comes from the culture and social norms in which it operates. Culture and norms often vary by geographic location (e.g., nation, region). These influence managerial assessment of the fairness of a situation or the value of a

worker which, in turn, impacts HRM choices (Brewster 2004). For example, the emphasis on loyalty and long-term relationships of Japanese firms leads to high levels of HRM practices as compared to workers and managers in the USA who have a more short-term orientation (Hofstede 1993).

Production Technology. The relationship between the firm's type of production process and the demand for HRM can be positive or negative. On one hand, firms that use more technologically advanced systems of production typically require a higher level of HRM practices since the employees in these firms have higher complementary skills or greater influence on the productivity of the technology (Begin 1997). On the other hand, there are also situations where a highly sophisticated technology of production (e.g., automated) leads to minimal use of HRM. The reason for this is that the job processes/formalization in these types of firms tends to be dictated by the machines, which thus downgrades the importance of employee skills and discretion (Lepak and Snell 2007).

One special category of production technologies worth discussing are industries that are service-oriented. In general, it is very hard to make generalizations regarding the relationship between service industry firms and the demand for expenditures on HRM industries. The principle reason for this uncertainty is that there exists a large amount of heterogeneity in the technology of production in this class of firms. The BNA dataset highlights this point as it includes a variety of service organizations ranging from fast food restaurant companies to law firms

There are two factors that enter into the firms' choice of HRM that should be mentioned. In the end, both of these characteristics of service firms indicate that they

will have a higher level of expenditures on HRM practices as compared to manufacturing firms. First, employees in service organizations tend to have more personal contact with customers than is true in manufacturing firms. Because of the relative importance of customer contact in service industries, they have more incentive to use HRM to control the effort and motivation of their workforce. Also, services are normally consumed as they are produced (whereas much of manufacturing involves durable goods), which makes it imperative that the products have a consistent level of quality since there is no time to use quality control to inspect and scrap defective output. As a result, to maintain a quality product, firms in the service industry will invest heavily in training as well as practices which keep worker motivation and effort at a high level. This includes instituting programs such as incentive pay plans and a broader choice of benefits to ensure that their product maintains a high quality (Othman 1998).

A second study which finds that non-manufacturing firms will have a higher incidence of HRM practices is Black and Lynch (1998). In this article, the authors use survey data from 1994 to try to uncover how the incidence and content of formal training programs are connected to workplace characteristics and practices. One of the many firm characteristics that they focus on is the sector in which the firm operates. While they do not provide conclusive reasons as to why non-manufacturing firms utilize higher levels of HRM, the data do suggest that the use of HRM in non-manufacturing firms is larger than in manufacturing firms.

Product Market Characteristics. The market concentration of the industry in which the firm operates, a (imperfect) proxy for the degree of product market competition, is expected to be positively related to the demand for HRM practices (i.e.,

more concentration implies more HRM). Relative to firms operating in low concentration (competitive) sectors, firms in concentrated sectors may have more discretionary income to put towards investment in HRM practices since they tend to earn higher extraordinary monopoly profits. That is, highly profitable firms may rent-share not only wages but HRM practices.

A second aspect of the product market that influences the use of HRM is the variability of the product market. In theory the relationship between product market variability and the demand for HRM can be positive or negative, and thus remains an empirical question. First, when a product market is seasonal or experiences marked cycles, it is reasonable to expect a high level of employee turnover (Hempel 1996). In general, the relationship between employee turnover and HRM has been empirically shown to be negative (Messersmith 2008). For instance, when there is large variation in the level of employment in a firm, it will not aggressively train employees because the transitory nature of the employment relationship makes it difficult to recoup such investments (Bayo-Moriones and Huerta-Arribas 2002). In addition, a high level of turnover gives firms less incentive to implement HRM practices that take time to create added motivation and productivity, such as programs directed at providing employee voice. This is in contrast to compensation programs which immediately influence employee behavior.

It is also possible that this relationship could be positive. In theory, one might suspect that firms with high turnover rates demand more extensive selection and termination practices to deal with their frequent hiring and firing of employees. On top of having formal procedures for dissolving the employment relationship such as

severance pay and assisting laid-off employees in looking for a new job, firms will need to spend extra resources on media and other external relations to maintain a satisfactory public image. In addition, Wright and Snell (1998) claim that firms with a lot of variation in employment will have a high demand for entrenched HRM systems which give workers a mentality that is open to accommodating organizational changes such as job rotation programs.

Employment. As the size (e.g., the number of employees) of an organization increases, so does its demand for HRM practices due to added difficulties and complexities in organizing workers using the external labor market (Huselid 1995; Begin 1997; Datta, Guthrie, et al. 2005; Katou and Budhwar 2006). While this proposed relationship is quite rational, there is also reason to believe that the price of HRM changes due to economies of scale. For example, Boxall and Purcell (2007) argue that firms that are large in size have lower costs of HRM innovations per worker due to economies of scale. Also, Kakabadse and Kakabadse (2002) find that EU firms tend to place a large focus on gaining economies of scale through outsourcing when HRM services to their employees.

One implication of the existence of economies of scale in the production of HRM services is that larger firms will provide more services than smaller firms given a constant level of expenditure per employee on HRM services. Alternatively stated, larger firms can achieve a given level of use of HRM at a lower cost as compared to smaller firms. To illustrate this point, we can consider the way that information technology influences administrative practices. The use of information technology has made it so that many administrative practices require large fixed costs consisting of computers, networking and

(customized) software; however, once these systems are instituted, the variable costs of administering an additional worker with the system is marginal. As a result, small and medium size firms are more likely to outsource HRM practices because their size does not allow them to benefit from the substantial economies of scale that are captured by large firms in providing administrative HRM practices (Klaas 2003).

A second example where larger firms have a relatively low cost of providing HRM practices is seen when looking at the provision of healthcare benefits. In general, firms are able to provide healthcare services to workers at a relatively lower price because the insurance policy can pool the risk of all the employees together. By doing this, the average risk associated with each individual employee becomes lower than would be the case if no pooling occurs (i.e., the workers each purchase private insurance policies). Thus, as the size of a firm grows it is able to provide health benefits to its workforce at a lower cost.

As a result of the potential for changes in the price of HRM, the link between the size of the firms' workforce and their expenditures on HRM practices per employee remains uncertain. Even though there is no doubt that larger firms use more HRM, we cannot be sure whether or not this added need for services will be counteracted by economies of scale that reduce their costs. Rather, this remains an empirical question that will be answered in the next chapter, Chapter IV.

Knowledge and Skills Characteristics. The degree to which workers rely on "general" skills that are valued at more than a single firm (i.e., transferable) as compared to "firm-specific" skills that are learned only with the current employer (i.e., non-transferable) influences the demand for HRM. As the firm-specific skills required for

production increase so will the firm's demand for HRM practices. This is due to these firms' relative need for an internal labor market that uses training programs to supply new employees with the needed firm-specific skills as well as practices that motivate the employee to use the skills correctly on the job. In addition, when there is a high level of firm-specific training provided to employees, firms have incentive to promote voice and fairness to help retain the skills so that firms can profit from their initial investment in training. Finally, it is also worth noting that companies will fund general training if workers already posses some specific training. One explanation for this is that there may be complementarities in production between the incumbent firm-specific skills of the workforce and general skills. Because of the added profits that come from these complementarities, firms are more likely to pay for general skills training (Acemoglu and Pischke 1999).

To try to maximize the return on their investment in providing training to employees, firms select employees that have a high probability of successfully completing the training program. One way in which this is accomplished is by screening out all applicants whose educational achievements demonstrate that they have not been able to, or lacked the commitment to, learn and apply similar types of concepts and/or skills in the past. Thus, there is reason to believe that the level of educational achievement and the demand for HRM will be positively related. One the other hand, there is also a strong argument that education and the demand for HRM will be negatively correlated because firms pay lesser educated workers relatively low wages and use general training on the job to substitute for training in school. Therefore, in the end, it is possible that the relationship between education and the demand for HRM could be

positive or negative. Thus, the true relationship remains an empirical question which we are able to investigate in the empirical estimations shown in Chapter IV.

Occupational Characteristics. It is hard to generalize the manner in which a firm that employs a largely white collar workforce will utilize HRM practices versus one that employs labor force with a high proportion of blue collar workers. The reason for this is that there is a great deal of heterogeneity in the types of occupations that are categorized as being white collar positions (e.g., file clerks, professors and attorneys). As a result of the variation of other shift variables such as the employees' average wages and their level educational achievement and skills within the white collar designation, it is impossible to make predictions when looking at this variable. Thus, no clear hypothesis can be made that relates the precise impact of the proportion of white collar workers in a firm on the utilization of HRM practices.

Workforce Demographics. The relationship between the demand for HRM and the presence of women and minorities in the workplace is uncertain. On one hand, there is reason to suspect that firms will provide less HRM practices on average to these groups of workers since they also pay these groups of workers lower wages. Market wages are lower for women and minorities for a host of reasons we do not full understand including discrimination. To the extent that wages and HRM expenditures per employee are used together to motivate and control employees, it is reasonable to expect a low level of HRM in firms that have a high proportion of women or minorities. On the other hand, by implementing HRM policies that address potential issues in the workplace, managers can address problems before they cause workers to quit or file official legal claims against the firm. This is especially important for issues that are racially or gender motivated since

the Equal Opportunity and Employment Commission find that they are two leading sources of discrimination claims in US firms (Noe, Hollenbeck, et al. 2005).

Wage Rate. Theoretically, the fifth independent variable in equation 8, the wage rate, can be a substitute or a complement for HRM practices (Ichniowski, Shaw, et al. (1997). When the wage rate is a substitute for HRM practices, firms may use a higher W in lieu of formal HRM practices. An example would be efficiency wage theory where being paid a higher-than-market wage motivates employees to self-enforce higher work effort which enables firms to reduce direct HRM control devices such as supervision and time clocks. On the other hand, firms that use high performance work systems often pay employees a higher than market wage to complement other HRM practices which are also aimed at increasing performance and/or retention like providing workers with flexible work arrangements (e.g., telecommuting or job sharing).

Labor Market Characteristics (Unemployment). When firms can count on a readily available supply of qualified labor in the external market there are fewer benefits to implementing an internal labor market (Osterman 1987; Marsden 1999). However, when firms cannot rely on the external labor market to provide a qualified labor input they produce their labor input in their own internal labor market. The development of a qualified labor force through an internalized labor market often requires a firm to utilize a broad spectrum of HRM practices. Thus, as the supply of qualified labor in the external labor market increases, the demand for establishing an internal labor market decreases as does the demand for HRM (Doeringer 1967).

Unionization. The relationship between unionization and the demand for HRM practices is uncertain. Union recognition might increase demand for HRM practices

since unions endeavor to negotiate more formalized, structured and standardized employment management practices (Turner 1994). And of course negotiating contracts, along with the occasional use of mediation and arbitration, involve substantial HRM expenditures (in particular, legal expenditures), although these expenditures may not be captured in the data used in this analysis. However, the presence of unions could also decrease the firm's use of HRM if the union assumes certain HRM functions like selection (e.g., a hiring hall, admittedly a rarity outside construction since passage of Taft-Hartley in 1947), resolving disputes, or resists certain incentive compensation practices that might increase HRM expenditures.

Firm Age. Past studies have shown that the choice and implementation of HRM practices is thought to be more effective in older firms. This is largely because the managers, and to a certain degree the employees, in these organizations are more experienced, having possibly dealt with similar situations in the past (Huselid, Jackson, et al. 1997). In addition, older firms will discovery new ways of implementing HRM practices over time that improve the efficiency with which such practices are provided. These innovating changes in HRM improve efficiency by increasing productivity or reducing price, both of which lead to an increase in the demand for HRM, *ceteris paribus*. On the other hand, older firms have more fomalized practices and procedures then younger firms, *ceteris paribus*, and so they have greater incentive to resist changes in their organization's HRM policies and procedures (Begin 1997). As a result, it might make more sense for older firms to retain their historical HRM systems while it may be optimal for newer organizations to adopt a different set of HRM practices.

Government Regulation. Firms that operate in industries that have a high degree of government regulation will have a relatively high demand for HRM practices. This is because these firms use HRM to reduce their potential legal liability by being in fuller compliance with government employment mandate(s). The benefits of using HRM practices relations in this way include reducing legal costs and keeping the firm's name from being publicized negatively as a violator of labor or environmental standards. Some examples of HRM practices that would fit into this category are affirmative action programs, union/labor relations (e.g., allowing union representation at board of directors meetings) and safety inspections.

Strategic Role of HRM in the Firm. As the role that the HR director is able to take in coordinating corporate strategy increases so will the overall expenditures on HRM per worker. This prediction is derived from the theory of bureaucracy which predicts that individuals are most interested in maximizing their own budgets (Brennan and Buchanan 1980). Thus, the predicted relationship between demand for HRM and the strategic role of the HR department in overall firm decisions is likely to be positive. Stated differently, firms that choose high levels of HRM expenditure are likely to assign HRM departments a larger role in decision making.

Level of the Surveyed HR Department in the Organization. Within the dataset used in this dissertation there are survey respondents from HR departments located in central corporate offices as well as divisional and subsidiary offices. Because of this variation, it is important to control for the level of the HRM department of the survey respondent since there are some HRM practices that a division or branch of a firm does not demand precisely because they are already provided centrally. This includes

practices such as compensation administration, benefits administration and publishing policy handbooks and other materials, whose ability to be produced with large economies of scale at the central level make them unlikely to be found in a divisional or subsidiary office. Thus, it is expected that an HRM department that is only responsible for a branch or division of a firm would have a lower demand for HRM than would be the case if it were located in the central corporate office of the same organization.

The Economic Model of the Demand for HRM and the Research Questions

The attractiveness of the economics-based model of the demand for HRM is that it can provide answers to the two research questions stated in the first chapter of this dissertation. In the first section of this chapter the HRM demand curve and input demand function are developed. After augmenting these analytical tools with the shift factors described in the second section of this chapter, we can answer the first stated research question by predicting the firms' demand curves. Using these curves, we can graphically determine the equilibrium level of demand for HRM for each firm, which predicts their position on the HRM frequency distribution. One significant implication of this theory of demand for HRM is that the shape of the HRM frequency distribution is an equilibrium result. The reason that the distribution takes on the bell-shape with skewness in the right-hand tail is because the optimal levels of HRM vary from firm to firm according to internal and environmental characteristics that determine the marginal benefit and cost of an additional unit of HRM.

The next stated line of inquiry in this dissertation looks to see if firms' choose systems of HRM practices, and if so, what factor(s) determine this choice. Accordingly, the third part of this chapter shows us that the demands for individual HRM practices are interrelated by replacing the aggregate HRM input with a vector of individual HRM practices. By extending the model in this way, we find that HRM practices can be complements, substitutes or be unrelated. In general, firms have incentive to create complementarities between individual practices so that they can benefit from added productivity or reduced costs when providing HRM. Thus, there is reason to believe that firms do demand HRM systems, implying that past research which has focused on isolated HRM practices may be mis-specified (Huselid, Jackson, et al. 1997; Luthans and Sommer 2000). Furthermore, this model theorizes that the key element in the firms' choice of employment system is their marginal revenue product per unit cost of different HRM practices. As the marginal revenue product of HRM practices per unit cost between firms varies, so will the adoption of different employment systems. Thus, one implication of this model is that firms should not *all* be expected to use a HPWS (i.e., AMO theory) because of heterogeneity in the marginal revenue product per unit cost for the various HRM practices. In practice, however, it makes sense to expect to observe a few groups of firms that share similar marginal revenue products of HRM practices per unit cost as has been hypothesized in the HRM literatures (Mintzberg 1983; Begin 1997; Marsden 1999). To see if firms use different (unique) employment systems or if there are few common groupings of HRM practices among similar firms, a cluster analysis is performed in Chapter V. If firms cluster into a few discrete groups that share similar

marginal revenue products of HRM practices per unit cost, then they should likewise cluster into distinct employment systems using common sets of HRM practices.

CHAPTER IV

ESTIMATING THE FIRM'S DEMAND FOR EXPENDITURES ON HUMAN RESOURCE MANAGEMENT PRACTICES

The HRM demand curve and input demand function provide a theoretical foundation for explaining the HRM choices of firms; however, to date, there has been no empirical test of this theory. The purpose of this chapter is to take the first step in this direction and estimate an empirical approximation of the theoretical HRM demand function. To accomplish this, it is necessary to modify the theory derived in Chapter III so that it can be estimated using available data. To get a better understanding for the modifications that are made, this chapter begins with a description of the dataset used to specify the estimating equation. After this, the chapter continues by presenting the dependent and independent variables that are used to specify the model as well as the econometric methodologies that are used in estimation. The chapter concludes by presenting the results of the model as well as a test of its robustness to an alternative specification.

Dataset

The majority of the information used to empirically analyze the demand for HRM comes from survey data collected by the Bureau of National Affairs for its 2005 and 2006 *HR Department Benchmarks and Analysis* reports. The quality and depth of information on firms' HRM activities in the BNA dataset are superior to that found in other sources. In all, the BNA dataset contains 614 observations on firms' expenditures on HRM

practices for the 2005 fiscal year. These data are useful for this dissertation because they come from a comprehensive survey of HR departments from a diverse group of firms. In addition to providing information on the outcome variables, the BNA survey data also include information on many of the independent variables used in the estimating equation. A further resource contained in the BNA dataset is the firm's principal 3-digit North American Industry Classification System (NAICS) code. Using this code, the remaining independent variables are specified with industry-level information from the Bureau of Labor Statistics and the Equal Employment and Opportunity Commission. After removing firms that don't have information on their NAICS code from the dataset we are left with 381 observations.[13] A copy of the survey used by the BNA is found in the Appendix.

Before explaining the specific dependent and independent variables used to specify the model, there are a few aspects of the collection of the data set that should be pointed out. First, because the BNA has the responsibility of protecting the privacy of survey respondents, the names and/or addresses of the firms are unavailable. This is not of great detriment to the present study because there is a large amount of firm specific information included in the survey.

A second independent aspect of the data is that the survey respondents are executives and managers of organizations with an HR department and a minimum headcount of at least 25 employees. There are both advantages and disadvantages to using HR executives and managers as survey respondents. On the one hand, managers have the best ability to appraise the use of HRM in their firm because they know about all

[13] In 29% of the firms a 2-digit NAICS code is used because it is all that was available.

the services that they are providing, whereas individual employees may only know about the HRM practices that affect them. However, relying on the information of top executives can also produce reporting error (as in most surveys) since their responses may indicate "intended" HRM practices, which are not always in line with what HRM practices are actually implemented (Khilji and Wang 2006).

Next, in some cases the survey respondents are HR professionals from organizations with single HR departments, while in others there are multiple HR departments (e.g., an HR department for each division or facility as well as the corporate headquarters). To control for this difference respondents were instructed to indicate their level within the organization and only provide data pertaining to the activities performed and the employees served by their own HR department. A variable controlling for the location of the HR department is included in the estimating equations.

Finally, because the survey is time consuming not all survey participants completed the section of the survey covering the specific HR department activities (see Sections E and G in the BNA survey shown in the Appendix). As a result, the dataset used to perform the cluster analysis in the following chapter is based on a subset of the data used in the empirical test reported in this chapter. In addition, the number of respondents who completed the budget section of the survey was less than the total surveyed because not all HR departments have separate budgets.

Specifying the Estimating Equation

Dependent Variable

In order to empirically test the HRM demand function derived in Chapter III, reproduced in equation 8 below, a linear equation is estimated where the dependent variable for HRM is specified as the log of the firm's aggregate expenditures on HRM per employee.

$$\frac{HRM}{\boldsymbol{L}} = f(\mathrm{A}, \mathrm{P}, \mathbf{L}, \mathrm{K}, w, \mathrm{X_i}) \qquad (8)$$

This way of measuring the firm's utilization of HRM is unlike past studies which have calculated HRM using an index that reflects the reported number of individual practices in a firm (e.g., Freeman and Rogers 1999, Bryson et al. 2007). Certainly the number of individual HRM practices and the level of HRM expenditures per employee are useful measures of HRM utilization in an organization; however, the latter measure is arguably preferable. By lumping all HRM practices into a single composite score with each practice taking the same value, it is possible to overstate the presence of HRM in some firms while not recognizing the amount used in others.

Several examples in the BNA dataset illustrate this situation. For example, two firms might both indicate that they participate in 'skills training'; however, one firm could require employees to engage in five hours of training a month while the other firm only requires five hours a year. Likewise, a suggestion box in the lunch area and a formal plant-wide employee involvement program both count as a 'suggestions system'

in the BNA survey yet the latter clearly involves much more expenditure and is a far more intensive use of HRM. For this reason, this dissertation will use the log of a firm's expenditures on HRM to measure its utilization (demand) for HRM.

Independent Variables

The HRM demand function shown in equation 8 shows that HRM is predicted by several factors, including technology, market prices, the prices of other factor inputs, the use of other factor inputs and a vector of control variables (X_i). Recall that this equation reflects the assumption made in the previous chapter that the price of HRM and the cost of capital do not vary across firms. Assuming that the price of HRM and K are fixed, the variables fall out of the estimating equation. This is necessary as a practical matter since no firm level data are available on the *v* variable.

Next, because of data limitations, it is not possible to specify all of the theorized internal and external characteristics in X_i as shown in Chapter III in the final estimating equation; however, the majority of the theorized independent variables are included. After augmenting the BNA survey data with information from other sources using firms' NAICS codes, we are left with a dataset that provides information on every firm's non-labor operating costs, the demographic, occupational and knowledge characteristics of their workforce, the sector in which the firm operates (public/non-profit/private), the level of the surveyed department in the organization, union activity, labor and product market characteristics, the strategic role of the HR department within the firm, and the degree to which a firm has a philosophy favoring the provision of a high level of HRM activities for its employees. Table 3 classifies each of these variables according to their

corresponding "shift variable" detailed in the second section of Chapter III, their predicted relationship with the demand for expenditures on HRM practices and where the data come from (e.g., the BNA, BLS or EEOC). Table A.1, found in the Appendix to this dissertation details how all of the industry-level information was gathered. In the event that the data come from the BNA, the relevant survey question is shown in parenthesis in the table below - the letter refers to the section of the survey and the number corresponds to the question within that section. The next table, Table 4, shows the summary statistics for these independent variables.

Table 3. Definition and Predicted Signs of the Independent Variables

Independent Variable	Theoretical Shift Variable	Predicted Sign	Source
Log of average annual wages (F.1 and D.1)	Wages	?	BNA
Log of the number of full time employees (D.1)	Firm Size	?	BNA
Dummy variable measuring the firm's focus on overall employee satisfaction and morale (C.3)*	Management Philosophy	+	BNA
Log of non-labor operating costs per worker (F.1)	Production Technology	?	BNA
Dummy variable=1 if organization is a non-profit entity (A.1)**	Organizational Characteristics	-	BNA
Dummy variable=1 if organization is a government entity (A.1)**	Organizational Characteristics	+	BNA
Dummy variable=1 if the organization is service oriented (i.e., a non-manufacturing entity) (A.1)	Production Technology	+	BNA
Index relating the HR department's influence in the firm's strategic decisions (recode of C.2 so that 5 is high involvement)	Strategic Involvement	+	BNA
The percentage of workers that belong to a union (A.10)	Unionization	?	BNA
Percent of labor that is female	Workforce Demographics	?	EEOC
Percent of labor that non-white		?	EEOC
Percent of labor with a Bachelors degree	Knowledge Characteristics	?	BLS
Percent of workers that are white collar	Occupational Characteristics	?	EEOC
State-Industry unemployment rate	Labor Market Characteristics	-	BLS

Dummy variable=1 if the HR department resides in the central corporate office (A.8)	Level of HR Department	+	BNA
Log of the Coefficient of Variation in Employment from 1991-2005	Product Market Characteristics	?	BLS
Rate of separations per 100 workers		?	BLS

*Firms that mark the second box in this question receive a score of 1.
**The baseline group here is all for-profit private firms.

Table 4. Summary Statistics of the Specified Independent Variables (381 Observations)

Specified Variable	Mean	Std. Dev.	Minimum	Maximum
Log of annual wages	10.49	1.35	4.47	15.20
Log of the number of full time employees	6.74	1.58	3.78	13.82
Dummy variable=1 if the firm's HRM is focused on overall employee satisfaction and morale	0.35	0.48	0.00	1.00
Log of non-labor operating costs per worker	9.41	2.45	1.35	15.49
Dummy variable=1 if organization is a non-profit entity	0.04	0.19	0.00	1.00
Dummy variable=1 if organization is a government entity	0.35	0.48	0.00	1.00
Dummy variable=1 if the organization is service oriented (i.e., a non-manufacturing entity)	0.39	0.49	0.00	1.00
Strategic Involvement of the HR Department (index from 1-5 where 5 is highest)	3.85	1.00	1.00	5.00
Percentage of workers that are in a union	10.02	18.95	0.00	65.00
Percent of labor that is female	51.25	17.67	0.54	82.20
Percent of labor that non-white	33.35	9.56	14.50	99.32
Percent of labor with a Bachelors degree	19.01	9.19	8.00	33.00
Percent of workers that are white collar	62.73	21.46	10.92	99.27
State-Industry unemployment rate	5.06	1.03	2.70	10.40
Dummy variable=1 if the HR department resides in the central corporate office	0.31	0.14	0.00	1.00
Log of the Coefficient of Variation in Employment from 1991-2005	-2.16	0.50	-4.47	-1.62
Rate of separations per 100 workers	37.35	17.65	15.20	75.50

Age, the competitiveness of the product market, the level of government intervention and the degree of centralization in the firm are four variables which are not included in the empirical model due to lack of data availability. Unfortunately, there was no way to gain access to data for the age for each firm so this predictor of the use of

HRM could not be specified in the empirical model. The second variable which is omitted is the market concentration of the industry in which the firm operates. While there is detailed industry level market concentration data available for many firms, there is no data for agricultural, mining, construction or public entities which reduces the total sample size of the dataset used in this dissertation by 15%. Using this restricted dataset the coefficient on the market concentration variable is never found to be significant, and reduces the significance of the results of the rest of the model. Therefore, the omission of the market concentration variable in X_i is justifiable in that its inclusion creates problems (i.e., costs) without yielding any additional information (i.e., benefits). The remaining two variables, the level of government regulation in the firm's industry and the degree of centralization in the firm's organizational structure are not included in the model specification because these shift factors are hard to quantify.

When we incorporate the aforementioned modifications into the theoretical model we are left with the following estimating equation (equation 8') that can be used to evaluate the firm's demand for HRM expenditures. In the next section, the econometric techniques used to estimate this equation are detailed. Then, in the subsequent section, this empirical model is modified to account for the econometric issues that it presents, including reporting error bias that could cause negative spurious correlation (i.e., division bias) and omitted variable bias. After correcting the model for these issues it is re-estimated to see if the estimated coefficients are stable and robust. If the results of the modified specifications are not notably different from the initial benchmark model, then we can assume that it is reasonable to use the results from estimating equation (8') to make inferences regarding the firm's HRM choice process.

$$\frac{HRM_i}{\boldsymbol{L}_i} = \alpha_i + \beta A_i + \beta P_i + \beta L_{ij} + \beta K_i + \beta w_i + \beta X_i + \varepsilon_i \qquad (8')$$

Empirical Methodology

The Aggregate Demand for Expenditures on HRM Practices

The methodology used to estimate the firm's HRM demand function shown in equation 8' uses two complementary techniques: ordinary least squares (OLS) and quantile regression (QR) analysis. The reason that both methods are used is that they work together to provide comprehensive results. In particular, the quantile analysis is able to check to see if the OLS estimates are correct for the entire sample population. When the OLS estimates are not valid, inference is made using the results from the quantile analysis. The reason that the results from the quantile analysis are not solely used is that the OLS results are more straightforward to report and interpret.

Accordingly, the first step of the empirical methodology used in this dissertation is to estimate the firm's demand for expenditures on HRM practices using OLS. The statistical package we use first adjusts the data for any potential intra-industry correlation(s).[14] To do this, then we use STATA and cluster the standard errors on the firms' NAICS industry codes at the 2-digit level. While informative, OLS results only reflect the behavior of the 'average firm', and thus are not necessarily representative of every firm in the population.

[14] It makes sense to control for intrastate correlations since the choice of HRM practices may be a function of the location of the firm as it indicates something about culture and thus managerial philosophy and the use of practices.

To check to see if the OLS estimates are representative of the behavior of firms with regard to conditional expenditures on HRM practices, a QR analysis is performed. In contrast to OLS which only evaluates the covariates at the conditional mean, the key aspect of the QR methodology is that the influence of the covariates on the demand for HRM is evaluated at different points along the conditional distribution, called quantiles. Consequently, the interpretation of the coefficients estimated using QR analysis present a new interesting perspective because one can interpret the results as rates of return or 'prices' of the independent variables on HRM at different points along the distribution (Machado and Mata 2005, 447). In addition, a second related advantage of the QR methodology is that the estimated coefficients are relatively unaffected by the presence of outliers in the dataset (Koenker and Hallock 2001; Madalozzo 2002). Thus, as it pertains to this dissertation, engaging in QR analysis is worthwhile since it is designed to handle the very broad range of expenditures on HRM practices that includes several outliers with relatively high levels of expenditure.

The specific specification of the QR model used in this study is based on the work of Machado and Mata (2005) who provide a clear presentation of the methodology, as originally developed by Koenker and Bassett (1978). The model can be summarized as follows: Suppose $Q_\theta(hrm \mid x)$ for $\theta\varepsilon(0,1)$ represents the level of HRM expenditures of firms in the θth quantile of the frequency distribution of HRM expenditures, and x represents the vector of covariates outlined above as well as a constant term. Within this framework each quantile is estimated using the following specified model:

$$Q_\theta(hrm \mid X) = x'\beta(\theta))$$

where $\beta(\theta)$ is the vector of coefficients corresponding to the θth quantile of the distribution. $B(\theta)$ is estimated by minimizing the following equation with respect to β:

$$n^{-1}\sum_{i=1}^{n}\rho_{\theta}(hrm_i - x_i^{'}\beta)$$

$$\text{with} \quad \rho_{\theta}(u) = \begin{cases} \theta u & for\ u \geq 0 \\ (\theta - 1)u & for\ u < 0 \end{cases}$$

Once the coefficients of each covariate have been estimated for several of the quantiles, it is possible to draw a graph which plots the magnitude of the coefficients as a function of their quantile. In doing this, it is possible to see if the covariate has a stronger or weaker impact on the demand for HRM in a given region of the distribution by observing if the coefficients are getting larger or smaller in magnitude as HRM expenditures increase. If the magnitudes of the coefficients do not plot an increasing or decreasing trend, then one can say that the OLS results are reasonable for all firms and should be used for making inferences. However, if the opposite is true, then the OLS results only predict the HRM expenditures of firms whose expenditures are similar to the conditional mean of the sample population. In this situation, the estimated results of the quantile analysis are used since they are able to explain the behavior of all firms whereas OLS cannot. Thus, the quantile analysis complements the explanatory power of OLS results in that (a) it identifies which coefficients on the independent variables in the HRM

demand function are estimated correctly by OLS; and (b) it provides reliable estimates on the explanatory variables on interest where OLS does not apply.

Disaggregating the Demand for Expenditures on HRM Practices

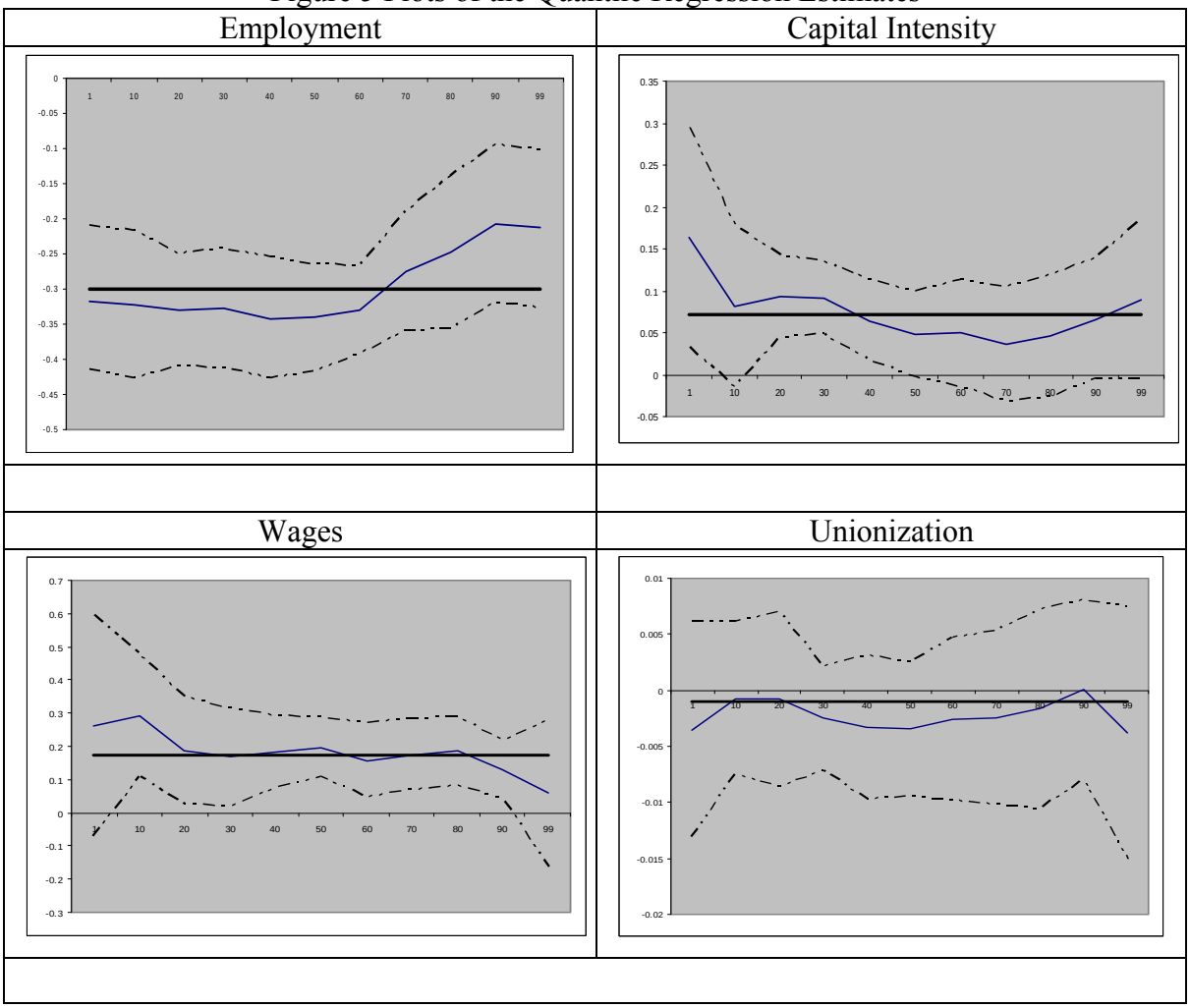
While the results of the model specification described above are very useful and serve as a benchmark for estimating the firm's overall demand for expenditures on HRM practices, it is also interesting to disaggregate the analysis by examining sub-components of the HRM expenditure variable. This secondary line of inquiry is explored in this chapter by estimating nine additional equations that use more narrow measures of HRM expenditures as the dependent variable. In particular, the new dependent variables are the log of expenditures per employee on recruitment, training, compensation, benefits administration, employee relations, external relations, personnel management, health and safety activities and strategic planning. As is the case with the aggregated model, an OLS regression model is used to estimate these specifications; however, these regressions are not also estimated using the quantile methodology. The reason that quantile analysis is not used is because it is not needed to determine whether the size and sign of the explanatory variables change for different types of HRM practices.

Results

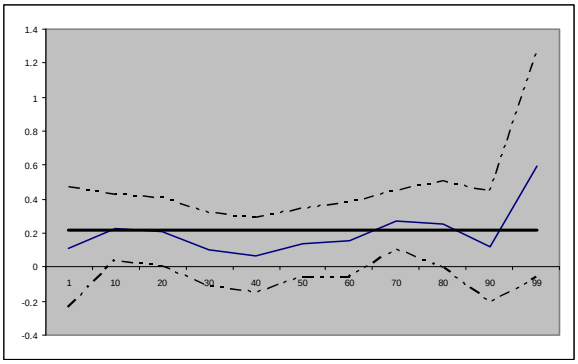
The author will first report the QR results, followed by the OLS results. This is done to reveal to what degree the OLS results are accurate estimates of the coefficients of the model. Figure 4.3 plots the distribution created by the QR estimates of each

independent variable taken at eleven different points along the conditional distribution of expenditures on HRM. The dotted lines represent the 95% confidence interval of the estimates, and the solid skinny line represents the estimates of the median quantile. The thick horizontal line represents the mean (OLS) estimates. If the OLS estimate for a given variable is closely approximated by the distribution created by the QR estimates then it is fair to use the coefficient estimated using OLS to characterize all firms in the economy. However, if there is substantial variation along the distribution the QR results should be used for inference.

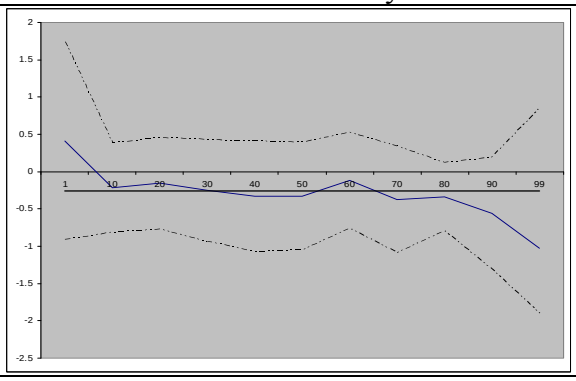
Figure 5 Plots of the Quantile Regression Estimates



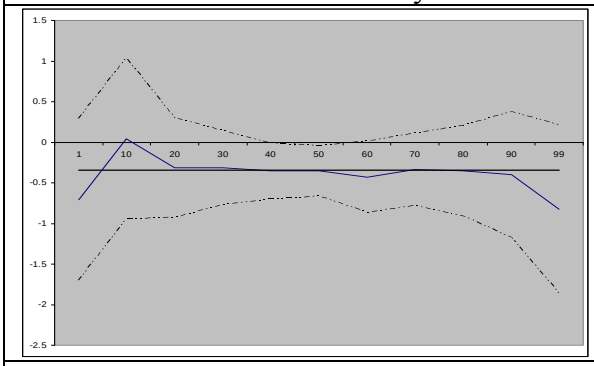
HPWS Ideology



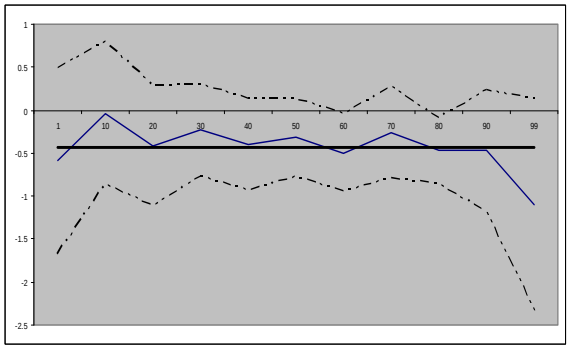
Non-Profit Entity



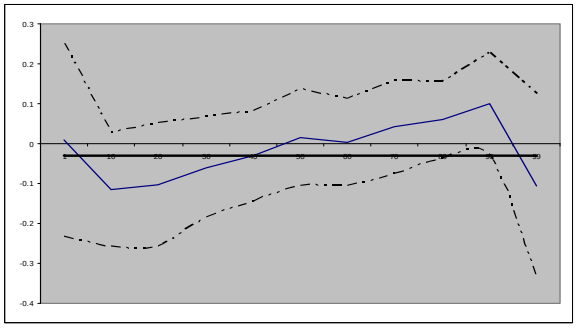
Government Entity



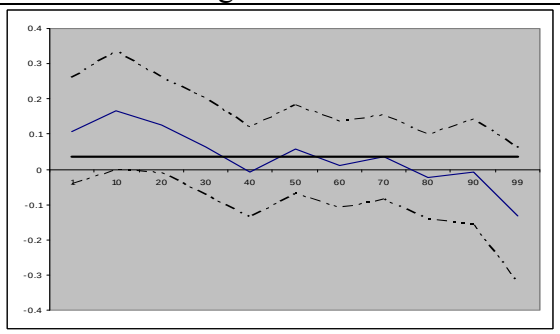
Service Oriented



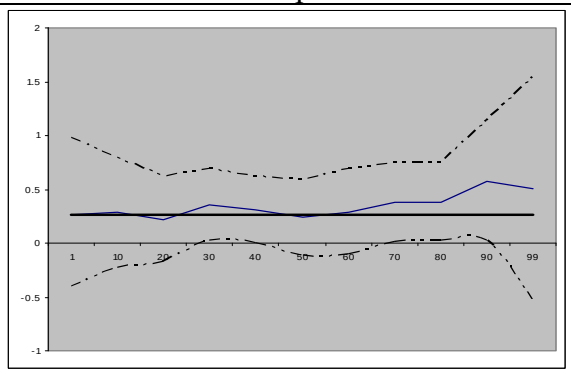
Unemployment



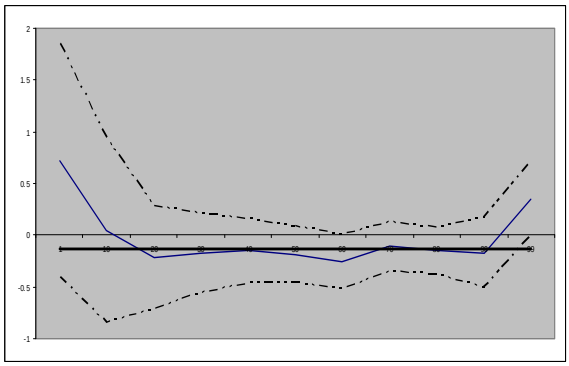
Strategic Involvement



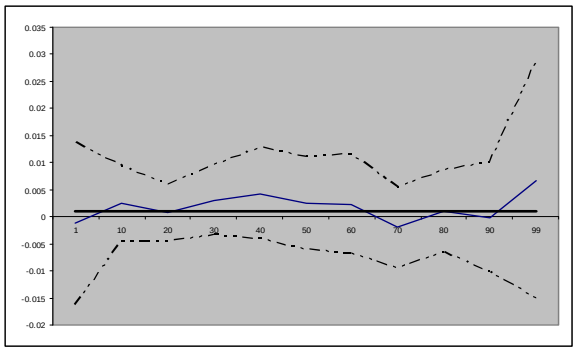
Rate of Separations



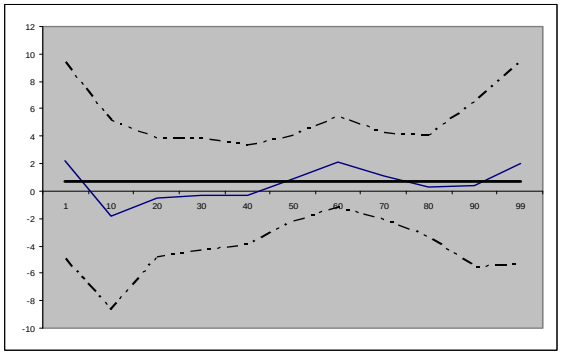
Variation in Employment



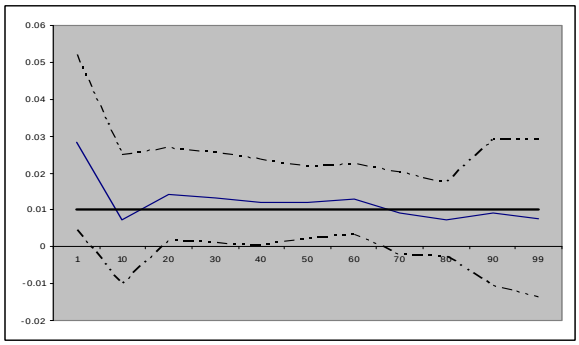
Percent White Collar Workers



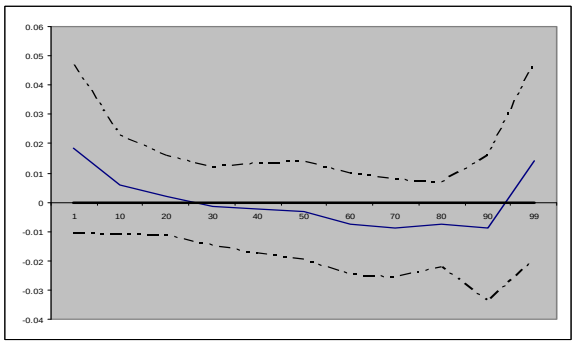
Percent with Bachelors Degree



Percent Women



Percent Minority



Corporate Level

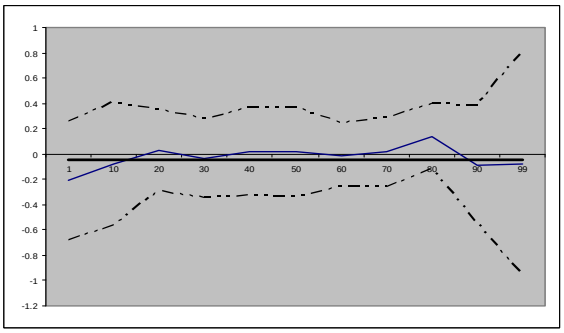


Figure 5 shows that none of the independent variables have QR coefficients that plot a distribution that is notably different from OLS estimate is the level of unionization in the firm. Therefore, we can assume that the mean (OLS) regression does a very good job of estimating the marginal effect of the covariates on the expenditures on HRM. The strong similarity between the quantile and OLS estimates is an important finding in that it

implies that the mean estimates from OLS can be used to generalize the behavior across all firms with respect to their HRM choices.

Table 5 reports the mean estimates for all of the model specifications. The first column shows the estimated coefficients for the "total" or "aggregate" HRM demand function (using total firm level HRM expenditures); columns 2-10 show the results for disaggregated HRM demand functions. The aggregate and disaggregated demand functions are estimated using OLS.

In the following paragraphs the estimated coefficients that are statistically significant are discussed in detail for all ten model specifications. However, before elaborating on the estimated coefficients of the independent variables, it should be noted that the regression equation itself is statistically significant in all ten specifications, as is demonstrated by the p-values shown in the last row of Table 5. This result is noteworthy because it supports the use of the HRM demand function as an analytical tool for predicting firms' HRM choices and, therefore, provides empirical proof in favor of the economics-based approach to understanding firms' HRM choices. In addition, a standard Chow test of the disaggregated specifications shows that there is in fact significant variation in the estimates across different HRM practice types for all but two of the specifications (i.e., that the demand for HRM expenditures varies depending on the HRM practice type). This finding indicates that the estimated coefficients from the disaggregated specifications provide additional information not revealed in the aggregated equation (Column 1), and therefore justifies the inclusion of the nine disaggregated equations in the present empirical analysis of the demand for HRM. Please see Table A.2 in the Appendix for the results of the Chow test.

Table 5. Results of the OLS Specifications (n = 381 Observations)

COEFFICIENT	(1) Total Expenditure	(2) Recruitment	(3) Training	(4) Compen-sation	(5) Benefits Admin.	(6) Employee Relations	(7) External Relations	(8) Personnel Mgt.	(9) Health and Safety	(10) Strategic Planning
Log of Employment	-0.307***	-0.218***	-0.307***	-0.357***	-0.312***	-0.301***	-0.302***	-0.342***	-0.320***	-0.258***
	(0.0263)	(0.0402)	(0.0339)	(0.0458)	(0.0359)	(0.0423)	(0.0511)	(0.0422)	(0.0463)	(0.0450)
Log of Wages	0.186***	0.257***	0.220***	0.166***	0.230***	0.243***	0.257***	0.169***	0.234***	0.273***
	(0.0345)	(0.0548)	(0.0464)	(0.0613)	(0.0476)	(0.0577)	(0.0746)	(0.0549)	(0.0667)	(0.0604)
Log of Capital Intensity	0.0700***	0.0528*	0.0772***	0.0748**	0.0511*	0.0926***	0.0629*	0.0601**	0.0944***	0.0246
	(0.0197)	(0.0300)	(0.0247)	(0.0341)	(0.0267)	(0.0312)	(0.0372)	(0.0300)	(0.0348)	(0.0322)
Unionization	-0.00109	-0.00277	0.000758	-0.00229	0.00492	0.00113	-4.67e-05	0.00104	0.00438	-0.00395
	(0.00221)	(0.00355)	(0.00297)	(0.00399)	(0.00307)	(0.00366)	(0.00455)	(0.00369)	(0.00404)	(0.00440)
HPWS Ideology	0.225***	0.425***	1.417***	-0.389***	0.0661	0.295**	-0.0317	0.224*	0.164	0.226
	(0.0837)	(0.127)	(0.105)	(0.148)	(0.116)	(0.132)	(0.163)	(0.134)	(0.152)	(0.144)
Non-profit Entity	-0.273	0.683	0.00152	-0.739	-0.491	0.513	0.315	0.511	0.241	0.782
	(0.269)	(0.418)	(0.346)	(0.490)	(0.386)	(0.416)	(0.567)	(0.441)	(0.559)	(0.500)
Government Entity	-0.317*	0.0338	0.0405	-0.0624	-0.313	-0.215	-0.00171	-0.209	-0.343	0.122
	(0.187)	(0.285)	(0.242)	(0.329)	(0.255)	(0.296)	(0.372)	(0.289)	(0.332)	(0.334)
Service Oriented Firm	-0.410**	-0.0942	-0.346	-0.889***	-0.674***	0.00351	-0.000461	-0.0937	0.0189	-0.0273
	(0.188)	(0.285)	(0.243)	(0.330)	(0.253)	(0.298)	(0.348)	(0.291)	(0.343)	(0.312)
Unemployment	-0.0308	0.0186	-0.0369	-0.0294	-0.0701	-0.00559	-0.0562	-0.0297	-0.0578	0.0243
	(0.0381)	(0.0579)	(0.0475)	(0.0664)	(0.0516)	(0.0607)	(0.0734)	(0.0580)	(0.0659)	(0.0653)
Strategic Interaction	0.0374	0.0493	0.0693	-0.0443	-0.0753	0.0960	0.0428	0.0513	-0.0395	0.0987
	(0.0385)	(0.0592)	(0.0490)	(0.0687)	(0.0537)	(0.0613)	(0.0737)	(0.0615)	(0.0703)	(0.0689)
Log of Rate of Separations	0.264**	0.369*	0.306*	0.719***	0.647***	-0.00813	0.319	-0.149	-0.0921	-0.0206
	(0.134)	(0.205)	(0.174)	(0.244)	(0.186)	(0.219)	(0.290)	(0.225)	(0.267)	(0.256)
Log of Var. in Employment	-0.165	-0.0652	-0.178	-0.224	-0.247	0.00492	-0.212	-0.0481	-0.0541	0.0115
	(0.108)	(0.174)	(0.143)	(0.206)	(0.155)	(0.204)	(0.293)	(0.196)	(0.256)	(0.264)
White Collar	0.00230	0.0119**	0.00181	0.00139	0.00532	0.00505	-0.0123	0.00189	-0.00604	0.00167
	(0.00344)	(0.00521)	(0.00431)	(0.00601)	(0.00469)	(0.00533)	(0.00784)	(0.00545)	(0.00605)	(0.00570)
Bachelors Degree	0.681*	-1.043	1.141	0.499***	0.641**	-2.310	1.159	-0.187	0.157	0.0121
	(0.131)	(2.229)	(1.862)	(0.179)	(0.217)	(2.385)	(1.895)	(2.360)	(2.680)	(2.548)
Percent Women	0.00865*	0.00826	0.00242	-4.10e-07	0.0107*	0.00449	0.00390	-0.000254	0.00103	-0.00332
	(0.00447)	(0.00673)	(0.00568)	(0.00772)	(0.00602)	(0.00696)	(0.00919)	(0.00701)	(0.00800)	(0.00764)
Percent Minority	0.00189	-0.000608	0.00299	0.00900	0.00292	0.00361	-0.00483	-0.00305	-0.00601	0.00281
	(0.00569)	(0.00871)	(0.00715)	(0.00989)	(0.00770)	(0.00891)	(0.0139)	(0.00879)	(0.00949)	(0.00978)
Corporate Level	-0.0236	-0.00853	-0.133	-0.194	0.333**	-0.150	-0.325*	-0.00691	-0.293	-0.189
	(0.103)	(0.156)	(0.130)	(0.183)	(0.143)	(0.160)	(0.191)	(0.169)	(0.184)	(0.176)
R-squared	0.474	0.302	0.569	0.332	0.391	0.358	0.431	0.320	0.354	0.321

Prob>F	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.10

Column (1) of Table 5 shows that nine of the seventeen independent variables are statistically significant determinants of the firm's aggregate demand for per employee HRM expenditures. Two of these variables, the log of employment and the log of average annual wages, are found to be statistically significant in all ten of the model specifications. Employment, as measured by the average number of fulltime employees, is found to have a negative relationship with the firms' expenditures on HRM practices. The results in column (1) show that a 1% increase in the size of a firm's labor force leads to a 0.307% decrease (on average) in expenditures on HRM practices per employee. Note that this figure is given in the log differential form as are all of the results in this section including dummy variables and non-marginal changes in continuous variables.[15] In addition, the magnitude of this relationship is found to relatively uniform across the remaining nine model specifications regardless of the type of HRM expenditures. Because the relationship is negative, it indicates that per capita HRM expenditures decrease with firm size. This is presumably because firms benefit from economies of scale when providing HRM practices and thus have lower provision costs, and not that the demand for HRM services per worker are lower in larger companies. In fact, if we assume that larger firms unequivocally require more HRM services per employee, *ceteris paribus*, then the estimated coefficient of 0.307 provides a lower bound of the level of economies of scale (i.e., a firm's costs decrease by at least 31% when they double the size of their labor force).

The second variable which is found to be statistically significant in all ten equations is the wage variable, which measures as the firm's total payroll costs divided by employment. The estimated coefficients are positive indicating that the wage rate is a

[15] To change the results to actual percentages one must utilize the following formula: $(e^{\beta}-1)100$.

complement for HRM practices. This result supports the idea presented in the second section of Chapter III that firms often pay employees a higher than market wage to complement other HRM practices, such as in a high performance work system (e.g., teams, employee involvement, etc…).

Next, the variable measuring the non-labor operating costs of the firm per employee is found to be positive in all equations and statistically significant in all but one. The magnitudes of the results are relatively consistent across all the specifications, corresponding to roughly a .07% increase in HRM expenditures per employee for every 1% increase in non-labor operating costs per employee. Interestingly, the coefficient with the highest magnitude is that which corresponds to employee relations. This result supports Begin's (1997) claim that firms who utilize technologically advanced systems of production require a high level of liaison services since these services are provided through employee relations practices like disciplinary and compliance procedures, employee communications, suggestion systems and union/labor relations.

The management philosophy of the firm is the fourth variable that is determined to be a statistically significant predictor of firms' HRM choices. The equation shown in column (1) shows that management with an HPWS philosophy will have aggregate HRM expenditures that are 23% higher than all other firms on average. Next, focusing on the significant results in columns (2)-(10), we see that expenditures on recruitment, training and employee relations practices are higher when the philosophy of the firm is to use HRM to improve overall employee satisfaction and morale. This result is in accordance with the predicted relationship. On the other hand, this type of managerial philosophy is

also found to decrease the expenditures on compensation in a statistically significant way by 39% on average.

The dummy variable that represents governmental organizations is also found to be statistically significant in the "total" specification shown in column (1). The sign of the coefficient is negative in contrast to what is predicted in the second section of Chapter III. Rather than having a high level of HRM expenditures that promote fairness, standardize practices and so on, we find that on average governmental organizations actually expend less on HRM practices. One potential explanation for this result is that governmental entities are able to utilize economies of scale in producing and delivering HRM services by streamlining administrative practices across various agencies (e.g., payroll, pensions and other fringe benefits).

The next variable whose estimated coefficients are statistically significant is the dummy variable that represents service oriented firms. Looking at Table 5, we see that the firm's aggregate expenditure on HRM is negatively related to the utilization of HRM. In addition, the equations that express the demand for expenditures on training as well as compensation and benefits administration also produced significant coefficients on this dummy variable. The result in the equation measuring firm expenditures on training makes sense given that manufacturing firms tend to use machinery requiring firm-specific skills. Conversely, service workers like accountants, lawyers, barbers and chefs have transferable (and sometimes credentialed) skills that can be used in many firms. It is hard to find a specific explanation for the results found in columns (1), (4) and (5). Perhaps the negative coefficients in these equations are a result of the technology of production or some other confounding factors of these firms.

Next, the rate of separations in the firm's industry is positively related to aggregate expenditures on HRM practices. In addition, when looking at the disaggregated equations, we find that the rate of separations is a statistically significant predictor of expenditures on recruitment, training, compensation administration and benefits administration. As it pertains to the stated hypotheses in Chapter III, all of these estimates go against the empirical evidence presented by Messersmith (2008) and Bayo-Moriones (2002). However, the result in column (2) is not so surprising because does support the theoretical claim made in Wright and Snell (1998) that firms with high turnover rates demand a higher level of recruitment practices to deal with their frequent hiring and firing of employees.

The estimated coefficient on the variable representing the percentage of workers who have a Bachelors degree is positive. This finding clarifies the predicted relationship shown in Table 3. As is expected, firms that employ workers who are more educated have greater incentive to establish internal labor markets that require a high level of expenditures on HRM practices. Specifically, a one percent increase in the percentage of employees with a Bachelors degree increases the overall expenditures on HRM by 0.68%. The same increase in educational background of the workforce also leads to increased expenditures on compensation administration and benefits administration practices in the magnitude of 0.50% and 0.64%, respectively.

With respect to the demographic characteristics of the labor force, we find that the percentage of women in the workforce leads to higher firm expenditures on HRM practices. In the previous chapter, this relationship is hypothesized to exist because firms with a high proportion of women will have a higher demand for HRM practices like

dispute resolution programs and policies that educate workers about sexual harassment and discrimination. The results of the disaggregated specifications neither confirm nor contradict this hypothesis (i.e., the coefficient in the employee relations equation shown in column (6) is not statistically significant); however, they do present an additional alternative explanation for the high demand for HRM demonstrated by firms that have a high proportion of female employees. Column (5) shows that there is a significant positive relationship between female employees and expenditures on benefits administration. In retrospect, this result is not so surprising since this classification of expenditures takes into account the substantial costs borne by firms due to maternity leave and childcare costs.

In addition to the above results, there are two independent variables which are not statistically significant in the "total" specification shown in column (1), but are found to be significant in at least one of the disaggregated specifications shown in columns (2)-(10). The first of these variables is percentage of workers whose jobs classify as white collar positions. While the coefficient on the percentage white collar variable is not significant in column (1), it is significant in two of the nine disaggregated specifications. Specifically, we find that the expenditures on external relations are decreasing with the percentage of white collar employees. In contrast, the expenditures on recruitment practices are positively related to the percentage of white collar employees.

A second variable found significant only in the dissagregated equations is the variable indicating whether the HR department resides in the corporation's central office or in a division or branch. The results show that the level of expenditures on benefits administration is higher in a corporate HR department, but the expenditures on health and

safety practices are higher in an HR department located in a branch or divisional office. This makes sense considering that a firm would concentrate benefits administration in a central location to capitalize on economies of scale, while something like safety training would need to be performed in a more decentralized fashion to account for the intricacies of each plant or division of a firm.

Testing for Mis-specification

The results from estimating the HRM demand function provide a wealth of information, as detailed above. However, it is important to check that the results are statistically well-specified. One possible source of mis-specification that the inclusion of the *employment* variable on the right hand side creates a division bias since *employment* is also used as the denominator for the dependent variable. While this issue is not thought to be of great significance due to the absence of measurement error in the dataset used to specify the *employment* variable, it is still necessary to make sure that its inclusion on the right hand side of the estimating equation is not driving the results of the regressions (Borjas 1980, 411).

To validate the assumption that employment is exogenous in the HRM equations, the model is estimated using an instrumental variables (2SLS) methodology which is shown in Column (2) of Table 6, and the variable is dropped altogether in the third column of Table 6. In the 2SLS specification, the employment of the firm is predicted using the historical trend in employment for the industry in which the firm operates. More specifically, using the Arellano-Bond methodology, the employment for each firm

is instrumented by using lagged values of employment for the industry for the five years preceding 2005, as well as the associated year to year differences (Arellano and Bond 1991). The results from this estimation are then compared to those generated by OLS (Column (1)). If the instruments are shown to be appropriately specified and the coefficients estimated in both regressions are not statistically different from one another, then we can say that the model is unaltered by the inclusion of instrumental variables. Furthermore, this result would imply that there is no reason to use the 2SLS. Such a finding is desirable for the purposes of this dissertation because computationally it is very difficult to estimate a quantile regression analysis that includes instrumental variables.

Table 6. Results of the OLS and 2SLS Specifications

COEFFICIENT	OLS	2SLS	Dropped
Log of Employment	-0.30***	-0.55***	
	(0.03)	(0.14)	
Log of Average Annual Wages	0.19***	0.14***	0.25***
	(0.03)	(0.05)	(0.04)
Log of Non-Labor Oper. Costs per Employee	0.07***	0.07***	0.08***
	(0.02)	(0.02)	(0.02)
Percent of Employees w/ Union Representation	-0.01*	-0.01*	-0.01**
	(0.00)	(0.00)	(0.00)
HPWS Ideology	0.22***	0.25***	0.19**
	(0.08)	(0.09)	(0.08)
Strategic Interaction of HR Dept w/ Firm	0.04*	0.05**	0.02**
	(0.02)	(0.02)	(0.00)
Dummy=1 if HR Dept is at the Corp. Level	-0.03	0.07	-0.14
	(0.10)	(0.13)	(0.12)
Dummy=1 if Government Entity	-0.31**	-0.32**	-0.29**
	(0.15)	(0.15)	(0.12)
Dummy=1 if Nonprofit	-0.26	-0.30	-0.21
	(0.27)	(0.30)	(0.31)
Dummy=1 if Serivce Oriented Firm	-0.41**	-0.46**	-0.34**
	(0.19)	(0.21)	(0.16)
Rate of Unemployment (Industry-State)	-0.03	-0.08	0.03
	(0.04)	(0.05)	(0.04)
Log of Separations per 100 Employees	0.26**	0.23*	0.42***
	(0.10)	(0.13)	(0.16)
Log of Variation in Employment (1990-2004)	-0.16	-0.10	-0.24*
	(0.11)	(0.12)	(0.13)
Percent of Employees that are White Collar	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)
Percent of Employees that Have a Bachelors Degree	0.68***	0.51***	1.64***
	(0.13)	(0.16)	(0.67)
Percent of Employees that are Women	0.01*	0.01*	0.01*
	(0.00)	(0.01)	(0.00)
Percent of Employees that are Minority	0.00	-0.00	0.01
	(0.01)	(0.01)	(0.01)
Observations	381	381	381
R-squared	0.474	0.276	0.348
Prob>F; Prob>Chi2	0.000	0.000	0.000
Robust standard errors in parentheses			
*** p<0.01, ** p<0.05, * p<0.10			

The results of the first stage equation of the 2SLS procedure are shown in Table 7 and the exogeneity tests for the 2SLS specification are shown in Table 8. The first important finding is that the first stage results are significant. Next, the instruments used are shown to be uncorrelated with the error term according to the Sargan and Basmann tests of overidentifying restrictions. Specifically, the test statistics fail to reject the null hypothesis that the instruments are uncorrelated with the error term. In addition, the estimated test statistic for the Durbin-Wu-Hausman test of endogeneity rejects the null hypothesis at the 5% level. This indicates that lagged values of employment for the firm's industry, as well as the associated year to year differences, are valid instruments.

Table 7. First Stage Results for 2SLS

VARIABLES	Ln(Employment)
L.1	0.00444**
	(0.00223)
D.1	(dropped)
L.2	(dropped)
D.2	-0.0125**
	(0.00556)
L.3	0.00259
	(0.00260)
D.3	(dropped)
L.4	-0.00710***
	(0.00236)
D.4	-0.00488***
	(0.00154)
Constant	6.922***
	(0.143)
Observations	381
R-squared	0.230
Prob>F	0.0370
Standard errors in parentheses	
*** p<0.01, ** p<0.05, * p<0.1	

Note: L.1 and D.1 refer to the first lagged value and first difference. L.2 refers to the second lagged value and so on.

Table 8. Testing the Validity of the Instruments in the 2SLS Specification

Sargan statistic: 5.01 chi-sq(4) P-value = 0.2934 (test of overidentifying restrictions)
Basmann statistic: 4.82 chi-sq(4) P-value = 0.3011 (test of overidentifying restrictions)
Wu-Hausman F-statistic: 5.29 F(1,373) P-value = 0.02200 (test for endogeneity)
Durbin-Wu-Hausman statistic: 5.47 chi-sq(1) P-value = 0.01930 (test for endogeneity)

With this result in hand, the next step in determining if the estimates of the HRM demand function are robust to the use of the 2SLS methodology is to see if the regression results from the OLS and 2SLS methodologies are statistically different from one another. Table 9 provides the results of a hypothesis test that determines if the estimates produced by the IV and OLS models are statistically different.

Table 9. Test for Difference in OLS and 2SLS Estimates (H_o: β_{OLS}- $\beta_{2SLS} \neq 0$)

Variable of Interest	chi2(1)
Log of Employment	2.04
Log of Non-Labor Operating Costs per Employee	0.97
Log of Firm's Mean Annual Wage	2.50
Unionization	2.13
High Demand Ideology	1.59
Non-Profit Entity	2.02
Government Entity	1.46
Non-Manufacturing Entity	7.96*
Strategic Interaction of the HRM Department	2.03
Rate of Separations	2.51
Rate of Unemployment	1.98
Log of the Coefficient of Variation in Employment	1.25
Percent of White Collar Employees in Workforce	2.00
Percent of Workers With a Bachelors Degree	2.14
Proportion of Women in the Workforce	1.26
Proportion of Minorities in the Workforce	10.44*
Corporate Level	3.16
*Significant at 5%	

In reviewing the results, we see that that the coefficients of the OLS and 2SLS only vary in a significant way for the dummy variable for non-manufacturing entities. Thus, just one of the ten statistically significant independent variables estimated in these models has coefficients that are impacted in any significant way by using OLS rather than 2SLS. Furthermore, while significant, this difference is neither substantial nor meaningful in terms of its marginal effect on the demand for HRM. Both the OLS and 2SLS methods produce significant results. In addition, in both cases the estimated coefficients on the 'non-manufacturing' dummy variable are negative and have a similar magnitude. In particular, the difference in expenditures on HRM in manufacturing firms versus non-manufacturing firms is 0.04% and 0.05% for the OLS and 2SLS methods, respectively.

The next source of bias which can be tested is omitted variable bias. As is stated in the "Specifying the Estimating Equation" section of this chapter, there are a few independent variables that are not included in the regression equation because of a lack of data availability. To see if the absence of these variables impacts the regression coefficients, the regression equation is re-specified by removing all of the industry-level and industry/state-level independent variables (i.e., those that do not come from the BNA dataset), and replacing them with industry and regional control variables. The following table, Table 10, reports the estimates of this specification in Column (1) and then includes the overlapping variables that are also estimated in the benchmark specification (i.e., Column (1) of Tables 4.3 and 4.4) in Column (2).

Table 10. Estimations Including Industry and Regional Dummy Variables[1]

VARIABLES	(1)	(2)
Log of Employment	-0.293***	-0.307***
	(0.0261)	(0.0263)
Log of Average Annual Wages	0.194***	0.186***
	(0.0341)	(0.0345)
Log of Non-Labor Operating Costs per Employee	0.0738***	0.0700***
	(0.0192)	(0.0197)
Percent of Employees w/ Union Representation	-0.012*	-0.010*
	(0.00635)	(0.00498)
HPWS Ideology	0.209**	0.225***
	(0.0835)	(0.0837)
Strategic Interaction of HR Dept w/ Firm	0.0345**	0.0364*
	(0.0155)	(0.0185)
Dummy=1 if HR Dept is at the Corp. Level	-0.0424	-0.0236
	(0.101)	(0.103)
Utilities	0.520*	
	(0.311)	
Construction	-0.651**	
	(0.290)	
Trade and Transportation	-0.169	
	(0.268)	
Manufacturing	0.0635	
	(0.147)	
Information	0.299	
	(0.184)	
Professional Services	0.173	
	(0.155)	
Education	-0.371**	
	(0.181)	
Healthcare	0.0661	
	(0.156)	
Other	0.190	
	(0.168)	
North East	-0.0523	
	(0.245)	
Middle Atlantic	-0.227	
	(0.237)	
North Central	-0.250	
	(0.236)	
South Atlantic	0.0481	
	(0.263)	
South Central	-0.252	
	(0.303)	
Mountain	-0.121	

	(0.328)	
Observations	381	381
R-squared	0.502	0.474
Prob>F	0.000	0.000
Robust standard errors in parentheses		
*** p<0.01, ** p<0.05, * p<0.10		

[1] Public Entities and the Pacific Region are Omitted to Identify the Model

Focusing on the independent variables that are common to both regressions (e.g., the first seven independent variables), we can clearly see that there is little to no variation in the estimates that are statistically significant across specifications. A hypothesis test is shown in Table 11 that demonstrates that there are no statistical differences in the six statistically significant independent variables.

Table 11. Test for Difference in OLS and 2SLS Estimates (H_o: β_{OLS}- $\beta_{dummies} \neq 0$)

Variable of Interest	chi2(1)
Log of Employment	1.45
Log of Non-Labor Operating Costs per Employee	1.01
Log of Firm's Mean Annual Wage	0.94
Unionization	1.98
High Demand Ideology	2.22
Strategic Interaction of the Firm	1.67
HR Department at the Corporate Level	5.31*

In the end, the estimated coefficients from the alternative specifications added in this section show that the inclusion of level of employment on the right-hand side is not influencing the results in any material way and that there is minimal omitted variable bias. The important implication of these results is that it supports the use of the benchmark equation that specifies *employment* on the right-hand side. As a result, it is reasonable to use OLS when estimating the HRM demand curves as represented by the

function expressed in equation 8'. More importantly, the results of this alternative specification support the claim that this approximation of the HRM demand curve is a statistically significant predictor of the use of HRM in all firms.

CHAPTER V

IDENTIFYING SYSTEMS OF HRM PRACTICES

In Chapter III an economics-based model is presented that predicts variation in the optimal use of HRM across firms and provides an explanation of the observed shape of the HRM frequency distribution.[16] A second theoretical contribution of Chapter III is found in the next to last section where the model is extended to explain firms' optimal mix (or "bundle") of HRM practices. The question that is addressed in this chapter is: do firms choose HRM bundles that can be categorized by a relatively small number of distinct configurations – earlier called "employment systems", or are these bundles so heterogeneous that they elude categorization? The theoretical model developed in Chapter III suggests bundles of HRM practices will indeed form into discrete employment systems if (1) the marginal product of individual HRM practices varies systematically across firm production systems and economic/organizational characteristics (e.g., assembly line versus craft production, reliance on internal versus external labor markets) and (2) if there are distinct complementarities among HRM practices.

As described in the Literature Review chapter (Chapter II), several authors (e.g., Mintzberg 1983; Begin 1997; Marsden 1999; Appelbaum, Bailey, et al. 2000; Black and Lynch 2001; Guthrie 2001) have argued that HRM practices will group into distinct employment systems and some of them have developed hypotheses that predict the characteristics of a few distinct employment systems that can categorize the use of HRM

[16] In Chapter IV this theoretical prediction was empirically tested and the results show that the HRM demand function is a useful tool for determining the firm's demand for expenditures on HRM practices.

in all firms. For example, Begin distinguishes five different employment systems (ES): They include (1) the *simple structure* where workers are managed through the use of direct supervision; (2) the *machine bureaucracy* in which a standardized technological process controls worker output; (3) a *professional bureaucracy* where firms hire workers with accredited skills and then give them freedom to practice their trade with little supervision or direction; (4) the *adhocracy system* where firms are only focused on improving worker effort and motivation so that they can maximize innovation; and (5) the *divisionalized form* used by large organizations where each division in this class of firm will have its own specific needs and is thus delegated the power to manage its own HRM activities.

It was also noted in Chapter II that no study to date has empirically tested any of these theoretical hypotheses. My dissertation is the first to do so, and it is to this subject that we will discuss in this chapter. My research plan is to take the BNA dataset and use the statistical technique of cluster analysis to empirically determine if firms' bundles of HRM practices sort into distinct systems. To implement this test the author uses Begin's model of five ES's. Ideally, it would be nice to be able to compare the results of the cluster analyses for Begin's model against the typology of ES's developed by other authors (e.g., Osterman 1987, Appelbaum, Bailey, et al. 2000); however, the characterizations of ES's by other authors are based on variables which are either immeasurable or not included in the BNA dataset. The present cluster analysis is performed by partitioning 264 firms according to the percentage of their HRM budget that they allocate to each of nine categories of HRM practices, including recruitment, training, compensation administration, benefits administration, employee relations,

external relations, personnel management, health and safety activities, and strategic planning. The firm-level information used in this analysis comes from the BNA dataset (see section E, question 3 of the survey in the Appendix).

If the cluster analysis can partition firms into a few groups, the next step will be to utilize the HRM demand function to predict the firms' choice of employment system. In the following sections, the methodology used to carry out the cluster analysis and subsequently estimate the choice of employment system are explained in detail. The third section provides the results of the cluster analysis.

A Methodology for Determining the Systems of HRM Practices Used in Firms

The methodology used to perform the cluster analysis is conducted in a similar, albeit more sophisticated, fashion to the analysis of ES's in steel-mills reported in *Manufacturing Advantage: Why High-Performance Work Systems Pay Off* (Appelbaum, Bailey, et al. 2000). In their study, Appelbaum, Bailey et. al. utilize a K-clustering (non-hierarchical) technique that partitions firms into a few discrete groups. In order to perform a K-clustering method one must *a priori* choose the number of groups into which all the observations are partitioned (g), and define a point of reference that serves as the starting point of each cluster (called a centroid). One weakness of the method used in Appelbaum, Bailey, et al. (2000) is that the authors specify both the number of clusters and the centriods in what they concede to be a somewhat arbitrary way, basing them solely on theoretical predictions. The methodology used in this study advances this approach by going one step further and utilizing a hierarchical agglomerative clustering

technique to predict the number of clusters and the centroids that are used to specify the K-clustering procedure. By adding this step to the clustering process, the clustering method is improved because it eliminates the previous approach to specifying the number of groups and their centroids.

The reason that clusters formed using hierarchical clustering cannot be used on their own for making inferences is that the procedure has many steps, and objects merged at any step of the process are never unmerged at subsequent steps. As a result, the grouping at each step is conditioned on the set of clusters formed during previous clustering steps. In the end, this can lead to situations in which the similarity of objects that are clustered together is less than would be the case if the unmerging of clusters were permitted.[17] On the other hand, the results offered by K-clustering avoid this issue by optimizing the intra-cluster dissimilarity in a single step and, as a result, are preferred to those generated using an agglomerative clustering technique. That said, using the less-than-optimal solution offered by agglomeration clustering "…usually gives a near optimal solution that is good enough for most purposes (Romesburg 1984)." Because the results from the agglomerative process are "near optimal" they are used to specify the K-clustering technique in lieu of the process described by Appelbaum, Bailey, et al. (2000). Thus, in the end, the use of both clustering techniques is wise as they work together to produce the best possible results.

Given the just-described relationship between these two clustering methods, the first step in this cluster analysis is to perform a hierarchical agglomerative cluster analysis. Agglomeration clustering begins by assuming that each firm comprises its own

[17] The way in which this issue arises will become more apparent once the hierarchical clustering methodology is explained in more detail below.

cluster (i.e., there are *n* initial clusters), and ends with all firms being part of the same cluster. The process by which *n* clusters are agglomerated into a single cluster takes *n*-1 steps. In each step, the two clusters which are the least dissimilar are fused together to create a single cluster. This process continues until there is only one cluster remaining (Duran and Odell 1974).

The technique used to measure the (dis)similarity between clusters in this analysis is Ward's clustering procedure. Ward (1963) argues that the best way to determine which two clusters should be merged together is to minimize the amount of information that is lost during each step of the clustering process. To accomplish this, in each of the *n*-1 steps, the potential information loss is measured for every potential union of the existing clusters by calculating the error sum-of-squares (*K*). Then, the cluster pairing whose combination results in the smallest increase in *K* is chosen, and the process repeats itself until all firms have been condensed into a single cluster. A single step in this process is represented in the functional form shown in the optimization equation shown below. Ward's method minimizes this function with respect to *K* *n*-1 times in order to agglomerate all objects into a single cluster (Bijnen 1973).

$$K = \sum_{s} \left\{ \sum_{g} \sum_{r} y_{rsg}^{2} - \sum_{g} \left[\frac{1}{n_g} \left(\sum_{r} y_{rsg} \right)^{2} \right] \right.$$

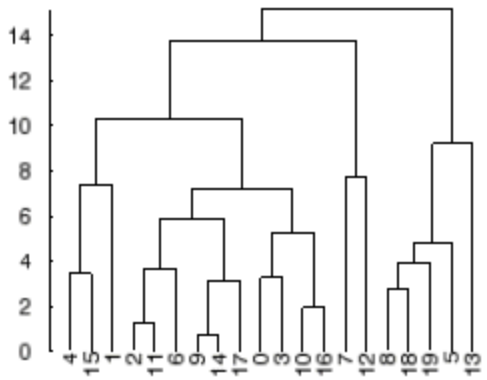
In the present analysis *s* represents the set of nine percentages that represent the distribution of expenditures on HRM which are used to cluster the firms; *g* represents the set of clusters and *r* represents the set of firms that are clustered. As a result, y_{rsg} is the

value of the *s*-th percentage for the *r*-th firm in cluster *g*, and n_g is the number of firms in cluster *g*.

The main issue with hierarchical clustering, as noted above, is that firms in a group cannot be unmerged once they are clustered together. The reason that this is a problem is that the "average" firm in each cluster, known as its "centroid", changes whenever a new firm is added to the group. As a result, there is potential for situations in which firms that are partitioned into a given cluster early in the process may actually be more similar to a different cluster at later stages of the analysis. Unfortunately, when this occurs, similarity of objects that are grouped together at the end of the cluster analysis is less than would be the case if the unmerging of firms were permitted after each step of the process.

The next step in the clustering methodology is to choose the number of groups that provides the best fit for the data. This number of clusters can be identified by using a dendrogram. Visually, the dendrogram looks like a typical tree diagram that graphs *K* on the vertical axis (see Figure 6).

Figure 6. An Example of a Typical Dendrogram



At the bottom of the dendrogram the measure of *K* is zero and there are *n* nodes (in Figure 6 *n*=20). As we move up the graph, the dissimilarity of observations within each cluster, *K*, increases. In the end, the graph looks like a series of steps leading to the single cluster of firms at the top of the figure. To determine the number of clusters, *g*, that provides the best fit for the data one must find the agglomerative step where there is relatively little to gain from reducing the number of total clusters. This point is shown on the dendrogram as a large increase in *K* or a "sharp step" from one number of clusters to the next (Everitt 1993; Kraznowski 2000).

After this point is established and *g* is known, the next step is to specify the centroids that are used as starting points in the K-clustering portion of this cluster analysis. To identify these points of reference, *g* groups of firms are formed using Ward's agglomerative clustering method. Then, the centroid of every cluster of firms is calculated as the intra-cluster mean for each of the nine variables which are used to partition the firms. That is, the centroids are each a vector of nine percentages that relate how firms in a particular cluster tend to distribute their HRM budget on average.

In this dissertation, K-clustering is performed using a mathematical procedure that minimizes intra-cluster dissimilarity called the K-means technique. As has been stated previously, one must specify the number of clusters and their centroids to begin the K-means clustering technique. Once specified, the K-means technique partitions the firms by placing them in the group whose centroid is most similar to their distribution of expenditures on HRM practices. This is accomplished by calculating the squared Euclidean distance between a firm's distribution of expenditures on HRM practices and

the centroids, and subsequently assigning the firm to the centroid that minimizes this value. The equation shown below demonstrates this choice process. Here, $d^2_{i,c(i)}$ represents the squared Euclidean distance of each firm, *i*, to its centroid, *c(i)*.

$$K = \sum_{i=1}^{n} d^2_{i,c(i)}$$

Once the firms have been grouped by optimizing this equation, the centroids for the clusters are recalculated and the firms are re-clustered using the same equation. If any of the firms move from one cluster to another, the centroids are recalculated and the firms are accordingly re-clustered using equation 5.2. The K-means clustering method is complete when no firms move between clusters. The main benefit of clustering the firms using the K-means techniques as opposed to using agglomeration clustering is that the methodology it clusters all firms in a single step. Therefore, the results are not subject to bias from mistakes made in previous steps as is the case with hierarchical agglomerative clustering (Anderson 1980; Everitt 1993).

The end product of the clustering analysis is a set of *g* clusters that are able to characterize all firms according to their distribution of expenditures on HRM practices. In other words, *g* discrete groups are created and each contains a group of firms that use their HRM budgets in a similar way. Thus, we can think of each cluster as a group of firms that utilize roughly the same system of HRM practices. As a consequence, observing the characteristics of each cluster answers the second research question posed in this dissertation as it sheds light on the actual HRM systems used by firms.

Results of the Cluster Analysis

The first step in evaluating the cluster analysis is to choose the number of groups that best fits the data using the dendrogram shown in Figure 7. To make this decision a bit easier, the differences in dissimilarity are traced on the vertical line on the right hand side of the figure. Restricting the potential number of clusters to six, the dendrogram shows us that the greatest changes in dissimilarity occur between 2 and 3 clusters and 4 and 5 clusters. The reason that the number of clusters in the dendrogram is restricted to six is because the purpose of this exercise is to determine a small number (a few) of discrete ES's that can categorize all firms.

After considering the fact that the level of intra-group dissimilarity is very high when there are only two clusters of firms, it becomes apparent that partitioning the firms into 4 clusters provides the best fit for this dataset. The characteristics of each of these four clusters are shown in Table 12. For the remainder of this chapter they will be referred to as Groups 1, 2, 3 and 4. The fact that the dataset shows that the firms neatly sort into four groups is important because it addresses the "classification problem" that has proven to be an obstacle for researchers in this field in the past (see page 31 of Chapter II for a more detailed explanation of this issue). In fact, the results of the cluster analysis identify a specific set of HRM systems used in practice. This is in contrast to the HRM literature which has yet to empirically establish a set of HRM systems that can classify all firms (Black and Lynch 2001).

Figure 7. Dendrogram of the Hierarchical Cluster Analysis

Table 12. Percentage of HRM Budget Allocated to Each Practice by the Average Firm in Each Group of Firms

HRM Practice	Group 1 (78 obs)	Group 2 (67 obs)	Group 3 (63 obs)	Group 4 (56 obs)	Population Average (264 obs)
Recruiting	15.08	16.68	15.02	15.44	15.55
Training	7.32	10.76	11.07	9.02	9.54
Compensation	23.08	15.62	15.74	13.55	17.00
Benefits Administration	22.71	22.08	21.77	25.51	23.02
Employee Relations	4.74	5.00	5.38	6.40	5.38
External Relations	1.34	1.69	2.46	1.80	1.82
Health and Safety	3.61	3.91	3.60	4.30	3.78
Personnel	3.18	3.64	4.24	3.55	3.65
Strategic Planning	2.92	4.47	4.10	3.41	3.97

Note: Groups 1-4 refer to clusters of firms that are formed by the cluster analysis when the optimal number of clusters is assumed to be 4 (as is suggested by the dendrogram in Figure 7).

Before comparing these results to Begin's hypothesis, and prior to estimating the firm's choice of employment system using the HRM demand function, it makes sense to

characterize the four groups of firms that are generated by the clustering process. First, relative to the other groups, Group 1 focuses its attention on compensation practices while using a small portion of the overall HRM budget on the other eight HRM practice types as compared to the rest of the firms in the dataset. Group 2 distinguishes itself by allocating a relatively large portion of its HRM budget to recruiting and strategic planning practices, and otherwise has a fairly average distribution of HRM expenditures. Next, in comparison to the other three groups of firms, Group 3 spends a relatively small portion of its budget on benefits administration practices, but chooses to allocate a larger than average percentage of expenditures on training, external relations and personnel management. Finally, Group 4 is characterized by a relatively high percentage of HRM expenditures on benefits administration and employee relations practices; however, the firms in this cluster tend to use compensation practices with less intensity that firms which are partitioned into the other three clusters.

An Evaluation of Previously Hypothesized Systems of HRM

One purpose of performing this cluster analysis is to use the identified groups of firms from the previous section to empirically test for the existence of the theorized HRM systems described by Mintzberg (1983). To make such a comparison, we rely on the hypotheses of Begin (1997) who argues that there are certain characteristics common to all firms that utilize the same type of employment system. Specifically, he characterizes what he considers the *simple structure*, the *machine bureaucracy*, the *professional bureaucracy* and the *adhocracy system* according to the degree of formalization with

which they use HRM practices to recruit, train, provide benefits, appraise performance and engage in employee relations. In addition, for each employment system, Begin predicts the firms' level of employment (i.e., size), degree of unionization, level of integration of the HR department with the firm's overall organizational strategy and the degree to which firms formalize their HRM practices in aggregate. Table 14, below, outlines his predictions. Unfortunately, the variation in intensity within the *divsionalized form* category means that it can not be easily distinguished using cluster analysis and, as a result, we must focus on the other proposed systems when conducting the cluster analysis. In the end, this assumption should have little bearing on the final placement of firms into clusters since the divisionalized firms are most likely distributed somewhat equally across each of the HRM systems excluding the simple structure. This is a result of the *divisionalized form* being nothing more than the addition of two other systems being implemented simultaneously in separate divisions of one firm.

Table 13. Predicted Characteristics of HRM Systems

Firm Characteristic	Simple Structure	Machine Bureaucracy	Professional Bureaucracy	Adhocracy System
Recruiting (Staffing)	LI	LF	LI	EF
Training	N/LI	LI	N	EF
Benefits (Rewards)	LI	EF	EI	EF
Performance Appraisal/Management	N/LI	LF	LF	EF
Employee Relations (Liaison Devices)	Few	Few	Moderate	Many
Size of Labor Force	Small	Large	Varies	Varies
Unionization	No	Yes	No	Yes
Integration with Org. Strategy	N	N/LI	N/LI	EF
Degree of Formalization**	Little	Much	Little	Much
*Definitions: N - none, LI - limited (informal), LF- limited (formal), EI - extensive (informal), EF - extensive (formal)				
Source: Table 2-2 and Chapter 5 of Begin (1997)				

In Table 13, four of the nine firm characteristics are measured on a scale that shows whether a given type of HRM practice is expected to be non-existent (N), limited and informal (LI), limited and formal (LF), extensive and informal (EI), or extensive and formal (EF). While it is clear that N, LI and EF represent low, moderately low and high demand respectively, the two remaining categories (i.e., LF and EI) are more difficult to distinguish. Each of these measures connotes a use of HRM that is moderate or moderately high. Thus, they are thought of as being equivalent for the purposes of carrying out this cluster analysis. In general, it is reasonable to expect some overlap between the different levels of this scale because the categories are so broad. To quantify these predictions, each of these five measures of the use of individual HRM practices is specified using a six point scale. N is given a score of 1-2 to connote a use of HRM that is well less than average, while LI is given a score of 2-3 to represent utilization of HRM that is moderately below average. Similar to N, EF is given a score of 5-6 because it suggests that a particular HRM practice type is used with an intensity that considerably higher than average. As is noted in the previous paragraph, LF and EI are assumed to be synonymous for the purposes of this analysis and represent moderate (3-4) to moderately high (4-5) usage of HRM. As such, these measures are given a score of 3-5 in the present scales.

In addition to the above measures of the use of individual HRM practices, this table also uses the six point scale to define a range for the terms used to characterize the other five aspects of each of these four employment systems. First, employee relations practices are measured according to whether there are a few, a moderate number, or many practices in the firm. Because these categories neatly break down into three discrete

groups there is no overlap in their scaled scores. In particular, "Few" is given a score of 1-2, "Moderate" is given a score of 3-4, and "Many" is given a score of 5-6. Next, Begin characterizes the *size of the labor force*, the *level of unionization* and the *degree of formalization* variables using descriptors that are binary (e.g., Small or Large, No or Yes, and Little or Much). Interpreting these measures in this way, it makes sense to simply indicate whether or not the variable in question is greater or less than the population average. As a result, to scale these variables we assign a score of 1-3 to "Small", "No" and "Little", and 4-6 for "Large", "Yes" and "Much.". Finally, the *strategic involvement* variable is characterized by Begin in the same way as the first four variables (i.e., N, LI, LF, EI or EF), and therefore follows the same scaling process. Table 14 summarizes this scaling procedure.

Table 14. Conversion Chart

Begin (1997) Terminology	Numeric Range
N	1,2
LI	2,3
LF	3,4,5
EI	3,4,5
EF	5,6
Few	1,2
Moderate	3,4
Many	5,6
Small	1,2,3
Large	4,5,6
No	1,2,3
Yes	4,5,6
Little	1,2,3
Much	4,5,6

Using this conversion chart we can rewrite Table 13 as Table 15 so that it is comparable to a scaled version the results of the cluster analysis (see below for the method used to scale the results of the cluster analysis).

Table 15. Quantifying the Hypotheses of Begin (1997) on a Scale of 1-6

Firm Characteristic	Simple Structure	Machine Bureaucracy	Professional Bureaucracy	Adhocracy System
Recruiting	2,3	3,4,5	2,3	5,6
Training	1,2,3	2,3	1,2	5,6
Benefits Administration	2,3	5,6	3,4,5	5,6
Personnel Management	1,2,3	3,4,5	3,4,5	5,6
Employee Relations	1,2	1,2	3,4	5,6
Employment	1,2,3	4,5,6	Varies	Varies
Unionization	1,2.3	4,5,6	1,2,3	4,5,6
Strategic Involvement	1,2	1,2,3	1,2,3	5,6
Degree of Formalization	1,2,3	4,5,6	1,2,3	4,5,6

In order to compare these predictions to the actual characteristics of the firms in each group identified by the cluster analysis it is necessary to identify the "firm characteristics", as shown in Table 15, for each cluster and then convert these figures to a six point scale. Using the BNA dataset, the author is able to specify all nine of these characteristics using firm-specific information. The first five factors are measured using the firms' expenditures per capita on recruitment, training, benefits administration, personnel management and employee relations HRM practices.[18] Next, similar to the specification in Chapter IV, the *employment* variable is measured by the average number of employees in the firm during 2005, and the *strategic involvement* variable is measured using a five point index. The *unionization* variable is specified as the percentage of

[18] In contrast to the regression analysis in Chapter IV, we can specify the firms' formalization of a given HRM practice type as their per capita expenditures without causing any potential statistical problems.

workers in a firm that are represented by a union. Finally, the *degree of formalization*, which is believed to approximate the firm's demand for HRM, is measured using the firms' aggregate expenditures on HRM practices per worker. Of course, the level of aggregate expenditures on HRM is not a perfect measure of the utilization of HRM practices; however it is the best measure available. As is explained in more detail in Chapter IV, the cost of providing HRM practices is hypothesized to decrease with firm size due to economies of scale, density and scope. Empirically, we interpret the estimated coefficients on the employment variable as suggestive that firms do experience rather substantial reduced costs in providing HRM practices as they grow in size. Table 16 shows each cluster's average values for all nine firm characteristics on which the comparison of the cluster analysis results and Begin's hypotheses is based.

Table 16. Characteristics of the Average Firm in Each of the Clustered HRM Systems

Firm Characteristic	Group 1 (78 obs)	Group 2 (67 obs)	Group 3 (63 obs)	Group 4 (56 obs)	Population Average	Population St. Dev.
Recruiting	223.55	660.53	341.03	513.88	395.43	992.54
Training	119.69	288.55	138.18	530.35	293.37	942.59
Benefits Administration	515.96	481.72	521.39	998.71	667.29	2506.66
Personnel Management	46.22	126.62	39.06	119.65	84.17	246.58
Employee Relations	99.21	154.09	50.09	220.50	138.31	414.20
Employment	1209.57	881.54	3124.59	1566.84	1666.55	5379.92
Unionization	0.29	0.20	0.27	0.30	0.27	0.44
Strategic Involvement	3.24	3.52	3.61	3.92	3.71	1.08
Degree of Formalization	1676.05	3349.71	3851.98	6543.09	3572.21	15193.44

Note: Groups 1-4 refer to clusters of firms that are formed by the cluster analysis when the optimal number of clusters is assumed to be 4 (as is suggested by the dendrogram in Figure 7).

Before it is possible to make a comparison to Begin's predictions we must scale these results from the cluster analysis. The scaling process used here is relatively

straightforward since the results of the cluster analysis are already characterized using an ordinal measure. The scale is determined in the following manner. First, the mean and standard deviation are calculated for each of the nine characteristics for the entire population of firms. These terms are represented by μ_j and σ_j, respectively, with j = {1, 2, …, 9}. Then, the mean values of these nine variables are determined for each cluster. These values are given by the term c_{ij} where i represents the cluster, g_i (i.e., i = {1,2,…,g}), and j represents the nine characteristics (i.e., j = {1,2,…,9}). Finally, each c_{ij} is assigned a score of 1-6, referred to as v_{ij} so they are comparable to the predictions shown above. This is done by using μ_j and σ_j to determine the value of c_{ij} relative to the rest of the population of firms in the dataset. The criteria used to determine each v_{ij} is as follows:

if…

$c_{ij} < \mu_j - 0.25*\sigma_j$,	then $v_{ij} = 1$
$\mu_j - 0.25*\sigma_j < c_{ij} < \mu_j - 0.1*\sigma_j$,	then $v_{ij} = 2$
$\mu_j - 0.1*\sigma_j < c_{ij} < \mu_i$,	then $v_{ij} = 3$
$\mu_j < c_{ij} < \mu_i + 0.1*\sigma_j$,	then $v_{ij} = 4$
$\mu_j + 0.1*\sigma_j < c_{ij} < \mu_j + 0.25*\sigma_j$,	then $v_{ij} = 5$
$c_{ij} > \mu_j + 0.25*\sigma_j$,	then $v_{ij} = 6$

Therefore a value of $v_{ij} = 1$ implies that the per employee expenditures on recruitment practices for a particular group of firms are less than 0.25 standard deviations from the population average. Similarly, a value of $v_{ij} = 2$ indicates that the group's average level of per employee expenditures on recruitment practices is between 0.10 and 0.25 standard deviations from the population mean. The reason that a difference of 0.1 and 0.25 standard deviations from the population mean are used as the threshold values for

creating this scale is because they create differentiation in the results.[19] Table 17 shows the results of the scaling process. After this scaling is complete, it becomes possible to make a direct comparison between the results of this cluster analysis and the predicted HRM systems found in Begin (1997).

Table. 5.6. The Scaled Characteristics of the Average Firm in Each Cluster

Firm Characteristic	Group 1	Group 2	Group 3	Group 4
Recruiting	2	6	3	5
Training	2	3	2	6
Benefits Administration	3	3	3	5
Personnel Management	2	5	3	5
Employee Relations	3	4	2	5
Employment	3	2	6	2
Unionization	4	2	4	4
Strategic Involvement	1	2	3	5
HR Expenditures	2	3	4	4

Note: Groups 1-4 refer to clusters of firms that are formed by the cluster analysis when the optimal number of clusters is assumed to be 4 (as is suggested by the dendrogram in Figure 7).

To execute the comparison, each group of firms created by the cluster analysis is compared to each of the predicted ES's shown in Table 15. For example, the values for the nine specified firm characteristics for Group 1 are placed side by side with the predicted values for each of the four described ES's. Then the process is repeated for Group 2, Group 3 and Group 4. After comparing the results of the cluster analysis to the characteristics the *simple structure, machine bureaucracy, professional bureaucracy* and *adhocracy system* employment systems proposed by Mintzberg and Begin, we find that each cluster of firms closely approximates one of the identified employment systems.

[19] Other values were also tried such as 1.0 and 0.5 standard deviations, and 0.5 and .25 standard deviations, but scaling the variables using these values provided little or no variation across the four groups of firms.

Furthermore, each group provides a good fit for a different ES. Specifically, the summary statistics of Group 4 are in line with the suggested nature of firms who utilize the adhocracy system for all nine characteristics. Groups 1, 2 and 3 also all closely approximate hypothesized employment systems. In particular they have similar characteristics to the *simple structure, professional bureaucracy* and *machine bureaucracy*, respectively. However, unlike Group 4, these groups of firms are not completely in line with Begin's theoretical predictions. The factors which are not in line with Begin's predictions are summarized in the following table, Table 18.

Table. 5.7. Comparing the Use of HRM Practices and Firm Characteristics for Each Cluster to the Hypotheses of Begin (1997)

Number of Group from Cluster Analysis Results	Group 1	Group 2	Group 3	Group 4
Type of HRM System	Simple Structure	Professional Bureaucracy	Machine Bureaucracy	Adhocracy System
Exception(s)	Employee Relations, Unionization	Recruitment and Training Practices	Benefits Administration Practices	None

Because the four groups of firms generated by the cluster analysis so closely approximate four of the ES that are theorized by Begin, we can take one additional step and see if the characteristics of the groups are in accord with the fundamental characteristic(s) of each ES detailed in the first part of this chapter. These hypotheses are listed again below.

H_1 : *Simple structure* firms control workers with managerial supervision

H_2 : *Machine bureaucracy* firms control workers with the technology of production

H_3 : *Professional bureaucracy* firms hire credentialed workers and then take a hands off approach

H_4 : *Adhocracy system* firms focus on improving the AMO of workers

To test the first of these hypotheses, industry information is gathered at the 3-digit NAICS level from the Equal Employment and Opportunity Commission (EEOC) on the percentage of workers that are managers. The data show that the mean percentage of workers that are managers in firms that utilize the *simple structure* is 11.01% in comparison to the rest of the population which has a mean value of 11.71%. On the surface, this result contradicts H_1; however, this difference is not statistically significant and, therefore, we cannot conclude that the percentage of workers that are managers in firms that utilize the *simple structure* is less than the rest of the population. Thus, in the end, the results are inconclusive regarding the first of the listed hypotheses.

The next hypothesis, H_2, states that firms that implement a *machine bureaucracy* ES will control workers with their technology of production. In practice, it is quite difficult to test this hypothesis because one must to identify all the elements and complexities of the firm's production process. However, we can approximate this relationship by observing the level of non-labor operating expenses (e.g., capital expenses on plant, machinery and raw materials) of the firms in this group, Group 3, relative to the rest of the population. This measure is used to test this hypothesis because a firm that makes a relatively large investment in its capital infrastructure has more incentive to establish an environment in which the investment can have high returns. As a result, a firm will have more incentive to focus its personnel practices around the technology of

production so that it operates efficiently and maximizes profits. The mean level of the log of non-labor operating expenses is slightly higher for firms in Group 3 versus the rest of the population (10.23 vs. 9.83); however, as was true with the previous result, this difference is not statistically significant and so it is not possible to make inference from this finding.

H_3 argues that firms that use an ES that is representative the *professional bureaucracy* function by hiring capable individuals and then allowing them to operate with little supervision. Following the same method as was used to test H_1, data from the EEOC is used to see if firms in Group 3 have fewer managers as a proportion of the workforces on average as compared to the rest of the population. In contrast to this, we find that firms that utilize a professional bureaucracy ES have a higher proportion of managers by roughly 8% (12.61% vs. 11.71%), and that this difference is statistically significant at the 5% level.

To investigate the fourth hypothesis, H_4, we must establish whether or not improving the effort and motivation of the workforce is the principle goal of the firms that are in Group 4. To approximate this, information is used from the BNA survey which asks respondents if satisfaction and morale are considered by top management as most important when evaluating the merit of the HR department (see the Appendix for a copy of the BNA survey). The data show that 33% of the firms in Group 4 consider improving employee satisfaction and morale to be top management's priority when evaluating the HR department, which is significantly[20] greater than the mean value for the firms that are in Groups 1, 2 and 3 (26.7%).

[20] This difference is statistically significant at the 5% level.

Estimating the HRM Demand Function

After clustering firms together that use similar systems of HRM and comparing them to the hypothesized typologies of Begin (1997), the next step is to determine why a firm chooses to use a particular HRM system versus others. By applying the HRM demand function to this aspect of the firm's HRM choice, we can attempt to identify what causes firms to choose one system over another. The HRM demand function is shown below (see Chapter III for a derivation and detailed explanation of this mathematical expression).

$$\frac{HRM}{L} = f(\mathrm{A}, \mathrm{P}, \mathbf{L}, \mathrm{K}, v, r, w, \mathrm{X_i})$$

Adapting this function to the present situation, the dependent variable in the HRM demand function becomes the cluster that the firm chooses (i.e., g_i where i = 1, …, g). The set of independent variables used to predict this decision is the same as those which are used in Chapter IV to determine the firm's expenditures on HRM practices. In total, there are seventeen internal and environmental characteristics of each firm that theoretically influence their costs and benefits from utilizing HRM practices. They include the size of the firm's workforce, wages, capital intensity, the demographic, occupational and knowledge characteristics of the workforce, the sector in which the firm operates (public/non-profit/private), the level of the surveyed department in the organization, union activity, labor and product market characteristics, the strategic role of

the HR department within the firm, and the degree to which a firm's ideology that favors the provision of a high level of HRM activities for its employees. Please refer to the second section of Chapter III for a detailed description the theoretical relationship of each of the independent variables with the use of HRM, and see Table 3 of Chapter IV for a list of the sources used to populate the dataset. The specific econometric method used to estimate this model is the *multinomial logit* approach. This is appropriate since the dependent variable is a series of unrelated outcomes which are all predicted by the same set of independent variables.

Table 19 shows the results of the HRM demand function that estimates the firms' choice of employment system using the *multinomial logit* technique. The base outcome in this estimation is Group 1. In general, it makes sense to use this group of firms as the base group since the other three identified employment systems all use HRM with more intensity than the *simple structure*. As is seen in the table, the HRM demand function's ability to predict the firms' choice of employment system is somewhat reduced compared to the predictive power of the HRM demand function to explain the firms' choices regarding aggregate and disaggregated expenditures on HRM practices. For example, the sign of the coefficients for each independent variable is consistent for six of the specified independent variables across the three specifications. This subset of variables includes *employment, wages, governmental entity, service oriented firm, strategic interaction* and *level of the HR department in the firm*. Even though this group of variables is relatively small, we find that the coefficients of this subset of estimates are consistent with the hypotheses regarding all of the variables except for the dummy variable that represents firms that are governmental entities. Next, no more than two of the seventeen

independent variables are found to be statistically significant determinants of the firms' choice to implement a given HRM system. In contrast to this, ten variables were found to be statistically significant determinants of the firms' aggregate expenditures on HRM practices. In addition, the reduced explanatory power of the HRM demand function for explaining the firms' choice of HRM system is also seen by observing the R-squared terms of the specifications. This number, which reflects the amount of variation in the demand for HRM that is "explained" by the regressors, is 0.474 when the dependent variable is the aggregate expenditures on HRM practices, but is only 0.145 when the dependent variable reflects the firms' choice regarding their system of HRM practices.

In retrospect, the reduction of explanatory power if the HRM demand function in explaining this aspect of firm choice is not so surprising since the construct of the HRM demand function is geared towards predicting the utilization of HRM practices in terms of magnitude rather than type. Similar to the K and L inputs, the HRM variable in the production function relates the magnitude of the input and not its type. For example, the labor demand function predicts the number of full time employees or labor hours required for production, but it does not address different types of workers. In fact, when there are different types of an input (e.g., blue-collar and white-collar workers) they should be included as separate inputs in the production function and their demand, and its magnitude, should be evaluated separately (Berndt and Christensen 1973; Berndt and Christensen 1974).

Table 19. Results of the Multinomial Logit Regression[1]

VARIABLES	Group2	Group3	Group4
Log of Employment	0.180	0.237	0.257
	(0.240)	(0.245)	(0.266)
Log of Capital Intensity	0.200	-0.121	0.0294
	(0.264)	(0.185)	(0.154)
Log of Wages	0.315	0.928*	1.159***
	(0.585)	(0.503)	(0.379)
Unionization	0.521	-0.239	0.0362
	(0.645)	(0.608)	(0.597)
HPWS Ideology	-0.230	0.334	0.366
	(0.708)	(0.681)	(0.698)
Unemployment	0.127	-0.205	-0.502
	(0.519)	(0.407)	(0.428)
Non-Profit Entity	0.664	-2.54***	-1.562
	(1.801)	(0.770)	(1.739)
Governmental Entity	-2.268	-1.574	-1.352
	(1.948)	(1.531)	(1.777)
Service Oriented Firm	0.235	1.060	0.322
	(1.947)	(1.698)	(1.777)
Strategic Interaction	0.549*	0.145	0.355
	(0.331)	(0.281)	(0.296)
Log of Rate of Separations	-2.324**	-1.782	0.117
	(1.141)	(1.428)	(0.928)
Log of Var. in Employment	-0.0306	0.519	-0.380
	(0.770)	(0.626)	(0.534)
White Collar	-0.0324	0.00461	-0.0156
	(0.0356)	(0.0268)	(0.0179)
Bachelors Degree	8.330	-2.048	2.413
	(22.07)	(12.02)	(12.58)
Percent Women	-0.0363	-0.0400	0.00579
	(0.0399)	(0.0400)	(0.0419)
Percent Minority	-0.00735	-0.00707	0.0100
	(0.0282)	(0.0254)	(0.0342)
Corporate Level	0.0441	0.185	0.449
	(0.604)	(0.752)	(0.697)

[1] Base outcome is Group 1, R-Sq. = 0.145

*** p<0.01, ** p<0.05, * p<0.1

Robust Standard Errors in Parenthesis

Note: Groups 1-4 refer to clusters of firms that are formed by the cluster analysis when the optimal number of clusters is assumed to be 4.

Even though there is little that we can say with relative certainty based on the estimated coefficients from this regression equation, there are some observations which can be made. In particular, Groups 3 and 4 contain firms that tend to pay a relatively high wage on average, and non-profit firms are less likely to join Group 3. Furthermore, the firms in Group 2 are characterized by HRM departments that have a high level of interaction in their respective firms' strategic choices, and are located in industries that have a relatively low level of employee turnover.

In the end, the results of the cluster analysis are able to partially answer the second research question stated in Chapter I which asks how firms will distribute their chosen level of HRM expenditures. After determining that separating the firms into four groups provides the best fit for the data, each firm is assigned to a cluster with firms who made similar choices when allocating their HRM expenditures to nine different practice types. Observing the characteristics of these four groups we can make some generalizations about a discrete set of four systems of HRM practices used by the firms in the dataset. However, while we can definitively say that firms separate into four groups that have distinct characteristics, the HRM demand function is not able to predict the firm's choice when it comes to selecting one of these four HRM systems. Even though this result is not ideal, the fact that the cluster analysis does neatly partition the firms into four groups is substantial, indicating that there are a few HRM systems (i.e., employment systems) that characterize the distribution of HRM expenditures in all firms.

Summary

The results of the cluster analysis performed in this chapter show that there is a discrete set of four HRM systems that characterize the practices used in all firms. This finding suggests that there is no "best practice" HRM system toward which all firms gravitate; rather, the cluster analysis shows us that each firm chooses to implement one of four types of ES's. In addition to evaluating the second stated research question, the results of the cluster analysis are useful because they allow us to test the hypothesized set of ES's described by Begin (1997). To enable such an evaluation, it is first necessary to scale Begin's predictions and the results of the cluster analysis so that they are equivalent. The results of this comparison show that groups of firms created by the cluster analysis provide a good fit for the hypothesized HRM systems described by Begin.

Next, the HRM demand function is estimated to try to determine the exogenous factors that cause a firm to choose one ES over the rest. As is shown in Table 19, the results of this regression are not informative. Thus, in the end, the results of this analysis are only able to partially address the second research question stated in Chapter I since they do not explain the causal factors of this aspect of firms' HRM choices. This result also signals the need for a sophisticated model that can better approximate the firms' choice of employment system since the relatively simplistic economics-based model here is unable to do so.

CHAPTER VI

CONCLUSION

Firms utilize human resource management (HRM) practices to effectively coordinate and administer their workforces with the ultimate goal of maximizing profits. There are two related aspects of the use of HRM practices that are investigated in this dissertation. The first is to determine why some firms expend a great deal of resources on HRM practices for each employee while others spend very little. The second is to determine if the HRM systems firms choose aggregate into distinct types of employment systems, and what factors influence this choice. Over the years, researchers in the fields of management, psychology, economics and industrial relations have attempted to theorize these aspects of the use of HRM practices in firms, yet none of the existing models or theories are very analytical or command widespread acceptance. In this study, the author brings to bear on these issues a new microeconomics-based model developed by my dissertation chair, Bruce Kaufman (2004; 2008). It models HRM as a factor input into production and posits that differences in the productivity and profitability of HRM cause firms to choose different levels of HRM. This prediction is consistent with the HRM frequency distributions shown in Figures 1.1, 1.2, 1.3 and A.1. The model also shows that complementarities among individual HRM practices can give rise to distinct employment systems.

This dissertation seeks to test these implications of the theory. The first step is to estimate the HRM demand curve where the firms' expenditures on HRM practices per employee are the dependent variable. On the right hand side of this equation are a

number of independent variables which the theoretical model and the literature suggest will influence the demand for HRM. They include the size of the firm's workforce, wages, non-labor operating costs per employee, the demographic, occupational and knowledge characteristics of the workforce, the sector in which the firm operates (public/non-profit/private), the level of the surveyed department in the organization, union activity, labor and product market characteristics, the strategic role of the HR department within the firm, and the degree to which a firm's management philosophy favors the provision of a high level of HRM activities for its employees.

The results of this estimation are twofold. First, the overall regression equation is found to be statistically significant. This means that the collection of independent variables is able to successfully explain part of the variation in HRM practices across firms. Second, there are nine independent variables, or "shift factors", which are statistically significant and thus identify individual determinants of firms' HRM demand. They include the number of employees in the firm (employment), average annual wage rate, level of non-labor operating costs per employee, managerial philosophy, sector (e.g., government, service), rate of separations, level of education and the proportion of women in the workforce.

In addition to estimating the influence of these independent variables on the firms' aggregate HRM expenditures, nine additional specifications are estimated where the dependent variable is specified as the total expenditure per employee on specific HRM practice types. These disaggregated demand functions are able to show to what extent the independent variables have common effects across individual HRM practice categories. The results show that there are only two independent variables (*employment*

and *wages*) that have a relatively stable influence on the demand for HRM for all nine practice types. For the rest of the independent variables, these additional specifications produce coefficients that show variation in statistical significance, magnitude and/or sign across HRM practice types. The additional model specifications are also useful because they identify two independent variables (the proportion of white collar workers in the firm and if the HR department resides in the firm's corporate headquarters) that are not statistically significant in predicting aggregate expenditures on HRM per employee, but are stable determinants of the demand for individual practice types.

After estimating both the aggregated and disaggregated versions of the HRM demand function, the dissertation next examines whether firms' HRM practices bundle into discrete employment systems. Thus, Chapter V utilizes a cluster analysis and finds that the distribution of expenditures on individual HRM practice types partitions firms into four groups, each of which represent a different employment system. By observing the level of usage of each type of HRM practice in each of the four groups it becomes possible to identify complementarities between types of HRM practices. This provides suggestive evidence that there are complementarities that exist in this grouping of firms that are specific to training, external relations and personnel management practices. Next, the results of the cluster analysis are used to test for the existence of four proposed employment systems theorized in Begin (1997) called the *simple structure*, *machine bureaucracy*, *professional bureaucracy*, and *adhocracy system*. The results of this comparison show that groups of firms created by the cluster analysis provide a good fit for the hypothesized HRM systems described by Begin.

While the results from the cluster analysis are informative, the HRM demand function's ability to predict the firms' choice of employment system is greatly reduced compared to the predictive power of the HRM demand function to explain the firms' choices regarding aggregate and disaggregated expenditures on HRM practices per employee. For example, the number of independent variables that are found to be statistically significant determinants of the firms' choice is reduced from nine to two. The reduced explanatory power of the HRM demand function for explaining the firms' choice of HRM system can also be seen by observing the R-squared term of the two specifications, which is 0.474 when the dependent variable is specified as the aggregate expenditures on HRM practices per employee, but is only 0.145 when the dependent variable reflects the firms' choice regarding their system of HRM practices. While this result is not encouraging, it is also not too surprising that the HRM demand function is not a good predictor of the firms' choice of employment system. Indeed, the present model is built on the standard neoclassical production function framework in which the factor input variables (i.e., the K, L and HRM variables) are intended to relate the *magnitude* of the input and not its *type*. Therefore, this result signals the importance of the need for a more complex model that is geared towards predicting this qualitative choice.

Significance and Addition to Knowledge

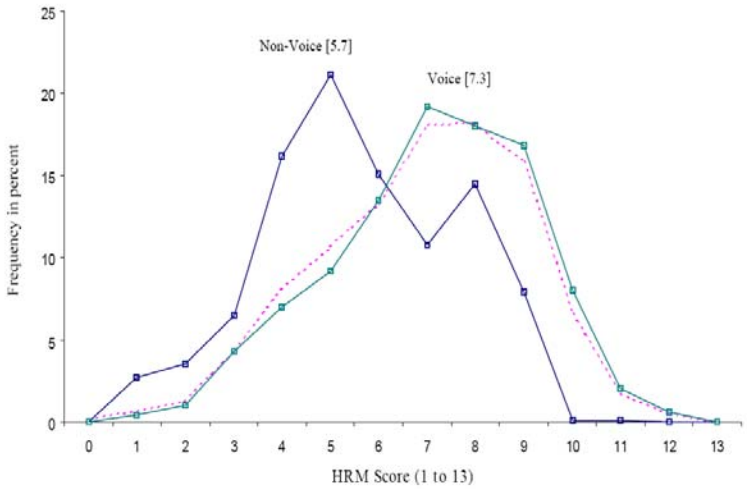
The empirical estimations of the HRM demand function conducted in this dissertation provide support for a microeconomics-based theoretical model of firms' choice of HRM practices. Perhaps the most influential contribution of this theory is that

it derives a clear connection between HRM practices and firm performance, and thus illuminates the proverbial "black-box" that has plagued the HRM literature for two decades. Next, the empirical results contribute to the extant literature by identifying a number of independent variables that are statistically significant determinants of the demand for HRM. Furthermore, the sign and magnitude of each of these statistically significant regression coefficients communicate the degree to which they each individually influence the level of demand for HRM. An additional contribution of this dissertation is that it uses a cluster analysis to demonstrate that there are a discrete set of a few employment systems that categorize all firms. By identifying a few such employment systems that exist in practice, this dissertation adds to the HRM systems literature by clarifying the "classification problem" that has constrained past research, and by providing empirical support in favor of the hypothetical employment systems proposed in Begin (1997).

APPENDIX

FIGURES

Figure A.1. The Demand for HRM Practices



Note: For the purposes of solving their research questions, Bryson and others show both the distribution for firms which are classified as having 'voice' and those which have 'no voice' in this graph. The study seeks to explain why the line representing voice strictly dominated the no voice line, concluding that voice and HRM are compliments.

Source: (Bryson, Gomez, et al. 2007)

Figure A.2. Bureau of National Affairs Survey Instrument

HR Department Benchmarks and Analysis Survey

Section A: Your Organization

Overview: The questions in this section address general factual/demographic information about your organization, for example: primary industry, annual revenues, and number of employees. This demographic information will help provide context for the information gathered in later sections.

1. Please choose the **PRIMARY** industry grouping that comes closest to representing your organization: (check one)

Manufacturing Categories

- ❑ Apparel
- ❑ Appliances and components
- ❑ Chemicals
- ❑ Computer/electronic products
- ❑ Food
- ❑ Furniture
- ❑ Leather
- ❑ Lumber
- ❑ Machinery
- ❑ Metals (fabricated)
- ❑ Metals (primary)
- ❑ Paper
- ❑ Petroleum/coal processing
- ❑ Printing
- ❑ Rubber/plastic products
- ❑ Stone, glass & concrete
- ❑ Tobacco
- ❑ Textiles
- ❑ Transportation equipment
- ❑ Other manufacturing _____

Nonmanufacturing/Services Categories

- ❑ Agriculture/forestry
- ❑ Banking
- ❑ Business, personnel, and miscellaneous services
- ❑ Communications
- ❑ Construction
- ❑ Finance (other than banking)
- ❑ Information services and data processing
- ❑ Insurance
- ❑ Mining
- ❑ Publishing
- ❑ Real estate
- ❑ Retail trade
- ❑ Transportation & warehousing
- ❑ Utilities
- ❑ Wholesale trade
- ❑ Other nonmanufacturing/services _____

Nonbusiness Categories

- ❑ Education
- ❑ Government (federal)
- ❑ Government (state)
- ❑ Government (local)
- ❑ Health care (other than hospital)
- ❑ Hospital
- ❑ Library/archive
- ❑ Membership organizations & associations
- ❑ Social services
- ❑ Other nonbusiness _____

2. Please verify the total annual revenue for your organization (nonbusiness entities, please report total operating budget): (check one)

- ❑ Less than $10 million
- ❑ $10-49 million
- ❑ $50-99 million
- ❑ $100-499 million
- ❑ $500-999 million
- ❑ $1-9 billion
- ❑ $10-24 billion
- ❑ $25 billion or more

3. Has your organization undergone a major transition (merger, acquisition, or restructuring) within the last two years?

❑ Yes ❑ No

4. **If you said "Yes" to question 3,** did this transition result in a reduction in force?

❑ Yes ❑ No

5. Including your own, approximately how many separate locations does your organization have? (check one)

- ❑ 1
- ❑ 2-3
- ❑ 4-5
- ❑ 6-10
- ❑ 11-25
- ❑ 26-49
- ❑ 50-99
- ❑ 100-499
- ❑ 500 or more

6. Please verify the total number of employees (headcount) in your organization, across all its locations. (check one)

- ❑ Less than 25
- ❑ 26-99
- ❑ 100-249
- ❑ 250-499
- ❑ 500-999
- ❑ 1,000-2,499
- ❑ 2,500-9,999
- ❑ 10,000-24,999
- ❑ 25,000-99,999
- ❑ 100,000 or more

7. Please indicate all levels of your organization that have HR departments:

- ❑ Corporate-level (serves all employees in the org. by developing company-wide HR policies/programs)
- ❑ Division-level (serves employees at a divisional, regional, or group level)
- ❑ Facility-level (serves employees at a single facility only)
- ❑ Other (please specify) _____

8. For which level of HR department are you responding?

- ❑ Corporate-level
- ❑ Division-level
- ❑ Facility-level
- ❑ Other (please specify) _____

IMPORTANT: In answering questions for the remainder of the survey, please provide data relating to the organizational level you selected above.

9. In what U.S. state or territory is your HR department located? _____

10. Are any employees served by your HR department represented by a union? (check one)

- ❑ Yes, more than 50%
- ❑ Yes, 25-49%
- ❑ Yes, 10-24%
- ❑ Yes, 5-9%
- ❑ Yes, less than 5%
- ❑ No employees are unionized

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Section B: HR Outsourcing

Overview: : In this section, you will be asked several questions about an outsourcing initiative undertaken by your HR department.

BENEFITS ACTIVITIES

- Vacation/leave policies and administration
- Insurance benefits administration
- Unemployment compensation
- Pension/retirement plan administration
- Flexible spending account administration
- Cafeteria benefits plan administration
- Profit-sharing plan administration
- Stock plan administration

EMPLOYEE SERVICES ACTIVITES

- Recreation/social programs
- Employee assistance plan/counseling
- Pre-retirement counseling/retirement planning
- Relocation services
- Outplacement services

1. Does your HR department outsource **any** of the Benefits or Employee Services activities listed above, **either partially or in full**?

   ❑ Yes ❑ No

2. Please select the Benefits or Employee Services activity from the following list that your HR department has **outsourced most recently**—whether partially or in full.

Benefits Activites

❑ Vacation/leave policies and administration
❑ Insurance benefits administration
❑ Unemployment compensation
❑ Pension/retirement plan administration
❑ Flexible spending account administration
❑ Cafeteria benefits plan administration
❑ Profit-sharing plan administration
❑ Stock plan administration

Employee Services Activities

❑ Recreation/social programs
❑ Employee assistance plan/counseling
❑ Pre-retirement counseling/retirement planning
❑ Relocation services
❑ Outplacement services

Other

❑ No portion of these activities is outsourced [skip to Section C]

Please answer the remaining questions in this section about the activity you selected in

3. Approximately what portion of the activity you selected in question (2) is outsourced to a vendor?

   ❑ Less than 25% ❑ 25-50% ❑ 51-75% ❑ More than 75% ❑ Don't know

4. What department or individual initiated the decision to outsource this activity?

   ❑ Human resources department ❑ Finance department ❑ Don't know
   ❑ Information technology department ❑ The CEO ❑ Other (please specify) _____

5. How many years ago was this activity outsourced?

   ❑ Less than 1 year ❑ 2+ years up to 4 years ❑ 6+ years up to 10 years
   ❑ 1+ years up to 2 years ❑ 4+ years up to 6 years ❑ Don't know

6. Prior to outsourcing, did your HR department perform this activity in house?

   ❑ Yes ❑ No ❑ Don't know

7. What were the **two most important factors** that drove the decision to outsource the activity? *Select two only.*

   ❑ Potential cost savings ❑ Improvement in service quality ❑ Don't know
   ❑ Access to greater expertise ❑ Shift in HR strategic priorities ❑ Other (please specify) _____

8. Does your HR department manage/oversee the relationship with the outsourcing vendor?

   ❑ Yes ❑ No ❑ Don't know

9. Did the outsourcing initiative coincide with a reduction in HR staff?

   ❑ Yes ❑ No ❑ Don't know

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Section B: HR Outsourcing *(continued)*

10. Please rate the outsourcing initiative in the following areas:

	Very Favorable	Somewhat Favorable	Undetermined	Somewhat Unfavorable	Very Unfavorable
Net cost savings to the organization	❑	❑	❑	❑	❑
Vendor quality of service to employees	❑	❑	❑	❑	❑
Re-allocation of HR resources	❑	❑	❑	❑	❑
HR relationship with the outsourcing vendor	❑	❑	❑	❑	❑
Planning prior to negotiating the outsourcing agreement	❑	❑	❑	❑	❑
Communicating with employees regarding the outsourcing	❑	❑	❑	❑	❑

11. Please give your overall rating of the outsourcing initiative to date:

❑ Very successful ❑ Somewhat disappointing ❑ Undetermined
❑ Somewhat successful ❑ Very disappointing

12. Has your HR department outsourced any activity that you later chose to bring back in house?

❑ Yes ❑ No ❑ Don't know

Section C: HR Strategy and Metrics

Overview: : The questions in this section address issues relating to your HR department's role in the organization and the range of measurement tools that HR currently uses to track information and inform organizational decision-making.

1. To whom does the top executive in your HR department directly report?

❑ CEO/President
❑ Senior Vice President or equivalent level position
❑ Vice President or equivalent level position
❑ Director or equivalent level position
❑ Other

2. How would you describe the HR function's strategic involvement in key business decisions made by your organization?

❑ Full strategic involvement
❑ Substantial strategic involvement
❑ Partial strategic involvement
❑ Minimal strategic involvement
❑ No involvement in strategic decisions

3. **What two areas** would you say most affect how top management evaluates your HR department's performance? *Please select only two.*

❑ HR cost containment and budget management
❑ Overall employee satisfaction and morale
❑ Internal "client"/manager satisfaction with HR
❑ Recruitment and retention of employees
❑ Employee training and development
❑ Other (please specify) _____
❑ Don't know

4. How frequently does your HR department use each of the following types of measurement and planning tools?

	Regularly	Occasionally/ On Demand	Currently Not Used	Don't Know
Trend analysis for reports to senior management (e.g., using data from balanced scorecards, dashboards processes, and statistics on staffing, demographics, and turnover)	❑	❑	❑	❑
Succession planning (e.g., conducting leadership training for senior and middle managers)	❑	❑	❑	❑
HR productivity measures (e.g., measuring ROI, turnover costs)	❑	❑	❑	❑
Employee relations measures (e.g., conducting employee morale surveys)	❑	❑	❑	❑
Staffing measures (e.g., calculating recruiting costs, quality of hires)	❑	❑	❑	❑
Training and development (e.g., reviewing scope of programs, number of employees trained)	❑	❑	❑	❑
Compensation and benefits (e.g., measuring average employee salary, costs per insurance claim)	❑	❑	❑	❑

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Section D: Organizational and Human Resource Staffing

Overview: : In this section, you will be asked for information relating to (1) the number of employees served by your HR department and (2) the number of full-time equivalent (FTE) staff positions in your HR department.

1. Please report the total number of regular employees (headcount) **in the organization, division, or facility served by your HR department**. *This should include all regular full-time and part-time staff. If reporting for the corporate level, provide headcount information for the entire organization.*

   Average number of employees during **2004**: _____
   Current number of employees: _____
   Average number of employees (projected) during **2005**: _____

Instructions for Question (2)

Question 2 asks for the number of HR staff positions in your department. Please use full-time equivalent (FTE) figures to report part-time staff. For example, report a full-time HR clerk and a half-time HR clerk as "1.5" in the secretarial/clerical category (1.0 + .5 = 1.5).

Please exclude the following from your figures: (1) positions left vacant for more than six months in 2004; (2) positions that are not likely to be filled within the first six months of 2005; (3) staff members who work exclusively in any of the following areas:

- Risk mgmt./business insurance
- Environmental/EPA compliance
- Company-wide clerical services
- Company-wide purchasing
- Maintenance/janitorial services
- Facilities management
- Security/property protection
- Public/media relations
- Legal services
- In-house medical services
- Commuter services (e.g., parking, shuttles)
- Fleet management
- Travel services/travel office
- Food services/cafeteria
- Credit union
- Library
- Child care center/arrangements

2. For each employee group, please report the number of full-time equivalent staff positions (including your own) in your HR department in 2004 and 2005. *Exclude any positions noted in the Instructions above. If the number of positions for a category is zero, please enter "0" in the appropriate box.*

	2004 HR Staff Positions (in FTEs)	2005 HR Staff Positions (in FTEs)
Managerial/supervisory:	_____	_____
Professional/technical:	_____	_____
Secretarial/clerical:	_____	_____
Total	_____	_____

3. Do any of your HR department staff members work as non-clerical specialists, focusing exclusively on only one or two areas that require professional expertise?

   ❑ Yes Number of non-clerical specialists: _____ ❑ No

4. **If you said YES to question 3**, in which specific areas do your non-clerical HR specialists work? *Check all that apply.*

   ❑ Benefits
   ❑ Compensation (other than payroll)
   ❑ EEO/affirmative action
   ❑ Employee assistance/counseling
   ❑ Employee communications
   ❑ Employee/labor relations
   ❑ Employment/recruitment
   ❑ Health and wellness
   ❑ Human resource information systems
   ❑ Payroll
   ❑ Safety/OSHA
   ❑ Strategic Management
   ❑ Training/development
   ❑ Workers' compensation
   ❑ Other (please specify) _____

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Section E: HR Department Expenditures and Budgets

Overview: : In this section, you will be asked to provide basic information about your HR department's 2004 expenditures and 2005 budget. As with all information you provide, the financial data you report below will be held strictly confidential.

1. Does your human resource department have its own budget?

   ❑ Yes ❑ No

Instructions for Question (2): HR Department Budget

Reporting of HR Labor Costs (salaries and benefits): Include salaries of benefits for all HR department staff members, even if some of these costs are actually budgeted to other departments. Be sure to count expenditures for all non-leave benefits—both legally required and not required—that your organization provides to its HR employees. **Exclude** benefits costs for any non-HR staff members that may be allocated to your HR department budget.

Reporting of Non-labor Costs: Include all non-labor costs incurred by the HR department (e.g., for materials, equipment, overhead, administration). If any non-labor costs are budgeted to other departments, also include those costs in the HR figures you report.

Finally, exclude labor and non-labor costs for any of the following activities, *if these costs are allocated to the HR department budget for the entire organization, division, or facility.*

- Risk mgmt./business insurance
- Environmental/EPA compliance
- Company-wide clerical services
- Company-wide purchasing
- Maintenance/janitorial services
- Facilities management
- Security/property protection
- Public/media relations
- Legal services
- In-house medical services
- Commuter services (e.g., parking, shuttles)
- Fleet management
- Travel services/travel office
- Food services/cafeteria
- Credit union
- Library
- Child care center/arrangements

2. Please provide the following information about your HR department's 2004 expenditures and 2005 budget. If actual numbers are not available, please provide your best estimate. (Please see the instructions in the box above.)

	FY 2004 Expenditures	FY 2005 Budget
HR department labor costs		
Salaries (excluding benefits)	$_____	$_____
Benefits	$_____	$_____
Non-labor HR department costs	$_____	$_____
Total HR department costs (The sum of HR labor costs—staff salaries and benefits—and non-labor HR costs.)	$_____	$_____

3. Please approximate the percentage of your 2005 HR budget allocated to each area below *(use left-most boxes)*. Then note how your 2006 HR budget allocations are likely to compare with 2005, after basic adjustments for inflation *(increase, decrease, or no change)*.

	HR Budget Allocation for 2005 (%)	Expected Change in 2006 Allocation		
		Increase	Decrease	No Change
Employment and recruiting	_____	❑	❑	❑
Training and development	_____	❑	❑	❑
Compensation	_____	❑	❑	❑
Benefits	_____	❑	❑	❑
Employee services	_____	❑	❑	❑
Employee relations	_____	❑	❑	❑
External relations	_____	❑	❑	❑
Personnel/HR records	_____	❑	❑	❑
Health and safety	_____	❑	❑	❑
Strategic planning	_____	❑	❑	❑
All other areas	_____	❑	❑	❑
Total (should equal 100%)	_____	❑	❑	❑

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Section F: Organization Expenditures and Budgets

Overview: This section focuses on your Organization's 2004 expenditures and 2005 budget.

1. Please provide the following expenditure and budget information for the organization, division, or facility served by your human resource department. (If actual numbers are not available, please provide your best estimates).

	FY 2004 Expenditures	FY 2005 Budget
Labor costs		
Salaries (excluding benefits)	$_____	$_____
Benefits*	$_____	$_____
Non-labor operating costs (Report costs of materials and equipment, overhead, sales, and administration)	$_____	$_____
Total operating costs	$_____	$_____

**Include expenditures for all non-leave benefits—those legally required and not required—that your organization provides to its employees.*

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Section G: Human Resource Activities

Overview: : This **final section of the survey** identifies a number of different human resource activities. Please indicate who performs each of the listed activities.

	Who performs the activity? (check one)				
	HR Department Only	HR and Other Department(s)	Other Department(s) Only	Outsourced Mostly or	Activity Not Performed
Employment and recruiting activities					
1. Employment interviews					
2. Pre-employment testing (except drug tests)					
3. Temporary labor administration					
4. Recruiting (other than college recruiting)					
5. College recruiting					
Training and development activities					
6. Orientation of new employees					
7. Performance appraisal, management					
8. Performance appraisal, nonmanagement					
9. Supervisory training/mgmt. development					
10. Skills training, nonmanagement					
11. Tuition aid/scholarships					
12. Career planning/development					
13. Productivity/quality enhancement programs					
Compensation activities					
14. Wage/salary administration					
15. Job descriptions					
16. Payroll administration					
17. Payroll processing					
18. Job evaluation					
19. Job analysis					
20. Executive compensation					
21. Incentive pay plans					
Benefits activities					
22. Vacation/leave policies and administration					
23. Insurance benefits administration					
24. Unemployment compensation					
25. Pension/retirement plan administration					
26. Flexible spending account administration					
27. Cafeteria benefits plan administration					
28. Profit-sharing plan administration					
29. Stock plan administration					
30. Recreation/social programs					
31. Employee assistance plan/counseling					
32. Pre-retirement counseling/ret. planning					
33. Relocation services					
34. Outplacement services					

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	Who performs the activity? (check one)				
	HR Department Only	HR and Other Department(s)	Other Department(s) Only	Outsourced Mostly or	Activity Not Performed
Employee relations activities					
35. Disciplinary procedures					
36. Complaint procedures					
37. Award/recognition programs					
38. Exit interviews					
39. Employee communications/publications					
40. EEO compliance/affirmative action programs					
41. Suggestion systems					
42. Attitude surveys					
43. Union/labor relations					
External relations activities					
44. Community relations/contribution programs					
45. Government relations					
46. Press/Media relations					
Personnel/HR records activities					
47. Personnel/HR recordkeeping					
48. Promotion/transfer/separation processing					
49. Human resource information systems					
50. HIPAA compliance					
Health and safety activities					
51. Workers' compensation administration					
52. Safety training					
53. Safety inspections/OSHA compliance					
54. Health/wellness program					
55. Drug testing					
Strategic planning activities					
56. Human resource forecasting/planning					
57. Organization development					
58. Mergers and acquisitions					
59. International personnel/HR administration					
60. Succession planning					

Did your HR department assume any new areas of responsibility during the past year?

❑ Yes ❑ No

Were any activities removed from the responsibilities of your HR department during the past year?

❑ Yes ❑ No

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TABLES

Table A.1. Description of Sources Used to Populate the Dataset

Variable	Source
Rate of Unemployment (Industry-State)	The 2005 Current Employment Statistics (CES) survey (State & Metro Area) conducted by the BLS
Log of Separations per 100 Employees	The 2005 Job Openings and Labor Turnover Survey (JOLTS) conducted by the BLS
Log of Variation in Employment (1990-2004)	The Quarterly Census of Employment and Wages conducted by the BLS (QCEW) from January of 1990 to December of 2004
Percent of Employees that Have a Bachelors Degree	Labor Force Statistics taken from the 2005 Current Population Survey (CPS) conducted by the BLS
Percent of Employees that are Women	Obtained from the U.S. Equal Employment Opportunity Commission's Statistical Database. The specific sources are (1) Job Patterns For Minorities And Women In Private Industry (EEO-1) and (2) Job Patterns For Minorities And Women In State And Local Government Industry (EEO-3). The White Collar workers are defined as the proportion of the labor forces working as managers, professionals, sales workers, and office and clerical workers.
Percent of Employees that are Minority	
Percent of Employees that are White Collar	

Table A.2. Testing for Differences in the Regression Equation Specifications

	Recruitment	Training	Compen-sation	Benefits Admin.	Employee Relations	External Relations	Personnel Mgt.	Health and Safety	Strategic Planning
Chi2(17)	54.29	56.23	76.42	45.14	26.78	37.10	14.96	35.91	18.38
Prob>Chi2	0.000	0.000	0.000	0.000	0.083	0.005	0.665	0.007	0.431

Note: In this test the estimated coefficients from the aggregated equation are compared to each of the disaggregated equations. The null hypothesis is that the estimated coefficients of the two specifications are equal.

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VITA

Benjamin Israel Miller, husband of Rachel Knopf Miller, was born on August 11, 1981, in Gainesville, Florida. He is the third and youngest child of Dr. Gary and Suzy Miller. He graduated from Eastside High School where he played soccer and tennis and received the International Baccalaureate Program Diploma. Benjamin graduated from the University of Florida in 2004 with a dual degree in International Economics and Spanish. While at UF, he enjoyed learning economics, international business and Hispanic linguistics and cheering for the Florida Gators. He also participated in a semester abroad where he studied economics at the Facultad de Ciencias Economicas in Sevilla, Spain.

In August of 2004, after completing his undergraduate studies, he went directly into the Ph.D. program in economics at the Andrew Young School of Policy Studies at Georgia State University. While at Georgia State University, Benjamin studied several topics in applied microeconomics including labor economics, public finance and industrial organization. In the end, he chose to focus his studies on labor economics. His dissertation is in the field of personnel economics and was conducted under the supervision of Dr. Bruce Kaufman. In addition, while at GSU he worked at a Graduate Research Assistant (GRA) with the International Studies Program, a research group which provides technical assistance to governments of developing and transitional economies around the world. In the process of completing the doctoral program requirements, Benjamin completed his Masters of Arts in Economics from the Andrew Young School of Policy Studies at Georgia State University in 2006.