Testing for Tournaments in Large Corporate Law Firms

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Table of Contents

I. Introduction:

Open the business section of any major newspaper and chances are good that there will be at least one article detailing the latest and greatest increase in the astronomical salaries paid to business professionals. In 2006, the prominent law firm of Wachtell, Lipton, Rosen & Katz divided its profits of more than $280m[1] between just 79 partners. As the largesse of high-level compensation creeps upward, it becomes increasingly difficult to justify any individual's pay upon the basis of his marginal product, the neoclassical explanation. Economists Lazear and Rosen articulate the problem well: "Consider the salary structure for executives…on the day that a given individual is promoted from vice-president to president, his salary may triple. It is difficult to argue that his skills have tripled in that 1-day period" (847). They provide an alternative explanation, tournament theory, which suggests that such extravagant payment to those in top positions motivates workers at lower levels to compete for promotion, and, in so doing, raise the firm's aggregate production.

The large American corporate law firm provides a likely setting for observing labor tournaments. These firms are run by partners, fractional owners who divide profits among themselves. They employ other younger attorneys as salaried associates to work on their behalf. The career path for a law school graduate entering one of these firms involves working as an associate for 7 to 10 years and then either being offered partnership or termination (a tradition known as the 'up-or-out' policy). The discontinuity in earnings involved in making partner suggests that some effort compensation is deferred from associates in the form of potential later partnership profits. The competition among associates to realize this deferred wage (via promotion) drives effort.

[1] 2006 AmLaw 100: http://www.law.com/jsp/article.jsp?id=1145803851927

I seek to empirically test the predictions of tournament theory on these large law firms. The theoretical model of the labor tournament asserts that the gap between associate and partner compensation determines worker effort, and should be inversely related with the probability of making partner (the ease of winning the prize), for any given associate effort level. The results of empirical regressions support the hypothesis that such a tradeoff exists among these firms. This adds to the small literature confirming the existence of corporate labor tournaments. Knowledge that a tournament is at work, that current pay is not directly related to marginal product, provides valuable information for associates currently working at these firms, or planning to join in the future.

This paper proceeds as follows: Section II provides brief summary of scholarship related to tournament theory, the empirical existence of tournaments, and the economics of law firms. Section III describes how the theoretical tournament model works as a labor incentive within the context of the law firm. Section IV describes the empirical data sources, and how they are used to calculate the unobserved tournament motivators described in section III. Section V provides the main empirical specifications and regression results, and Section VI focuses on potential complications and extensions. The result of this process is the conclusion that trends in the empirical data are consistent with the hypothesis that a tournament is at work within the large American law firm. Finally, alternative specifications and derivations not explicated in the body of the paper are presented in the appendix.

II. Literature Review:

I have drawn heavily upon literature of personnel economics, the application of economic theory to questions about human resources. One central topic within this area concerns how workers are efficiently motivated by compensation to expend costly labor on a firm's behalf. Personnel economists explain the principal-agent relationship of this interaction through claims about organizational hierarchy, worker performance, and employee payment schemes. The literature includes potential explanations involving different wage and promotion schemes. Among these, the one relevant to my study is tournament theory. Its theoretical basis and empirical applications are described below.

The Theoretical Tournament Model

Pioneering personnel economists Lazear and Rosen (1981) provide a detailed theoretical explanation of precisely how tournaments incentivize labor in their article "Rank Order Tournaments as Optimum Labor Contracts." The key insight drawn from their paper is that "when workers are risk neutral, it is shown that wages based upon rank induce the same efficient allocation of resources as an incentive reward scheme based on individual output levels" (841). This implies that payment based upon hierarchical position (e.g. whether one is an associate or partner in the law firm) can achieve the same efficient equilibrium as direct compensation for effort and output.

Lazear and Rosen's model serves as the basis for the theoretical tournament model I later construct in Section III. They describe a competition between two workers who each choose an unobserved effort[2] level in hopes of producing a higher observed signal (noisily tied to unobserved effort). They are motivated because the firm rewards the worker with the higher effort signal with a predetermined prize –in reality, a

[2] Both workers' effort cost curves are identical, with positive first and second derivatives.

promotion and the attendant wage increase. A crucial point is that this refers to a "rank order tournament," of purely relative comparisons. The *margin* of victory is irrelevant; there is simply a winner and a loser. With enough information, the competing workers can condition their effort to maximize their expected utility from participating in the tournament. Lazear and Rosen conclude that this effort decision is based on the tournament's prize differentials (the gap between winners' and losers' prizes) rather than their absolute levels; increasing the differential motivates increased equilibrium effort.

The model articulates how identical workers (with the same cost and utility functions) come to equilibrium in a labor tournament. This is not the case in reality, and heterogeneous workers present problems because each responds differently to the prize differential (e.g. workers with high cost of effort may choose zero effort because of their competitive disadvantage). Lazear and Rosen deal with this complexity by introducing a handicapping scheme tailored to individual workers. These individualized corrections "level the playing field," allowing each to compete, and expend optimal effort.

Their paper not only describes the tournament equilibrium but also addresses the relative strengths and weaknesses of tournament and wage-based labor incentives. If effort is perfectly observable, a wage proportional to effort, paid at frequent intervals, would be preferred over the tournament system by workers and firms. The realities of decreasing utility to wealth and workers' desire to consumption-smooth make the large income discontinuity of the tournament prize less appealing.

Individual effort is rarely observable. Filtering noise to determine worker effort is expensive, and firms seeking to minimize costs may be forced to reduce observation of worker effort. This promotes the moral hazard problem of shirking in wage-based

structures. By tying prizes to production rather than effort forecasts, the tournament fosters competition, destabilizing the shirking equilibrium.

Another benefit is that the relative nature of such tournaments provides protection to workers against exogenous shocks to output. If the shocks are systematically applied, universally boosting or decreasing workers' production signals, the rankings between workers, and thus their expected utility, remains unchanged. As such shocks are the case in many industries, e.g. agriculture (blights) or corporate R&D (project failures), this insurance is an attractive facet of the tournament system.

The rank-order nature of the tournament presents a potential pitfall for firms because it may promote desperate actions from workers who begin to fall behind. Because prizes are determined ex ante, and production signals are compared relative to one another, workers who foresee low production marks may take excessive risks (a "hail Mary" strategy) in hopes of leaping ahead of the frontrunner. Such actions may prove a problem for firms running tournaments with high potential for performance forecasting.

McLaughlin (1988) extends Lazear and Rosen's model, and articulates equilibrium for risk-averse workers as well. He also incorporates the theoretical details added by Nalebuff and Stiglitz (1983), most importantly their generalization from a two person tournament to one of indeterminate size. McLaughlin provides an expression for the optimal prize differential in N person tournaments. This equation can be used to prove that, in equilibrium, the prize differential is increasing, not just in associate effort, but also in the size of the tournament - a crucial point for Section III's tournament model.

Empirical Examinations of Tournaments

Ehrenberg and Bognanno (1990) provide an interesting empirical confirmation of tournaments' effect on competitor effort through their analysis of professional golfers. The PGA events, individualistic sporting contests, represent the tournament *par excellence*, because prizes are awarded according to rank, regardless of absolute score. Using information on the prize structures and the individual scores of the competing golfers, they find trends consistent with tournament theory.

They show that an increase of $100,000 in total prize money (its distribution always heavily skewed towards the lowest scoring golfers) motivates an increase in effort resulting in an average decrease of 1.1 strokes over the four days (1313). Furthermore, in the final round, golfers in contention for top prizes show consistently lower scores than those farther back in the competitive field[3]. Because prize money is always disproportionately weighted towards the top few finishers, the frontrunners face a larger prize differential. The empirical significance of 4th day ranking suggests that this prize differential does affect a golfer's effort decisions.

Knoeber and Thurman (1994) examine empirical data from North Carolina broiler chicken farmers. These farmers contract with distributors using a rank-order tournament as a form of insurance against exogenous shocks in chicken quality. Their study finds that changes in the level of prizes that do not change the prize differentials motivate no change in chicken production (and, it is implied, farmer effort).

Main et Al. (1993) use the tournament model to explain executive compensation, the field most similar and relevant to the law firm tournament this paper seeks to observe.

[3] The frontrunner tends to score lower even if two golfers have the same absolute score entering the 4th day of their tournaments - a scenario which could occur if they are participating in different actual tournaments.

They estimate that promotion from corporate vice-president to president constitutes an increase in lifetime earnings of $6.2m[4]. Their regressions suggest that the size of this pay increase is positively correlated to the number of vice-presidents competing for the position. That this correlation persists even after controlling for firm-specific attributes strongly supports the argument that executive pay is the prize of a tournament rather than compensation for value added. Eriksson (1999) presents similar findings from an empirical investigation of 210 Danish firms. He explains firm performance (log(Profits/Sales)) by pay differentials (the gap between CEO and VP pay), controlling for industry and firm-size. His pay differential yields a statistically significant coefficient, also consistent with tournament theory.

The Economics of Law Firms

Galanter and Palay (1990) provide a broad history of the large American law firm over the last hundred years. They describe the organization of these firms and explain their constant growth over the last century. Their study highlights the increasing firm leverage (the ratio of associates to partners) within the last ten years as a significant factor. This increase has led to an increasingly competitive workplace describes thus: "Within the [firm], promotion comes to fewer and it comes later…. The prospect of an orderly procession to unassailable eminence has been replaced by an arena of pressure and risk amid frenetic movement"(755). This description certainly suggests that competitive tournaments rather than static wages are motivating labor.

They explain firm growth by viewing the large law firm as an institution for sharing and profit-maximizing the senior attorneys' reputational capital. The firm's partners can attract much more business than they can service, and thus they hire

[4] Calculated in 1984. This figure is most likely substantially higher today.

associates to assist them. Agency costs exist within this relationship, particularly in situations when associate shirking can damage partner and firm reputation. The labor tournament effectively minimizes associates' undesirable incentives. Growth occurs because the firm must promote a fraction of its associates to maintain the tournament, but for each promotion, it must take on an additional set of new associates to share the new partners' reputational capital.

Gilson and Mnookin (1985) examine the tradition of law firms organizing themselves as profit-sharing partnerships, an anomalous business practice fairly unique to the profession. They argue that many legal services are correlated with the business cycle (e.g. bankruptcy vs. mergers and acquisitions), and therefore profit-sharing partnerships diversify away the idiosyncratic risk associated with that specialization while still capturing its expertise-related gains. Each partner essentially holds a diversified portfolio of returns to different legal specialties. By articulating the appeal of making partner, Gilson and Mnookin address why the prize to winning the associate tournaments is so valuable and also why it assumes the peculiar form observed in reality.

The foundation provided by these articles has prompted more focused economic investigations of the large corporate law firm. These are mainly directed at two particular aspects of law firms: partnership profit sharing, and the "up-or-out" promotion structure. Levin and Tadelis (2005) address this former issue, seeking to explain why some industries choose partnership organization and others choose incorporation. They argue that partnerships are prevalent in human-capital intensive industries (e.g. law, medicine, architecture, or accounting) because the profit-sharing nature of the organization makes

partners very selective about accepting new members. This selectivity promotes business by assuring potential clients who may not otherwise be able to assess work quality.

O'Flaherty and Siow (1995), Kahn and Huberman (1988), and Waldman (1990) examine the prevalent use of "up-or-out" contracts for associates. This term refers to the practice of retaining an associate for a given period of time (usually between 8 and 10 years) and then either promoting him to partner, or terminating his employment at the firm. Such arbitrary termination seems puzzling since the associate's skills have not diminished, and most likely have increased with experience. O'Flaherty and Siow argue that up-or-out practices are used as a screening process to determine whether current associates will be effective business generators when promoted to partner. Because associate positions are scarce, the up-or-out system continually creates space for new associates to be tested for partnership potential. Kahn and Huberman see the system as firms' solution to the moral hazard problems concerning associates' human capital investments. The firm profits from such investments, but if it pays for them directly it runs the risk of losing its investment if associates quit, thereby taking their developed capital elsewhere. Up-or-out systems commit firms to rewarding such investment *ex post*. Waldman extends this view to argue that the widespread adoption of up-or-out contracts reduces the information gathering costs to all firms in the legal labor market. Whether an associate made partner constitutes a publicly observable signal as to his productive quality – a signal which is useful for other potential employers as well.

Ferrall (1996) and Henderson (2006) conduct empirical studies on law firms, motivated by tournament theory. They seek to explain how the tournament structure (promotion and compensation) affects associate effort and in turn is affected by firm

profitability and prestige. Ferall examines 1987 data on 100 law firms and finds that higher partner profits or promotion rates significantly increase associate effort. Henderson uses 2004 data on 200 large law firms (the AmLaw 200 list) to examine the effect of tiers on firm profitability. Citing Gilson and Mnookin, he argues that single-tier firms[5] have more reputational capital than multi-tier firms (which predominantly reward a few "rainmakers"). The higher profitability among single tier firms allows them to "run a more rigorous promotion-to-partnership tournament in which associates work longer hours and are less secure in their futures with the firms" (Henderson, 2006, 1691).

Summary

My study is based upon the theoretical tournament model described by Lazear and Rosen. Personnel economists have demonstrated that areas such as athletics, agriculture, and business, exhibit organization consistent with the theory. Galanter and Palay suggest that the large law firm is also a likely candidate. Henderson and Ferrall conduct empirical tests of this claim. However, each study leaves room for improvement. Ferall uses 20 year old data on firms of various size, and Henderson focuses on the level of the "winner's prize" (profits per partner) while ignoring the crucial prize differential. I seek to improve upon their methodology by using current data on the largest law firms, with attention to associate as well as partner pay. Controlling for firm organization and geography, I test whether firms' prize differentials incentivize associate labor as predicted by tournament theory. The regression results support previous empirical conclusions that law firm data is consistent with the predictions of tournament theory.

[5] Partnership tiers will be described in detail in Section IV. They refer to the manner in which firm profits are divided among partners. Single-tier firms divide profits strictly according to seniority while multi-tier firms divide profits based largely upon individual business generation. As Gilson and Mnookin address, multi-tiered sharing organizations diminish the appeal of partnership as a portfolio of different legal specialties.

III. Theoretical Model:

I use the following model to illustrate how a rank-order tournament motivates an efficient labor market equilibrium. This model follows from that described in Lazear and Rosen (1981), and elaborated in McLaughlin (1988). The tournament model exists in a world involving one firm seeking to motivate N identical, risk-neutral workers in its employ. Its equilibrium solution suggests a connection between labor effort and compensation which has empirically testable implications. These drive the subsequent data collection and empirical analyses.

The firm is a price-taker within a competitive product market that demands units of production at the price, ρ. The firm's income is dependent on this price (ρ) as well as the aggregate product of its labor force (Q). Subtracting the cost of labor from this income yields the firm's expected profit:

(3.1): $E(\Pi_{Firm}) = \rho Q - C_{Firm}$

The nature of production is such that Q is simply an aggregation of each worker's individual product:

(3.2): $Q = \sum_{i=1}^{N} q_i$

Each worker's contribution (q), in turn, is solely (albeit noisily) dependent on that worker's effort (μ). (3.3) expresses individual production as a summation of that worker's effort and a random error term distributed around 0:

(3.3): $q_i = \mu_i + \varepsilon_i, \quad i = 1, 2, \ldots, N \qquad \varepsilon \sim g(\varepsilon) \qquad E(g(\varepsilon)) = 0$

Because effort is costly, workers will not work unless given proper incentives. Since μ is unobservable, the firm chooses a labor tournament out of the many possible ways to induce labor effort[6] - one which minimizes the agency costs related to this unobservability. Having decided to implement a labor tournament, the firm must choose three things: the winner(s)' prize (W_1), the losers' prize (W_2), and the winner/loser ratio. For simplicity, this model explains a firm awarding W_1 *only* to the highest ranked worker, awarding W_2 to the other N-1 workers.

Given the rules set out by the firm, the workers must each decide how much effort (μ) to input, knowing that they will be ranked on their output (q), described in (3.3). Being identical, each worker faces an identical increasing disutility of effort function $C(\mu)$, where $C'(\mu) > 0$ and $C''(\mu) > 0$. From the workers' perspective, the tournament equilibrium involves choosing a personal effort level, μ^*, which equates the marginal change in their expected benefit with the marginal effort cost increase, $C'(\mu)$.

Each worker's expected utility depends positively on his own effort, μ, which increases his chances of a higher q and attainment of W_1, and negatively on his peers' effort. Any workers' expected utility is expressed in (3.4) and (3.5) as follows:

(3.4): $E(\Pi_i) = P_i(W_1) + (1 - P_i)(W_2) - C(\mu_i) \qquad i = 1, 2, \ldots, N$

[6] Lazear and Rosen (1981) detail specific reasons for choosing tournaments over more conventional (e.g. wage-based) structures in certain circumstances. The tournament's reduced necessity for effort monitoring, its discouragement of worker shirking, and the insurance it provides workers against exogenous production shocks all are attractive features of this particular method of labor organization.

(3.5): $E(\Pi_i) = P_i(W_1 - W_2) + (W_2) - C(\mu_i)$ $\quad i = 1, 2, \ldots, N$

P_i represents any individual worker's probability of achieving W_1. For the jth worker in this tournament, P_j represents the probability that q_j is greater than the q of every other.

This probability can be written as a multiplication of comparisons between q_j and each other worker's q, observed one at a time and in succession[7]. P_j is the probability that worker j, the Nth worker in the tournament, will win. It is written as:

(3.6)[8]: $P_j = \prod_{i=1}^{N-1}\left[\Pr(q_j > q_i) \mid \bigcap_{x=1}^{i-1}(q_j > q_x)\right]$

Using (3.5) and (3.6), worker *j's* best response function can be written in terms of the other workers' effort ($\mu_1 \ldots \mu_{N-1}$). It describes the effort level for *j* which, given all other workers' effort levels, equilibrates *j's* marginal benefit and marginal cost to increasing effort, the first-order condition of (3.5), described below in (3.7).

(3.7): $\delta E(\Pi_i)/\delta\mu_i = (W_1 - W_2)\,(\delta P_i/\delta\,\mu_i) - C'(\mu) = 0$ $\quad i = 1,2,\ldots N$

Because workers are identical (they face the same functions governing P, C, W_1, and W_2), each of the other N-1 workers has the same utility-maximizing first-order condition, and

[7] Each dual *q* comparison after the first within this sequence must be written as a probability conditional on each of the previous inequalities being true. (E.g. consider three contestants in a lottery, each drawing from a bag containing three lots numbered 1,2, and 3. It is true that the probability that contestant A's draw will be greater than contestant B's is 0.5. However, once this outcome is established, the probability of A's draw being greater than C's is no longer 0.5. If A > B, then A must have lot 2 or lot 3. However nothing can be said about C's lot. Therefore, given the information (A>B), Prob(A>C) is greater than 0.5)

[8] I use the intersection symbol in a somewhat unconventional way within (3.6). It represents the aggregation of background knowledge (i.e. it is already known that q_j is greater than every q up to q_{i-1})

thus the same best response function. Simultaneously solving N best response functions with N unknowns (namely, μ_i, i = 1, 2, … N) yields μ_i^*, a vector describing the individual effort level of each worker in Nash equilibrium. Because of symmetry, μ^* is the same for each worker, essentially making the tournament random (i.e. P = 1/N).

(3.8): $\mu^* = \mu_1 = \mu_2 = \ldots = \mu_N$

The firm can predict worker response via the reasoning above, and it seeks to induce a worker effort response, μ^*, which, when aggregated, solves its first-order condition for profit maximization:

(3.9): $\delta(\Pi_{Firm}))/\delta\mu^* = \rho(\delta Q/\delta(\mu^*)) - C'_{Firm}(W_1, W_2, N)$

The workers' first order condition, (3.7), implies that μ^* increases with the prize gap ($W_1 - W_2$), holding $\delta P_i/\delta\mu_i$ constant – the case if N is fixed. By increasing the rewards to winning (or the dangers of losing), ΔW affects the equilibrium effort of each worker. Importantly, it is the differential between W_1 and W_2, not the levels of prizes, which determines μ^*.[9] For a firm with a fixed number of workers (N), an equilibrium wage differential (ΔW^*) exists which motivates μ^* effort from each worker, leading to Q^* expected aggregate production: the profit maximizing production quantity for the firm. In this case, the wage differential is the only influence on worker effort, ($\delta Q/\delta(\mu^*)$ varies

[9] Note on the participation constraint: The levels of the prizes do matter to attract workers to the firm. The combination of W_1 and W_2 must together be high enough to constitute a positive expected utility at some level of individual effort (e.g. one could not set up a tournament where $W_1 = 0$ and $W_2 = -500$, even though it generates a large wage differential)

solely through this instrument. Solution of (3.9), an equilibrium for both the firm and its workers, occurs at this optimal wage gap, ΔW^*.

Increases in N appear to be an alternative instrument available to the firm for generating more aggregate effort. To this point, the model has held N fixed, examining effort and prize spread interaction. However, N can change in two ways, either through the entry of more workers or through an increase in the number of winners' prizes awarded among the group. The latter can be thought of as a breakdown of the original tournament into a collection of sub-tournaments, each with one winner. Closer examination of P reveals how changes in N affect the tournament equilibrium[10].

It is obvious that N, the number of competitors in the tournament, negatively influences P, the probability of any one competitor winning. Formally, the reasoning is as follows: assuming an interior solution, each worker chooses $\mu^* > 0$. Because ε is distributed around 0, the workers' signals q^* are distributed around μ^*. Because every worker is subject to the same noise, and every worker exerts some effort, there is a non-zero probability that any worker's q could be greater than any other worker's q. Thus, each of the individual probability expressions in (3.6) falls between 0 and 1. Adding an additional worker to the pool of N adds an additional probability to the end of equation (3.6). Because this probability is non-zero in equilibrium, increasing the size of the tournament necessarily decreases any competitor's probability of winning, *ceteris paribus*. P_j emerges as a function increasing in μ_j and decreasing in N as well as in each other worker's, $\mu_{i \neq j}$.

[10] These examples, increasing N and increasing the winning proportion, run in opposite directions. Increasing N leads to riskier tournaments, while increasing the number of tournament winners does the exact opposite (as if N had decreased leading to smaller sub-tournaments).

(3.10): $\Pr(q_j > q_{i \neq j}) = P_j(\mu_j, N, \mu_i)$ $\qquad i = 1, 2, \ldots, N\text{-}1$

Described in (3.10), P is decreasing in N - it is harder to win a tournament with more players. The more relevant, and less obvious, question is whether effort's effect on promotion probability, $(\delta P_i/\delta\mu_i)$ is related to tournament size. It seems reasonable to think that increases in individual effort will have less bearing in a larger tournament because some worker will have fantastic luck (ε from equation (3.3)) which will result in his high q signal and winning of W_1. However, it could also be the case that increases in individual effort will move any worker past a larger portion of his peers, making tournament size irrelevant to individual effort decisions. To assert that (ΔW^*) is increasing in N, holding effort constant, requires proof that $(\delta P_i/\delta\mu_i)$ actually does decrease as N increases.

McLaughlin (1988) provides the answer to this question, showing that increasing N does reduce effort's effect on P. He begins by providing a detailed description of the functions P_i and $(\delta P_i/\delta\mu_i)$. [11] The latter (at the Nash equilibrium) is displayed below:

(3.11)[12]: $(\delta P_i/\delta\mu_i) = (N\text{-}1)\int F(\varepsilon_i)^{N-2} f(\varepsilon_i)^2 d\varepsilon_i$

A Taylor series approximation is used to articulate an expression for the optimal prize spread:

(3.12): $$\Delta W^* = \frac{(\delta P_i/\delta\mu_i)\rho}{(\delta P_i/\delta\mu_i)^2}$$

[11] Equation (46.0) on P. 240. "Aspects of Tournament Models" *Research in Labor Economics*
[12] $F(\varepsilon_i) = F(\varepsilon_i + \mu_i - \mu^*)$, in equilibrium = $\Pr[q_i > q_j]$, expressed as a CDF

In conjunction, (3.11) and (3.12) show that the prize spread is increasing in N because the $\lim_{N\to\infty} (\Delta W^*) = \infty$. McLaughlin summarizes by stating that "With N large, a marginal increase in effort has a negligible effect on the probability of winning. Hence a big prize spread is required to induce effort." (240)

Via McLaughlin, this model is able to assert that (ΔW^*) is increasing in N; larger labor tournaments must provide increased prize gaps to motivate the same effort from each worker. This (prize gap, tournament size) mechanism, together with the (prize gap, effort) mechanism, constitute the two forces at work within the labor tournament.

The theory explains one method whereby a firm induces a profit maximizing amount of aggregate effort from its workforce. This amount is $N\mu^*$, and it costs the firm $(W_1 + (N-1) W_2)$. This model shows how two firm decisions determine μ^*: 1) Its determination of the prize gap and 2) its determination of N (through hiring and its award decision).

This insight into firms' setting of μ^* via tournament mechanisms suggests empirically testable implications. Controlling for size, firms with higher effort ought to exhibit larger wage gaps. Controlling for effort, firms with larger tournaments also should have larger wage gaps. These two mechanisms are not mutually exclusive; variation in effort, size or both should systematically affect the wage gap. An empirical specification taking into account tournament size, worker effort, and firm wage gap allows for the testing of both mechanisms described by this theoretical tournament model.

IV. Data:

Empirical Data Sources

The information necessary for empirical tests of the tournament model is drawn from studies in *The American Lawyer*, a prominent trade journal published by American Legal Media (ALM). This source is supplemented by data from the National Association for Legal Professions (NALP) website.

This study's primary sources are the AmLaw 100 and AmLaw 200 lists compiled by the research division of ALM. These lists are drawn from the 2005 July and June *American Lawyer* issues, respectively. They provide summary financial and personnel information for the 200 largest American law firms, as ranked by gross revenue from the '04 – '05 fiscal year. In addition to gross revenue, the AmLaw100/200 list provides information on the following variables: number of lawyers[13], the number of equity partners[14], average equity partner profits, firm main office location, and partnership tiers. This last variable is binary, whether or not the firm maintains tiers (which determine profit share) within its partnership profit-division structure. Partnership tiers could be used to keep senior partners' profit shares large, making junior partnership less attractive, or they could be used to retain the service of former associates not worthy of full partnership status. Due to ALM's rigorous data collection and verification process, these lists represent a comprehensive and reliable[15] statistical description of large law firms.

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[13] ALM's methodology webpage states that it calculates "total fulltime equivalent lawyers" by aggregating part-time attorneys and then adding that amount to the number of full-time attorneys, including "of counsel" lawyers. < http://www.law.com/jsp/article.jsp?id=1119603921695>

[14] ALM's methodology webpage states that equity partners are "those that file a schedule K-1 tax form and receive no more than half their compensation on a fixed-income basis"

[15] ALM's data collection methodology involves voluntary solicitation of data from firms, supplemented by direct partner surveys in the event of noncompliance. To ensure accuracy, these surveys are investigated and verified by ALM employees before their integration into the larger data set.

While the AmLaw 100/200 presents firm-specific information about personnel, organization, and partner earnings, it lacks information about associate work levels and compensation. These variables are observed in another ALM publication, the "2006 Midlevel Associate Survey," (MAS) published in the August, 2006 issue of *American Lawyer*. This data set yields three variables useful for the empirical investigation: average hours worked, average hours billed, and average midlevel associate compensation. The MAS data is obtained, aggregated, and verified with the same rigor as applied to the AmLaw 100/200, resulting in very reliable statistics.[16] Because of some non-response, the MAS data set is missing 55 of the 200 firms listed in the AmLaw 100/200.[17] These firms are omitted from the final data set.

The ALM data from AmLaw100/200 and MAS are further supplemented by NALP data on 2004 and 2005 firm hiring practices, collected from its website.[18] Designed as an informational resource for attorneys, this website contains a wealth of demographic information on law firms, including those in the AmLaw 100/200. The NALP website provides the following four variables: 2004 entry-level[19] hires, 2004 lateral hires, 2005 entry-level hires, and 2005 lateral hires. These variables allow for estimation of the size of each tournament as well as estimation of firm growth.

Judith Collins, NALP director of research, addresses a concern about the NALP data accuracy, saying, "NALP's Directory is neither a census, nor a sample, nor a survey; it is first and foremost a consumer information guide, primarily for law students, as they

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[16] According to ALM's methodology webpage, of the 15,932 surveys sent to 4th, 5th, and 6th year associates, ALM received 6,568 (41%) responses. To reduce error due to small sample sizes, firms with less than 10 responses were left out of the list, resulting in the final MAS listing of 175 firms.
< http://www.law.com/jsp/article.jsp?id=1154349332240>
[17] 9 firms omitted from the AmLaw100, 46 firms omitted from the AmLaw200.
[18] <www.nalpdirectory.com>
[19] "Entry-level" refers to associates hired directly from law school plus those hired from judicial clerkships.

begin to collect information about potential employers. As such it reflects law offices and firms that pay to have a listing, and their self-reporting of information for that purpose."[20] This lack of standardization may call into question comparisons of hiring decisions across firms, however the data is used mainly to assess firm growth, and observation of a particular firm's hires across years is much less susceptible to self-reporting bias.

Of the 145 remaining firms, the NALP directory provides these statistics for 142, resulting in the final complete dataset. This final data set includes firm-specific information which can be used to calculate every theoretical variable described in Section III's tournament model. Section V's empirical regressions are run on these 142 firms.

Summary Statistics I

Table 4.1: Data Summary Statistics (N = 142)					
Source:	**Variable**	**Mean**	**Median**	**Min**	**Max**
2005 AmLaw 100 and 200	Gross Revenue (FY '04)	356,000,000 (266,000,000)	250,000,000	87,000,000	1,440,000,000
	# Equity Partners	150.3028 (88.97597)	125.5	44	614
	# Non-Partner Lawyers	386.838 (313.9477)	307.5	79	2378
	Associates per Partner	2.556381 (1.043492)	2.44	0.7391304	6.383178
	Average Equity Partner Compensation	$794,049.30 ($521,377.70)	$630,000.00	$315,000.00	$3,500,000.00
2006 ALM Midlevel Associate Survey	Assoc. Hours Worked (per Week)	56.07606 (2.665166)	55.9	50.5	69.1
	Assoc. Hours Billed (per Week)	44.87676 (2.874433)	44.75	40.2	59.6
	Average Midlevel Assoc. Compensation	$157,199.40 ($24012.64)	$170,000.00	$101,857.00	$191,250.00
NALP Directory Website	2004 Entry Associate Hires	37.71831 (30.79384)	27	2	163
	2004 Lateral Hires	42.77465 (41.76775)	29	0	250
	2005 Entry Associate Hires	42.66197 (38.87147)	29.5	3	309
	2005 Lateral Hires	50.66197 (41.09768)	37	0	250
	04 - '05 ?% (Entry+Lateral) Hires	0.2311449 (0.4681293)	0.16	-0.5744681	3.1875

Table (4.1) presents the summary statistics of the completed data set compiled

[20] Judith Collins, NALP Director of Research (personal communication, Feb. 16, 2007)

from the three aforementioned resources. The summary statistics for gross revenue, the basis for firms' inclusion in the AmLaw100/200, show that there is significant variation within this class of large law firms. While the average firm earns $356 million, gross revenue ranges from $87 million to $1.44 billion among the group. Much of this variation is driven by the massive earnings of top 5 firms, outliers such as Skadden Arps, Baker & McKenzie, and Latham & Watkins, among others. The drop-off from the 1st ranked firm to the 20th is $747 million, the rate of decrease slows substantially after that.

As would be expected, the variation in Gross Revenue is highly correlated to the firm's number of lawyers, yielding a correlation coefficient of 0.9001. Smaller firms with fewer employees earn less total income. However, it is not the case that partners at smaller firms are necessarily paid less than their larger firm peers. The correlation between gross revenue and equity partner compensation is much smaller, 0.4165.

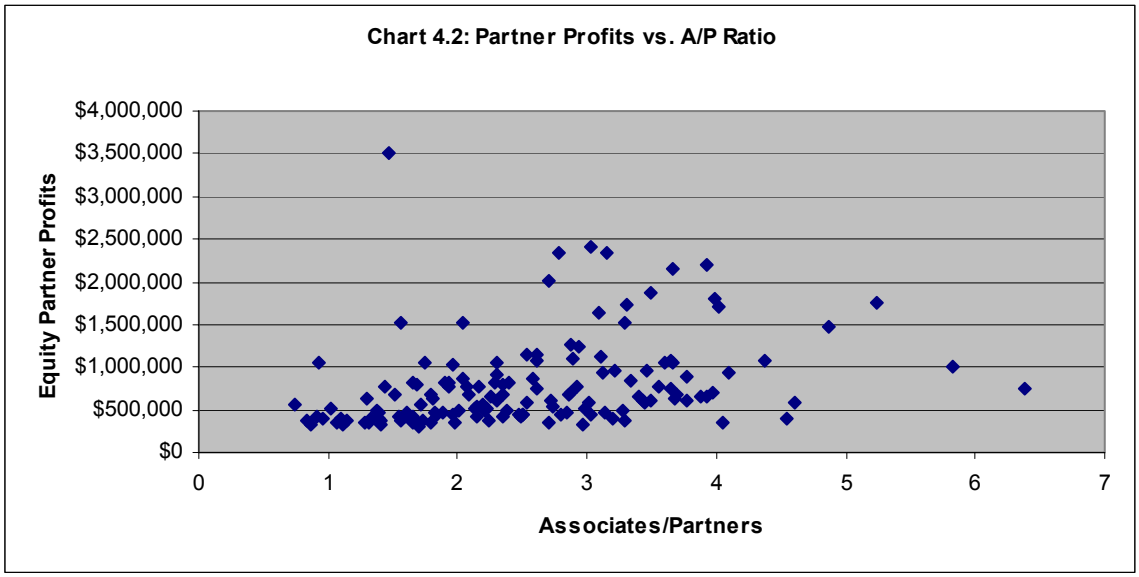


Figure (4.2) displays the relationship between equity partner earnings and the associate/partner ratio. The commonly held view is that associates are paid less than their marginal product. This view implies that more leveraged firms should generate larger

profits for each partner. The lack of a strong upward trend in (4.2) presents a problem for that interpretation.

The AmLaw data also include firm-specific descriptors such as main office location and the existence of partnership tiers. The most frequent main office listing is New York (28 firms), but most major U.S. cities are represented by at least one firm. 23 firms list themselves as "national" or "international" rather than based in a home city.

Table 4.3: Number of Firms by Tiers and NY-HQ				
		New York HQ?		
		Yes	No	Total
Tiers?	Yes	14	98	112
	No	14	16	30
	Total	28	114	142

Table (4.3) shows that the majority of firms (79%) utilize some form of tier structure within their partnership profit sharing agreement. However, New York firms are less likely to use such a structure than firms in other cities.

Table 4.4: Mean Partner Profit by Tiers and NY-HQ				
		New York HQ?		
		Yes	No	Total
Tiers?	Yes	$1,278,928.57	$576,326.53	$664,151.79
	No	$1,818,214.29	$807,187.50	$1,279,000.00
	Total	$1,548,571.43	$608,728.07	$794,049.30

Table (4.4) elaborates by showing mean partner profits varies by location and tiers. On average, the partners at firms in New York without tiers enjoy the highest profits, and those at firms elsewhere with tiers, the lowest. In conjunction with (4.3), (4.4) makes an argument that both of these firm-specific variables have effects on compensation and they should be taken into consideration when constructing empirical specifications.

Supplementing the AmLaw 100/200, the MAS provides data on associate work and compensation. Table (4.1) shows that the average midlevel associate works nearly 56

hours/week, generating 44.8 billable hours (79.97% of work is effectively billed). The range of effort across firms is small but noticeable, from 50.5 hours worked/week (Chapman & Cutler, AmLaw rank 184th) to 69.1 (Wachtell, Lipton, AmLaw rank 44th). Much of this range is due to differences between New York firms and others.

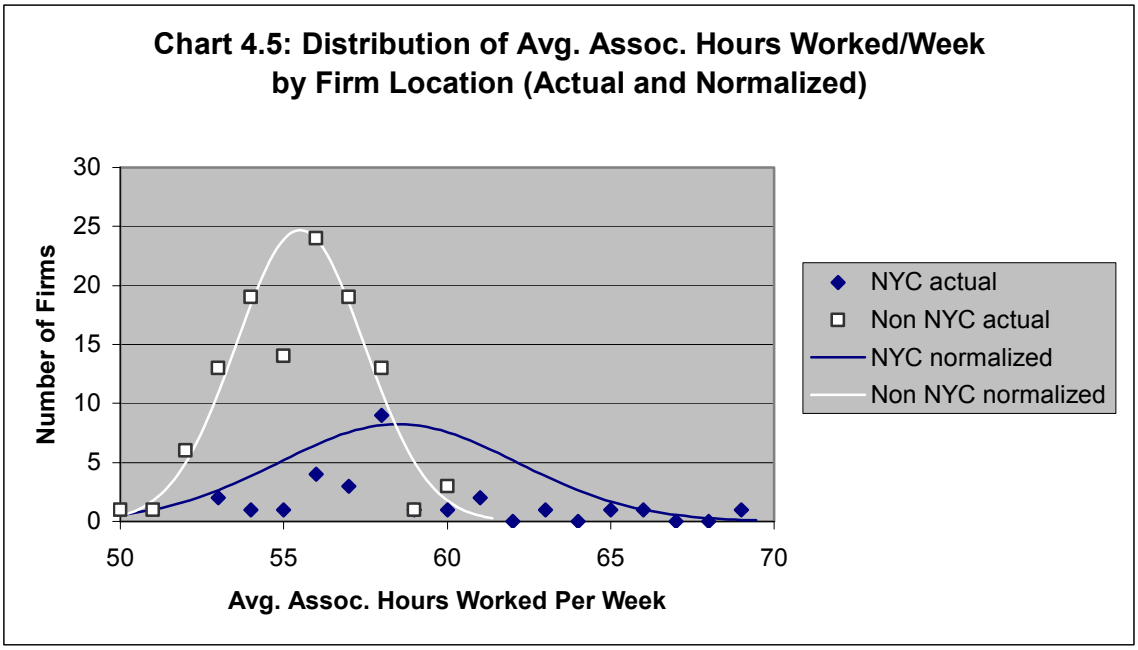


Chart (4.5) provides two visualizations of the distribution of associate effort, separated into NY and non-NY firms, one a frequency plot rounded to the nearest hour and the other a hypothetical normalized distribution based on the summary statistics. It suggests that associates in New York firms work longer hours. However, there is more variation among them than their peers in other cities.

In addition to this information about associate effort, the MAS also includes Average Midlevel Associate salary by firm. Together with AmLaw100/200, this illuminates the increase in earnings resultant from making partner, and how it varies across firms. These data are later used in constructing the wage differential.

Finally, the NALP data allow for a measure of tournament size at each firm. The data on entering attorneys (both entry-level and laterals) represent how many attorneys are competing for partnership. Table (4.1) suggests that an attorney at one of these firms faces between 70 and 100 others for partnership. The exact calculation of tournament size is addressed later in this section.

Firm growth also may have an effect on the tournament model. A brief firm by firm comparison of total hires[21] across years shows that, in general, firms hired slightly more attorneys in 2005 than in 2004. The summary statistics support this by showing an average 22% increase in the 2005 associate class over the previous year.

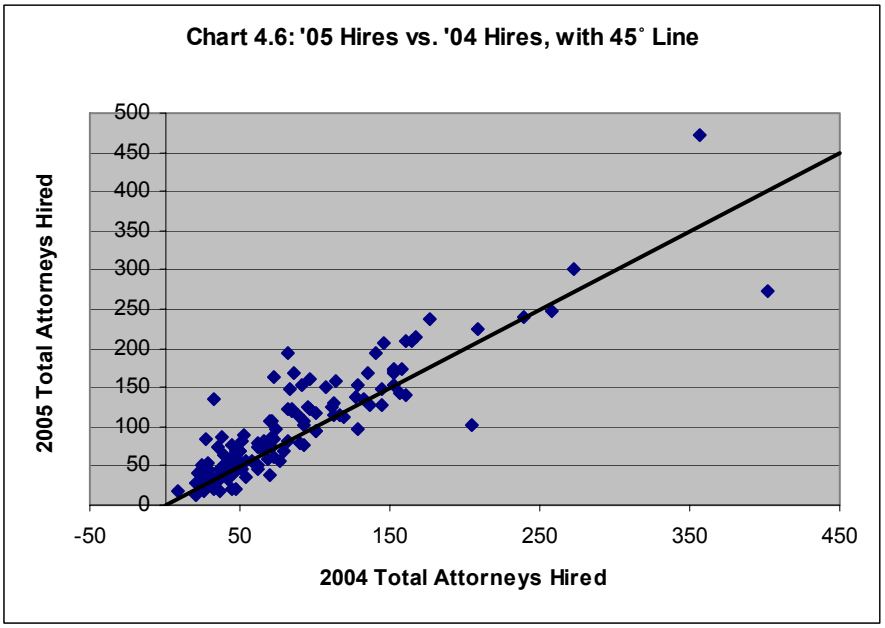


Chart (4.6) supports the summary statistic by showing a discernible growth trend among the majority of firms. This is important because the growth rate of entering attorneys relative to that of the firm's partners will significantly affect any individual attorney's changes of possibly making partner 8 years in the future.

[21] NALP listings for entry-level hires + laterals

Wage Gap

Equation (3.11), the first-order condition which determines μ^*, shows how associate effort is positively influenced by the gap between the winners' and losers' payments, $(W_1 - W_2)$. W_1 can be directly observed in the empirical dataset by information on firms' average equity partner compensation, however W_2, the losers' prize, must be indirectly observed. Many of the associates who are denied partnership end up taking positions as in-house corporate counsel, a far less lucrative but also less demanding niche. Variation within in-house counsel salaries (as well as the lack of systematic statistics) precludes a satisfactory estimate of this prize. Another popular option is continued work as "non-equity partners," a position much closer to associate than partner due to its salaried, rather than profit-sharing, compensation structure. The salary of a firm's non-equity partners is a more observable estimate of W_2. Neither ALM nor other trade journals track such positions. Because non-equity partners are essentially ultra-senior associates, the salary of a firm's associates, as reported by ALM's MAS, may provide a way of indirectly observing W_2. Following this assumption about W_2, the prize gap of the theoretical model, becomes the wage gap (between mid-level associates' and equity partners' compensation) in the empirical study. This statistic most likely underestimates W_2 (and thus overestimates the wage gap) by observing lower paid mid-level associates' salaries rather than those of the most senior associates. However this error is likely to be uniform across firms because associates of the same year are observed in each case. Therefore wage gap comparisons between firms are still accurate.

Probability of Making Partner – Law Firm Flow Model

Equations (3.4), and (3.7), articulate how the probability of winning the tournament (P) influences workers' effort choices (μ^*). In the context of law firms, this is explicitly the probability that an entry-level associate (calculated at his entry to the firm, and conditional upon his hire) will avoid termination all through his associateship, and eventually make partner. This probability is unknown, but using the empirical data on a firm's number of partners and new hires, P^* can be estimated in a steady-state equilibrium.

This steady-state model of the law firm makes the following assumptions:

i. Every new hire (entry-level or lateral transfer) must work 7 years as an associate before they can make partner.[22]

ii. Each year an exogenous and unchanging rate of attrition, γ, removes a portion of each associate class.

iii. Each partner remains in that position for 25 years and then retires.

iv. Each associate who remains with the firm for 7 years[23] will either be promoted to partner or dismissed[24].

Moreover, the steady state nature of the model implies that the number of associates entering the firm each year (N) is unchanging. At time t=0, $N_0 = N_{-1} = N^*$.

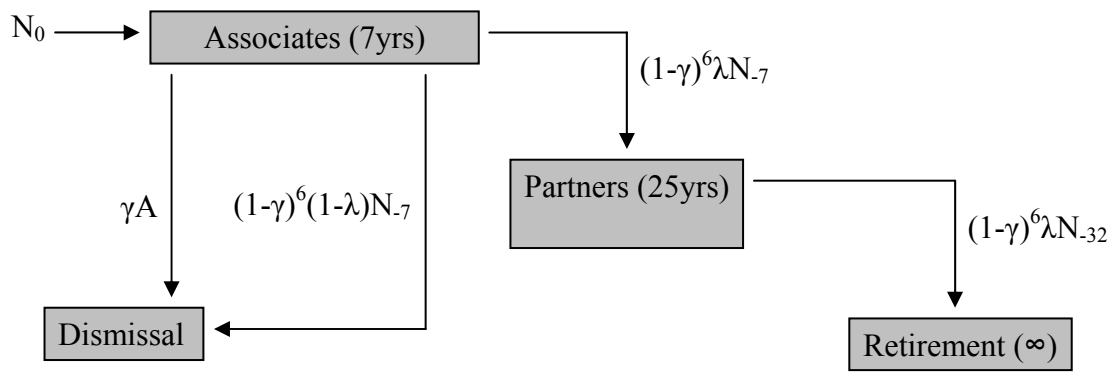
Using these simplifying assumptions, the law firm flow model shows each attorney's (so long as he avoids being fired) progression from a 7 year associateship, to a

[22] Using only entry level hires to calculate the size of the competitive pool represents an alternate method of calculating P. Comparison of regressions using each calculation method appear in Appendix A.1, both methods result in the same statistically significant coefficients.
[23] Anecdotal evidence suggests that the partnership track lasts between 7 and 9 years at these firms
[24] This abstraction of dismissal includes those attorneys denied equity partnership but retained at the firm as non-equity partners or other similar titles.

25 year partnership, to an infinite retirement. In each period, there are N new associates entering the firm, A attorneys of associate status, and R attorneys of partner status. The firm's associates experience a yearly exogenous attrition rate of γ, meaning that γA attorneys either leave or are dismissed from the firm. Additionally, a fraction, λ, of the 7th year associate class is promoted to partner, and the rest are dismissed. This progression is depicted below:

Figure 4.7: Law Firm Flow Model (at time t = 0)

Current Size: $A = \sum_{i=0}^{6}(1-\gamma)^i N$ $\qquad R = 25(1-\gamma)^6\lambda N$



The number of attorneys leaving the firm each year is given by:

(4.8): $\gamma A + (1-\gamma)^6(1-\lambda)N$

γA accounts for 1st through 6th year associate attrition, and $(1-\gamma)^6(1-\lambda)N$ representing those 7th year associates that were dismissed. A^* represents the steady state equilibrium number of associates at the firm:

(4.9): $$A^* = \frac{N(1-(1-\gamma)^6)}{\gamma}$$

Each year, $(1-\gamma)^6\lambda N$ associates join the ranks of partner. Since partnership is strictly limited to 25 years, each year $(1-\gamma)^6\lambda N$ partners also leave the partner phase for retirement. Since the incoming and outgoing number of partners is the same, R is simply the aggregation of 25 classes of promoted 7th year associates. R^* is expressed as follows:

(4.10): $R^*=25(1-\gamma)^6\lambda N$

This model explains the probability of winning in terms of empirically observed variables. From the point of view of an entry-level associate (one of the entering N class), the probability of making partner is the probability of surviving 6 rounds of associate dismissal and being part of the group of 7th year associates (λ) tapped for partnership. In terms of the model's variables, this probability is $(1-\gamma)^6\lambda$. In the steady state, a first year associate's promotion probability can be written in terms of R and N:

(4.11): $P = (1-\gamma)^6\lambda = R^*/(25N)$

This methodology is used to calculate an empirical probability of making partner at each firm in the data set.

A potential criticism stems from the steady state assumption. Realistically, firm growth is indeed present, and growth between years -7 and 0 constitutes a measurement

error in this model's calculation of P. This error may undermine the regression coefficients in two ways: it may attenuate the promotion probability coefficient towards zero, and it may undermine the entire empirical specification if it is correlated with other variables. Section VI addresses these two problems, concluding that the latter concern is not present, and that the former exists, but does not undermine statistical significance.

Summary Statistics II

Table 4.12: Summary Statistics - Empirical Estimates of Theoretical Variables					
Sources:	**Variable**	**Mean**	**Median**	**Min**	**Max**
AmLaw100/200 & NALP	Pr(Promotion| Hire)	0.0828022 (0.0507619)	0.050	0.020	0.357
AmLaw100/200 & MAS	$(W_1\text{-}W_2)$	$636,849.90 ($506,104.1)	$480,000.00	$200,033.00	$3,313,000.00

Table (4.12) displays the summary statistics for the tournament model's two unobserved variables, $(W_1 - W_2)$ and P, calculated according to the previous rationale.

P is calculated according to (4.11), using NALP data on 2005 entry hires + lateral transfers as N. This assumes that lateral transfers start essentially as first-year associates, when in fact they may only have to wait a year or two to be eligible for partnership promotion. Because of this problem with the observation of N, P may be biased downwards – moreso if the firm accepts many lateral transfers. This estimate suggests a first-year associates faces less than a 1 in 10 chance of eventually making partner.

The wage gap, an estimate of the prize gap in (3.4), shows a substantial difference in the compensation of associates vs. partners, and this difference varies greatly between firms. Section V will test inverse relationship of these two variables, posited by Section III's tournament model, using the empirical dataset described in Section IV.

V. Empirical Results

Methodological Summary

The theoretical model described in Section III suggests a connection between compensation, effort, and probability of promotion at work within labor tournaments. Recall (3.7), the workers' utility-maximizing first order condition:

$$(3.7): \quad \delta E(\Pi_i)/\delta\mu_i = (W_1 - W_2)(\delta P_i/\delta\mu_i) - C'(\mu_i) = 0 \qquad i = 1, 2, \ldots N$$

It implies a link between the tournament's prize gap ($W_1 - W_2$), a worker's probability of making partner (P via $\delta P/\delta\mu$), and his resultant equilibrium effort (μ^*). Specifically, increases in either the prize gap or the probability of winning[25] will increase each worker's expected utility of participating in the tournament, thus motivating a new equilibrium with each associate choosing higher effort level, μ^*.

Section IV addresses the empirical calculation of these variables. Justified by this reasoning, the theoretical prize gap is replaced by the observed difference in associate and partner compensation, and the probability of promotion is calculated according to (4.10), derived from the law firm flow model. With the empirical data translated onto the theoretical model's terms, regressions can be run to test whether it is consistent with the tournament model.

Econometric Specification

Table (4.12) shows a remarkable amount of variation in the wage gap between firms, while Table (4.1) shows much less variation among associates' estimates of their

[25] Increases in the probability of winning necessarily imply increases in ($\delta P_i/\delta\mu_i$). See McLaughlin (1988) as addressed in Section III.

work hours. These observations contrast with an expectation of labor market efficiency, assuming homogeneity of legal services provided by the dataset's firms. The empirical specifications seek to explain wage gap variation according to associates' probability of promotion (P), controlling for variations in associate effort, (H). The inverse relationship between these two variables, shown in subsequent regressions, supports the hypothesis that there is an efficient "tournament motivation" driving associates' effort decisions. This labor motivation can rely on many different combinations of wage gap or promotion probability intensive incentives, since these factors raise associates' expected utility and effort in the same way. Thus, the observed wage gap variation is due to the fact that different firms differ in their desired associate effort level, and also in how to go about achieving it (via wage gap or promotion probability).

(5.1): $\log(Y_i) = \beta_0 + \beta_1 P_i + \beta_2 H_i + \varepsilon_i$

Equation (5.1) represents the econometric specification of the basic tournament mechanism. Y_i is the observed wage gap for firm *i*, P_i is the probability that a first year associate at firm *i* will make partner (conditional upon his hire at that firm), and H_i is the average weekly number of hours worked by firm *i*'s associates, the effort control.

(5.2): $\log(Y_i) = \beta_0 + \beta_1 P_i + \beta_2 H_i + \beta_3 X_{iT} + \beta_4 X_{in} + \varepsilon_i$

(5.2) adds an additional control vector of firm-specific descriptors. Two other variables, the presence of partnership tiers and whether the firm is based in New York,

may influence a firm's wage gap. The vector X_{iTn} embodies these firm-specific controls.

The binary variable X_{iT} records whether firm *i* has a partnership tier structure. Table (4.4) suggests that the average partner profits (W_1) of tiered-partnership firms are lower than non-tiered ones. Similarly, X_{in} records whether the firm's home office is in New York, a legal market very different from other American cities due to its concentration of financial service firms and their uniquely labor intensive schedules. Table (4.4) also suggests that partner profits are higher in New York than elsewhere.

Regression Results

OLS regressions are conducted according to specifications (5.1) and (5.2). The coefficients are reported in Table (5.3):

Table 5.3: Regression Results

Independent Variable	Estimated Coefficient	
	Specification (5.1)	Specification (5.2)
β_1: Pr(Promotion)	-2.490567**	-2.278335**
	(0.8561008)	(0.6772288)
β_2: Assoc. Hours Worked / Week	0.1316263**	0.0702371**
	(0.0163057)	(0.0140639)
β_3: Partnership Tiers?		-0.3604884**
(1 if Yes)		(0.0814073)
β_4: Based in New York?		0.6735195**
(1 if Yes)		(0.0931273)
Dependent Var = log(Wage Gap)		
Mean Dependent Variable	5.90	5.90
Adjusted R^2	0.4129	0.6499
F-statistic	50.59	66.44
N	142	142

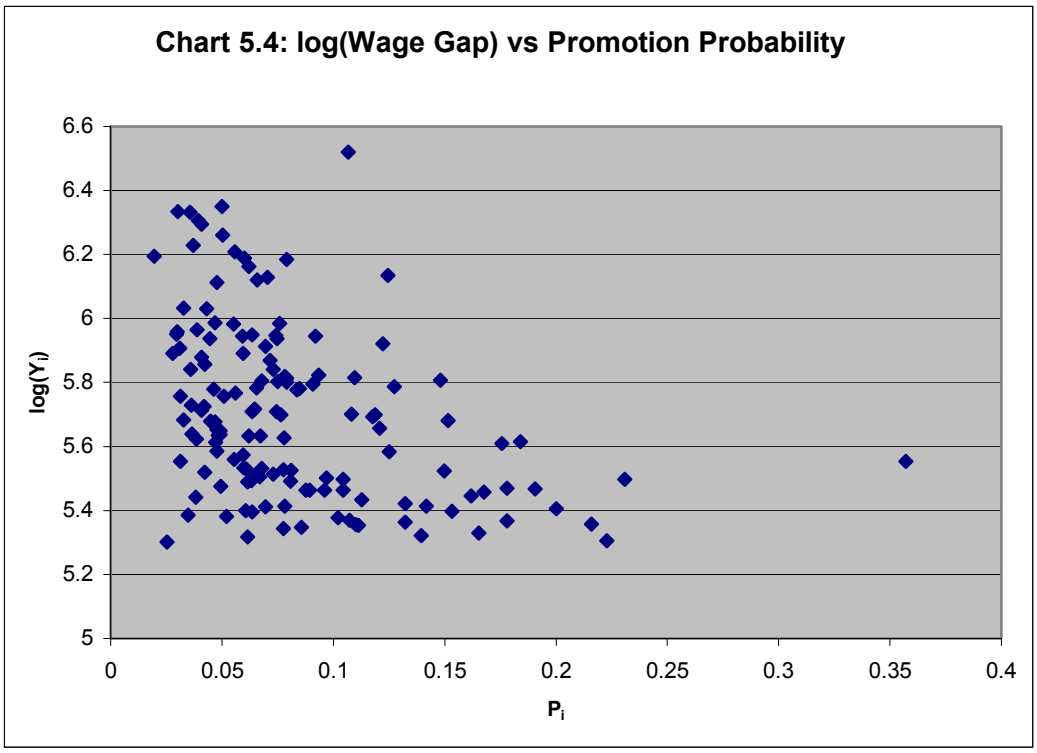
Standard errors are shown in parentheses

** = significant at $\alpha < .01$

The significantly negative β_1 coefficients in both specifications (5.1) and (5.2) suggest that there is a connection between the wage gap and the probability of promotion. This correlation suggests an inverse relationship, the direction hypothesized by tournament theory. Specification (5.2)'s β_2 coefficient suggests that increases in associate

work by 1 hour per week coincides with 7% larger wage gaps, suggesting that harder working associates are found at firms with wage differentials. Attention to the control coefficients suggests that maintaining partnership tiers decreases the wage gap by 36%, and that New York firms offer 67% greater wage gaps than firms in other cities.

The β_1 coefficient describes the relationship between firms' Promotion Probability and their Wage Gap. Controlling for effort, this isolates the fundamental tournament labor incentive. Chart (5.4), which plots (P_i, $\log(Y_i)$) by firm, shows a discernible downward trend, suggesting that (5.1) and (5.2) provide a fairly good fit:



The β_1 coefficient describes proportional variation in the Y in terms of linear variation in P. However, a "promotion probability elasticity of the wage gap"[26] can be calculated from the β_1 coefficient, and this description of the proportional variation in Y_i in terms of the *proportional* variation in P_i can also be useful.

[26] A derivation of $E_{Y,P}$ can be found in Appendix A.2

(5.5): $$E_{Y,P} = \frac{\Delta Y_i / Y_i}{\Delta P_i / P_i} = -0.146456$$

$E_{Y,P}$ states that a 100% increase in P_i decreases Y_i by 14.6%. It is necessary to be aware of two different notions of percentage at work in this interpretation of $E_{Y,P}$. P_i is already itself denominated in percentage terms. The aforementioned 100% increase in P_i would be a doubling in the probability of making partner (e.g. from 10% to 20% chance).

The regressions of Section V provide empirical support for the hypothesis that a labor tournament is motivating attorneys in large corporate law firms. Among firms extracting the same effort from each of their associates, tournament theory predicts that those offering fewer partnerships must compensate by making the partnerships offered more attractive. The significantly negative promotion probability coefficient, β_1, supports this prediction. Among firms offering equally risky tournaments (the same probability of promotion), those with higher wage gaps motivate each individual associate to work harder. This prediction is supported by the significantly positive β_2 coefficients.

The tournament model described in Section III is not the only explanation for the observed peculiarities in law firm labor organization – other personnel economics models may prove persuasive as well. Section V suggests that the empirical data on law firms is consistent with the hypothesis that a labor tournament is at work. While ultimate assessment of what really is driving associates' labor decisions will involve comparison of this tournament-based empirical investigation against other theories, this study provides a solid foundation, illuminating potential tournament-based incentives used in the legal labor market.

VI. Extensions

Firm Growth – Measurement Error

To this point, the model has operated under the assumption that firms are in steady-state equilibrium. The empirical calculation of a firm's promotion probability, P_i, relies on an implication of this assumption – that N, the number of new associates, is unchanging[27]. The empirical data set focuses on the wage gap at the present (time t = 0) and this is the estimate of the prize spread affecting associates in the tournament started at t = -7. Because theirs is the prize spread is being observed in the data, P should be calculated for those 7 year-old associates, not the current ones. If $N_{-7} = N_0$, as the steady-state necessitates, N_{-7} and its attendant P can be calculated simply by observing N_0. When this assumption is relaxed, increases in N between t = -7 and 0 result in a calculation of P that underestimates the appropriate probability of making partner.

The use of N_0 to infer N_{-7} leads to measurement error in P. The observed P, a function of N_0 in equation (4.11), differs from the actual P^*, a function of N_{-7}. Measurement error, $e(\Delta N)$, affects P in the following way:

(6.1): $P_i = P_i^* + e(\Delta N_i)$

If $e(\Delta N_i)$ is correlated with P_i , the *observed* promotion probability, coefficient estimates may be subject to attenuation bias, leading to coefficients closer to zero than those produced by the actual probability, P_i^*. The fact that this measurement error is likely a

[27] Consequently, A (the number of total associates) and R (the number of partners) are also unchanging in the steady state.

function of firm growth presents an opportunity to test for its presence. Specification (6.2) explains variation in P_i according to ΔN_i.

(6.2): $P_i = \beta_0 + \beta_1 (\%\Delta N_i)$ $\qquad \%\Delta N_i = \dfrac{(N_{i,2005} - N_{i,2004})}{N_{i,2004}}$

Table 6.3: Regression Results	
Independent Variable	**Estimated Coeff.** Specification (6.2)
β_1: $\%\Delta N_{'04\text{-}'05}$	-0.0245542** (0.089264)
Dependent Var = Prob.Promotion	
Mean Dependent Variable	0.082
Adjusted R^2	0.0446
F-statistic	7.57
N	142

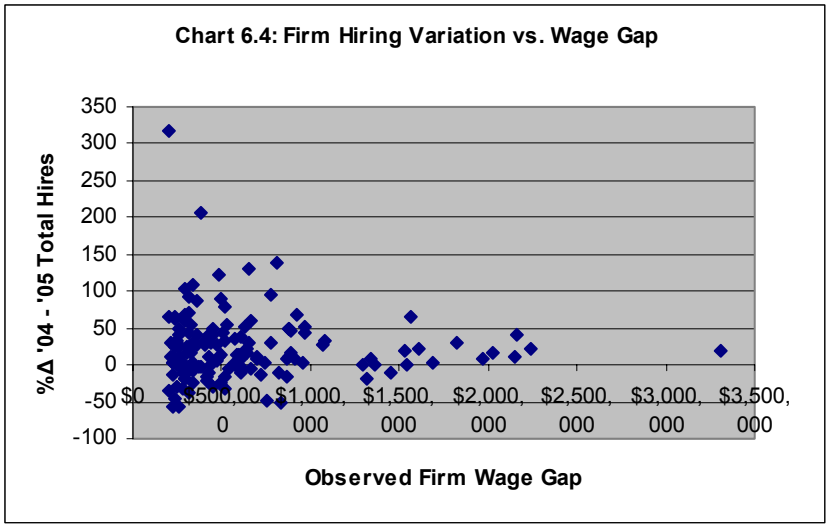
Standard errors are shown in parentheses
** = significant at α < .01

For a 1% increase in firm hire growth, the observed probability decreases by 0.025%. This is small, but statistically significant, suggesting that Section V's P coefficients are indeed subject to attenuation bias. Using P*, the correct coefficients may be further from zero, indicating that the wage gap is even more responsive to changes in promotion probability. The presence of attenuation bias does not undermine the empirical study's conclusion – it suggests that the connection between P and Y may be stronger in reality.

Returning to equation (6.1), if $e(\Delta N_i)$ is correlated with another explanatory variable, significant problems may undermine all the coefficient estimates. If firm growth has an effect on the wage gap, Y, then it ought to be in the empirical specification. If this is the case, $e(\Delta N_i)$ is correlated with another explanatory variable - ΔN_i.

Further investigation reveals that ΔN_i is orthogonal to Y, that firm growth has little effect on observed wage gaps. Chart (6.4) visualizes the relationship, suggesting

that growth is essentially uncorrelated to the wage gap.[28] Because growth need not be in the empirical specification, its correlation with P's measurement error is irrelevant.



A further OLS regression explaining Y by ΔN yields no statistically significant coefficient[29]. This provides further support for the conclusion that, aside from attenuation bias in the P coefficient, measurement error does not undermine the empirical studies.

(6.5): $\log(Y_i) = \beta_0 + \beta_1 (\%\Delta N_i) + \varepsilon_i \qquad \%\Delta N_i = \frac{(N_{i,2005} - N_{i,2004})}{N_{i,2004}}$

Table 6.6: Regression Results	
Independent Variable	**Estimated Coefficient** Specification (6.5)
β_1: $\%\Delta N_{'04\text{-}'05}$	-0.0557746 (0.1142929)
Dependent Var = log(Wage Gap)	
Mean Dependent Variable	5.90
Adjusted R^2	0.0017
F-statistic	0.24
N	142

Standard errors are shown in parentheses

[28] That firm growth is uncorrelated to the wage gap is further supported by $Corr_{\Delta N,Y} = -0.0386$.
[29] I conduct further regressions testing for correlation between ΔN_i and H_i, X_{iT}, and X_{in}. I find no significant results, reinforcing the conclusion that e(ΔN) does not undermine the empirical results.

Non-linearity of Relationship

Chart (5.4) suggests a linear relationship between log(Wage Gap) and Promotion Probability. Investigation of a possible non-linear specification can be conducted using a quadratic regression, still retaining the first-order effort and firm-descriptive controls:

$$(6.7): \quad \log(Y_i) = \beta_0 + \beta_1 P_i + \beta_{1a} (P_i)^2 + \beta_2 H_i + \beta_3 X_{iT} + \beta_4 X_{in} + \varepsilon_i$$

Table 6.8: Regression Results

Independent Variable	Estimated Coefficient	
	Specification (6.7)	Specification (5.2)
β_1: Pr(Promotion)	-4.740267*	-2.278335**
	(1.94648)	(0.6772288)
β_{1a}: Pr(Promotion)^2	8.904816	
	(6.603254)	
β_2: Assoc. Hours Worked / Week	0.0652837**	0.0702371**
	(0.0144952)	(0.0140639)
β_3: Partnership Tiers?	-0.3964623**	-0.3604884**
(1 if Yes)	(0.0867839)	(0.0814073)
β_4: Based in New York?	0.661348**	0.6735195**
(1 if Yes)	(0.0932879)	(0.0931273)
Dependent Var = log(Wage Gap)		
Mean Dependent Variable	5.90	5.90
Adjusted R^2	0.652	0.6499
F-statistic	53.83	66.44
N	142	142

Standard errors are shown in parentheses

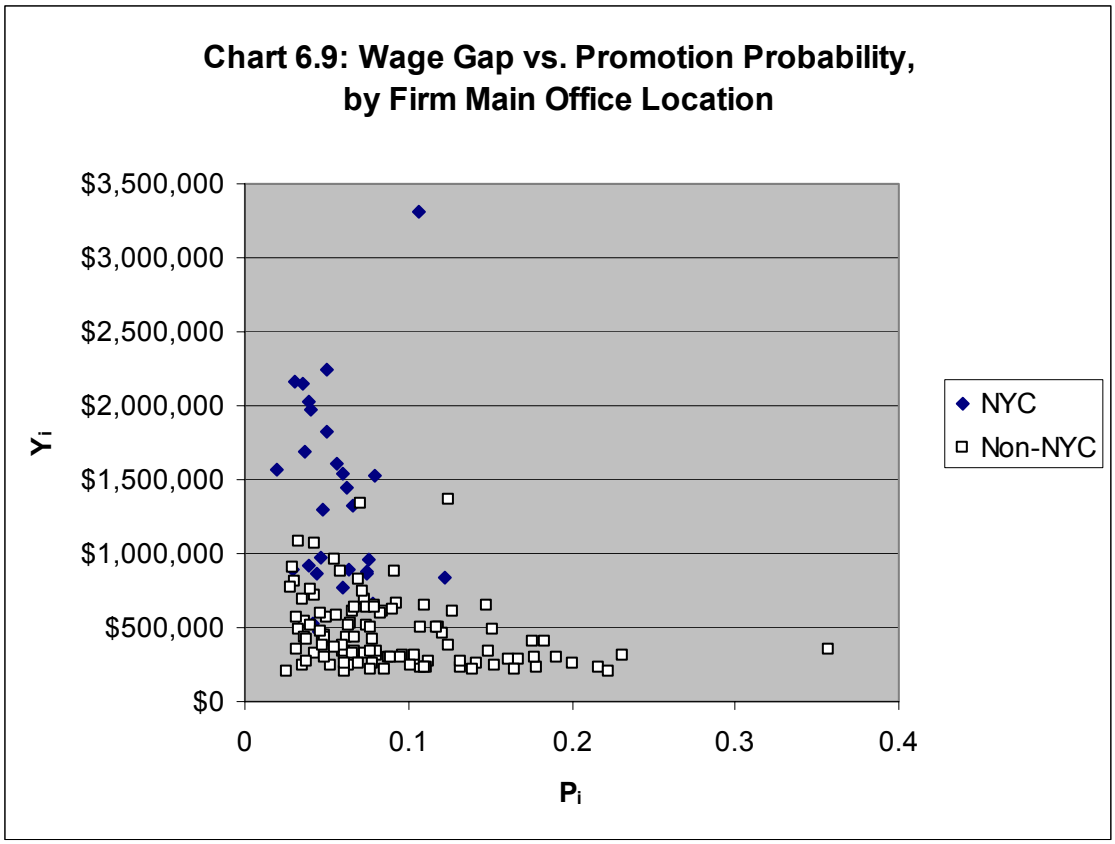
* = significant at $\alpha < .05$

** = significant at $\alpha < .01$

Comparison of the coefficients in Specification (6.7) against those of (5.2) reveals that inclusion of a higher order P term captures little additional variation. The adjusted R^2 remains constant, and the higher order P_i coefficient is far from statistically significant. This suggests that initial specification (5.2) provides an adequate fit for the data.

Firm Location and Tiers

X_{in} records whether the firm's home office is in New York, a legal market very different from other American cities. The geographical breakdown of Chart (6.9) supports this by showing that New York firms offer higher wage gaps and lower promotion probabilities than their peers elsewhere.



Analysis of the data reveals that this higher observed NY wage gap is driven largely by the higher partner profits enjoyed by New York firms. Two hypotheses can explain the systematic difference in the wage gap and promotion probabilities between New York firms and others: 1) New York associates respond to tournament incentives in the same ways as their counterparts in other cities, however New York firms simply choose to create riskier (but potentially more lucrative) tournaments, or 2) New York

associates respond more favorably to wage-gap based incentives than their peers elsewhere, thus implying a fundamentally different type of tournament at work in New York with a different equilibrium balance of wage gap and promotion probability.

Inclusion of an interaction variable, $P_iX_{in,}$ isolates the difference between New York firms' tournaments and those of other firms in other cities. It allows the probability of promotion to influence the wage gap in ways different for New York firms than for others. Specification (6.10) incorporates this interaction variable to account for the difference in New York firm's promotion practices compared to that of others.

Additionally, the presence or absence of tiers may constitute a similarly different tournament. Henderson (2006) highlights the importance of tiers in determining the nature of a firm's labor tournament. He sees tiers as a costly way for less prestigious firms to bond themselves in order to keep talented rainmakers, and asserts that single-tiered firms have the prestige to subject their associates to "more rigorous tournaments."

Specification (6.11) addresses whether the incentive tradeoff (between Y and P) facing associates at single tier firms is significantly different from multi-tier firms. This is accomplished through the addition of a tiers-promotion probability variable.

(6.10): $\log(Y_i) = \beta_0 + \beta_1 P_i + \beta_2 W_i + \beta_3 X_{iT} + \beta_4 X_{in} + \beta_5 (P_i X_{in}) + \varepsilon_i$

(6.11): $\log(Y_i) = \beta_0 + \beta_1 P_i + \beta_2 W_i + \beta_3 X_{iT} + \beta_4 X_{in} + \beta_6 (P_i X_{iT}) + \varepsilon_i$

Table 6.12: Regression Results		
Independent Variable	**Estimated Coefficient**	
	Specification (6.10)	Specification (6.11)
β_1: Pr(Promotion)	-2.276068**	-3.2477
	(0.6915133)	(1.826518)
β_2: Assoc. Hours Worked / Week	0.0702346**	0.0694878**
	(0.0141162)	(0.0141594)
β_3: Partnership Tiers?	-0.3700312**	-0.467216*
(1 if Yes)	(0.0853468)	(0.1902448)
β_4: Based in New York?	0.6768052**	0.6606592**
(1 if Yes)	(0.206728)	(0.096029)
β_5: NY*Promotion Prob. Interaction	-0.0576852	
	(3.237234)	
β_6: Tiers*Promotion Prob. Interaction		1.07789
		(1.885498)
Dependent Var = log(Wage Gap)		
Mean Dependent Variable	5.9	5.9
Adjusted R2	0.6473	0.6482
F-statistic	52.76	52.95
N	142	142
Standard errors are shown in parentheses		

* = significant at α < .05
** = significant at α < .01

The lack of statistical significance on the (P_iX_{in}) interaction coefficient strongly suggests that New York firms do not operate substantially different tournaments than those firms elsewhere. Thus, New York associates respond to incentives in the same way as their peers in other cities. However, their effort is motivated by riskier tournaments offering larger, though less assured, rewards to the winners.

The positive P_iX_{iT} coefficient suggests that tiers may play a significant role in determining the nature of the labor tournament. Together, the β_1 and β_6 coefficients state that the wage gap – promotion probability tradeoff is less steep among firms operating multi-tiered tournaments. This seems to contradict Henderson's (2006) claim that single tier firms are more attractive to potential associates, and can therefore afford to run more competitive tournaments with less wage-promotion elasticity. The regression suggests that single tier firms actually increase their wage gap by more than their multi-tiered

counterparts for an equal decrease in the promotion probability. The explanation may be that a multi-tiered system provides valuable added insurance by retaining associates who do not win (via non-equity partner positions). While the role of partnership tiers may be an avenue of further study, this empirical extension fails to produce a statistically significant interaction coefficient, suggesting that partnership tiers may indeed have no effect upon the wage gap / promotion probability interaction.

VII. Conclusion:

The results of this study indicate that there is an inverse relationship between a firm's wage gap and its partnership promotion prospects, after controlling for other relevant factors such as associate effort, geography and structural organization. This is consistent with tournament theory, which says that both the wage differential and the promotion probability increase an associate's expected utility from working at the firm, and thus his utility-maximizing effort level. Controlling for effort, the two incentives assume an inverse relationship, according to the theory (a relationship observed in the data). This suggests that firms set their compensation and promotion schemes as if they do affect associate effort, running more lucrative or less competitive tournaments to increase production from their labor force.

Because the time span of the law firm labor tournament is longer than that of my empirical data, crucial variables are projected rather than observed. The steady-state assumption used to calculate a firm's promotion probability is unrealistic, and leads to measurement error. Section VI shows that this measurement error leads to potential attenuation bias, however it also defends the empirical results by showing that this bias does not undermine statistical significance.

The limitations of the data, and the resultant error, suggest an obvious avenue for further investigation. Attenuation bias may be removed by obtaining panel data tracking the hiring and compensation of these firms annually, for periods of more than 10 years. By using multiple observations, true measures of firm growth would replace this model's projections. A fixed-effects regression conducted on such a dataset would illuminate the relationship between wage gap and promotion probability with more accuracy than this study, which relies upon one observation per firm and the assumption of the steady state.

Nevertheless, I find this current snapshot of firm compensation and hiring data to be consistent with the workings of a labor tournament. This suggests that substantial portions of current associate compensation may be deferred in the form of the chance at partnership. In other words, current period associate compensation is directly dependent on hierarchical position, and only indirectly tied to marginal product. With the exception of commission-driven sales forces, compensation is similarly tied to rank in almost every industry. This study's finding that law firms' hierarchical pay structure is consistent with the existence of a labor tournament illuminates the relationship between pay and productivity within the industry. Such knowledge provides current and future employees of hierarchical industries, corporate law is one example among many, with a more complete picture of the risks and rewards inherent in their positions.

VIII. Appendix:

A.1 – Different Assessments of Tournament Size

As section IV describes, calculation of promotion probability depends on the size of the entering associate class. The status of incoming lateral transfer attorneys presents a puzzle, as these may be entering the associate tournament or may be entering the ranks of partnership. The default promotion probability is calculated assuming all lateral transfers enter the associate pool with the entry-level hires. This is compared in the appendix with the possibility that none of the lateral transfers enter the associate pool. The coefficient results for regression (5.2), given calculations of P using each methodology, are displayed below.

Table A.1: Regression Results

Independent Variable	Estimated Coefficient	
	Specification (5.2) Given N=Entry+Laterals	Alt. Specification (5.2) Given N=Entry Only
β_1: Pr(Promotion)	-2.278335**	-0.9915612**
	(0.6772288)	(0.2178828)
β_2: Assoc. Hours Worked / Week	0.0702371**	0.0661611**
	(0.0140639)	(0.0136318)
β_3: Partnership Tiers?	-0.3604884**	-0.3604884**
(1 if Yes)	(0.0814073)	(0.0814073)
β_4: Based in New York?	0.6735195**	0.6538768**
(1 if Yes)	(0.0931273)	(0.0904324)
Dependent Var = log(Wage Gap)		
Mean Dependent Variable	5.90	5.9
Adjusted R^2	0.6708	0.6499
F-statistic	72.81	66.44
N	142	142

Standard errors are shown in parentheses

** = significant at $\alpha < .01$

Table (A.1) suggests that whether lateral hires are considered associates or partners makes little difference for the statistical significance of the Promotion Probability coefficient. Thus, the choice within Section IV to use both entry level hires

and lateral transfers to calculate the size of the competitive associate pool does not cause doubts as to the validity of the empirical results.

A.2 - Derivation of $E_{Y,P}$

The "promotion probability elasticity of the wage gap," is calculated using the coefficients from specification (5.2) and the summary statistics described in Table 4.1:

$$E_{Y,P} = \frac{\Delta Y_i / Y_i}{\Delta P_i / P_i}$$

$$\beta_1 = \frac{\Delta Y_i / Y_i}{\Delta P_i}$$

$$P_i = \frac{\overline{P}}{25\overline{N}}$$

$$E_{Y,P} = \beta_1 \frac{\overline{P}}{25\overline{N}}$$

$$E_{Y,P} = -2.2783 * \frac{149.94}{25 * (42.7 + 50.6)}$$

$$E_{Y,P} = -0.146456$$

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