The Property Rights Theory of Vertical Relations: Evidence from the Hollywood Studio Era

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April 9, 2015

ABSTRACT: Empirical tests of the Grossman, Hart, and Moore property rights theory (PRT) generally take the form of linking factors expected to alter the benefits or costs of non-contractible investment to predicted differences in ownership regimes. By contrast, in this paper, we are able to 1) proxy for non-contractible investment in a more direct fashion than most studies and 2) take advantage of an exogenous change in ownership regime. As a result, we can test PRT more straightforwardly than is usually possible. During the famous Hollywood studio era of the 1930s and 1940s, actors worked for movie production companies under de facto lifetime contracts, receiving fixed salaries in return for granting studios control rights and residual claims associated with subsequent films made. Two exogenous shocks (in the form of court decisions) shifted those rights and claims to actors. We develop a model to analyze the impact of that change on investment in talent discovery. Employing a unique data set, we find that actors under studio contract were cast in substantially more film roles (our proxy measure of non-contractible investment in talent discovery), ceteris paribus, as our model predicts. We find some evidence that actor own-investment was weaker during the studio era. We also discuss how talent agencies (representing actors) attempted to reconstitute the studio system in the 1950s and 1960s, until stopped by antitrust authorities. This paper’s results thus demonstrate the importance of residual rights to non-contractible investment, as PRT predicts.

The views expressed herein are solely the authors’, and are not purported to reflect those of the U.S. Department of Justice. For helpful comments, we thank Patrick Warren and participants at Clemson University’s Industrial Organization workshop.
“The studios owned you, and they wanted their property in great shape.”
-MGM contract player Jean Porter, quoted in Davis (1993, 88)

I. INTRODUCTION

Over the past four decades, the vast majority of empirical research on the organization of vertical relationships has focused on testing the predictions of transaction cost economics (TCE), as developed in the seminal work of Williamson (1975, 1979, 1985), Klein, Crawford and Alchian (1978), Masten (1984), and Joskow (1985). Empirical tests of the property rights theory (PRT) of Grossman and Hart (1986), Hart and Moore (1990) and Hart (1995) have been slower to develop, but have grown in recent years to include analyses of the Mexican footwear industry (Woodruff, 2002), the trucking industry (Baker and Hubbard, 2004), the export processing trade in China (Feenstra and Hanson, 2005), U.K. manufacturing (Aghion, Griffith and Howitt, 2006), and innovation (Acemoglu, Aghion, Griffith and Zilibotti, 2010).

Speaking broadly, these tests of PRT take the form of demonstrating that factors that alter the benefits or costs of non-contractible investment are associated with the predicted differences in ownership regimes. By contrast, in this analysis we are able to employ a

1 Joskow (2008) describes a main difference between the two approaches: “TCE emphasizes (verbally) ex post adaptation issues and the associated bargaining and performance costs…The property rights literature assumes that ex post bargaining is efficient and emphasizes the effects of ex post rent expropriation on ex ante investment.” Whinston (2001, 2003) concludes that the large body of empirical research on TCE reveals little about PRT’s validity.

2 Woodruff’s (2002) analysis of the Mexican footwear industry concludes that manufacturers are more likely to vertically integrate into retailing where fashion turnover is slower and the non-contractible investment of the retailer therefore less important, while faster fashion turnover is associated with independent manufacturing and retailing. Baker and Hubbard’s (2004) study of trucking finds that the development of more effective in-truck monitoring systems decreased independent ownership of long-haul trucks. Feenstra and Hanson (2005) finds that foreign ownership of Chinese factories is coupled with local control over input purchases where holdup costs are small and both parties’ investments are important, while same party ownership and control is more common where investment specificity is high (all proxied for by province in which factory is located). Aghion, Griffith, and Howitt (2006), in an examination of U.K. manufacturing, find a U-shaped relationship between level of product market competition and vertical integration, which they take as consistent with the PRT prediction that the relative bargaining power of the
better proxy for non-contractible investment than is typically available, and to take advantage of an exogenous change in ownership regime. We can thus conduct a more direct test than is usually possible.

Our analysis will focus on the arrangement between movie actors and movie production companies (“movie studios”) that arose during the famous Hollywood studio era of the 1930s and 1940s. During the studio era, actors worked for studios under long term (de facto lifetime) contracts, receiving fixed salaries in return for granting studios the residual claims associated with all subsequent films made, as well as the right to determine what those films would be. Although PRT generally treats human capital as inalienable, vigorous studio enforcement of these contracts, and an expansive interpretation of California labor law (subsequently voided by court decision - see below), allowed studios to, in effect, “own” actor careers.

We examine how this ownership influenced investment. The canonical PRT model treats the disposition of control rights over a given asset between two agents, each of whom will undertake non-contractible investment prior to trade. Ownership of the asset—and the associated right to exclude others from its use—improves bargaining position, increasing the owner’s share of the bilateral surplus from trade and thereby sharpening the owner’s incentive to invest. By the same token, the non-owning agent’s investment incentive is lower than it otherwise would be.

In our setting, the two agents in question are an actor of unknown ability and a movie studio. The surplus from their trade is the incremental box office generated by the actor’s parties will affect the ownership structure. Acemoglu, Aghion, Griffith, and Zilibotti (2010) find that degree of technology intensity (a proxy for the likelihood of holdup problems) in the downstream firm is positively correlated with the likelihood of vertical integration, while technology intensity in the upstream firm is negatively correlated with the likelihood of vertical integration.
participation in a film, which depends on the quality of the actor’s performance. Performance quality is determined by innate talent, developed skills and the effort exerted. In turn, an actor’s perceived talent and skill are subject to non-contractible investment. The studio invests in talent discovery by casting the actor in film roles, while the actor invests effort in honing his skills.

There are several reasons to expect the problem of non-contractibility to be more severe for investment in talent discovery than for development of acting skills. First, actors typically enjoy honing their craft, which lessens the risk of shirking. Second, the studios could and did provide training directly to actors—in singing, dancing, swordplay, elocution, table manners and the like—and so could closely monitor an actor’s efforts and progress. Finally, the relationship between studio and actor took the form of a buyer-option contract, specifying a wage schedule that escalated with the actor’s tenure but left the studio free to unilaterally terminate. Actors who failed to make adequate progress—for lack of either talent or effort—were routinely dismissed. This buyer-option feature would be predicted to substantially reduce the holdup problem with respect to an actor’s investment of effort in developing his skills (Noldeke and Schmidt, 1995).

By contrast, talent discovery—which proceeds through the casting process—is inherently non-contractible. A studio casts an actor in a role because she judges that he has a reasonable chance to succeed in it. The evidence onscreen and audience response either validate her judgment, or not. The role best suited to an actor’s perceived ability at any point in time cannot be specified in advance, depending as it does on myriad unpredictable factors such as the outcome of the actor’s performances in previous roles,
revealed “chemistry” with other actors or compatibility with a director, and—most importantly—the discovery of audience preferences.

A studio with a stake in actors’ futures casts differently from one that does not. Absent a stake, the studio casts to maximize the expected profit from a given film. With such stakes, the studio casts to maximize the expected present value of her portfolio of talent, taking into account that the outcome of a performance yields information on the actor’s talent that can be exploited in future casting decisions. Casting an actor of imperfectly known ability is an investment in talent discovery, the cost of which is the foregone opportunity to cast someone else—an actor of known ability, or another actor of unknown ability who has similar potential. The privately optimal investment in talent discovery increases with the studio’s financial interest in the actors’ futures. The greater is this stake, the greater the studio’s incentive to experiment on the extensive margin, casting an actor repeatedly to better assess his talent.3

Given all the foregoing, PRT would predict that (absent legal constraints) the studio rather than the actor would “own” the actor’s human capital – the associated gains from sharpening studio incentives to invest in talent discovery likely outweighed any loss from discouraging actors’ investments in skills. The prediction is supported by the fact that, when free to contract, actors and studios entered into *de facto* lifetime arrangements –

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3 Unlike an owned machine, an actor under contract could refuse to perform, and sometimes did. Complaints about casting (and typecasting) were not uncommon among actors during the studio era – then as now, actors cared about artistic fulfillment in addition to monetary rewards. (The central issue in the *De Havilland* case was whether the maximum contract term fixed by California law was inclusive of periods when an actor refused to perform a role. Warner Brothers argued that such periods of idleness did not count toward reaching the maximum; the California Supreme Court disagreed.) Nonetheless, long term contracts greatly strengthened a studio’s bargaining position. First, the contract prevented the actor from performing for another producer without the studio’s consent, thereby reducing the actor’s disagreement outcome to non-movie activities (consuming leisure, acting on the stage, etc.). Second, the studio’s disagreement outcome was elevated by the contract system as a whole; having a large portfolio of actors under long-term contract, with whose abilities the studio was intimately familiar and who could be called upon at a moment’s notice, made it much easier for a studio to replace an actor who refused to perform.
ushering in Hollywood’s so-called “Golden Age” – only to see the system collapse following a court ruling that sharply limited the permissible length of labor contracts. Furthermore, talent agencies engaged in attempts to reconstitute the studio system subsequently, as we will discuss below.

The studio era was brought to an end by a court decision: *De Havilland v. Warner Bros. Pictures* 67 Cal. App. 2d 225a (1942), which set a maximum seven-year term to the studio contract. By the mid-to-late 1940s, contracts between actors and studios had changed fundamentally, in a way that shifted ownership of actors’ careers back to the actors. Actors and producers today contract on a film-by-film basis, with the biggest stars often paid a percentage of the box office take.

The paper proceeds as follows. In Section II, we briefly review the rise of the star system and describe the studio contract. The contract addressed a variety of contingencies (e.g., expected comportment; obligations regarding non-film activities), but had in common the fundamental feature of a fixed (weekly) payment to the actor in return for granting the studio the right to make casting decisions and the residual claims to all films produced. The contract ran for a nominal period (typically seven years, the maximum allowed under California law), but was applied in ways that extended the term substantially. However, following the court decisions, studio contracts quickly changed:

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4 The end of the studio era may also have been impelled by the slightly later, but increasingly likely (litigation had begun in 1938), *U.S. v. Paramount Pictures, Inc.*, 334 U.S. 131 (1948), which banned the complex set of contractual practices that studios had used to book films at cinemas, as well as enjoining the ownership of cinema chains, thereby increasing the ability of independent theater chains to capture returns from studio investment in talent discovery.

5 “Hollywood today is a series of making deals rather than making pictures”; Ken Murray, quoted in Davis (1993, 378), who also quotes director Billy Wilder: “Now studios are nothing but the Ramada Inn. You rent space, you shoot, and out you go” (381).

6 A very small number of very well-known actors received a percentage of movie revenue as well as flat payments in compensation, but this practice was rare until the end of the studio system. See Weinstein (1998) for detail.
Long term obligations were replaced by the film-by-film agreements that remain the norm today.

In order to generate testable predictions, we develop a theoretical model in Section III. In the model, a movie studio invests in actor talent revelation by casting actors in scarce film roles. From observable film performance, studios assess unobservable actor talent, promoting or terminating actors according to an optimal stopping rule. The model predicts that the stopping rule will be longer the longer the term of the contract between actor and studio.

Section IV presents the empirical analysis. We draw information on actors and film roles from the Internet Movie Database (IMDB), a widely cited source that seeks to list all movies produced, roles played, and actors employed from 1874 onwards. We draw the names of actors under studio contract from an annual publication, the *International Motion Picture Almanac*, which provided a yearly listing beginning in 1932 and running through 1942. Combined, these data give us the means to engage in comparison over time (how casting differed between the studio era and later) and comparison within the studio era (actors under contract versus those not under contract).

We begin by looking for evidence of a career pattern consistent with our model’s characterization. We find that although there have always been actors who progressed from smaller roles to larger roles, with a proportion failing to make the leap at each level, the pattern was more pronounced during the studio era. For example, more than 80 percent of actors who played lead roles during the studio era began by playing uncredited roles, versus less than 30 percent over the decades since the end of the studio era.

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7 According to its own statistics (http://www.imdb.com/stats), the IMDB has compiled information on 2.5 million actors who acted in 370,000 feature films, millions of TV episodes, and hundreds of thousands of film shorts.
Turning to the model’s predictions, we find that the average actor under studio contract played significantly and substantially more roles over his/her career than the average non-studio contemporary (37 roles to 15 roles), and that actors in years following the end of the studio era played in even fewer career roles (7 roles). When we restrict our analysis to major movie stars, we find that the average studio era star (all major stars were under studio contract at some point) played 56 roles over a career, versus 34 over a career for a star who began slightly later.

We then conduct a more careful analysis of the effect of studio contracts during the studio era. We find that a studio contract is associated with a greater than 50 percent increase in roles played annually. Because more talented actors are also more likely to sign long term contracts (as our model predicts), we do three things to pin down the causal effect. First, we look at the influence of being under contract in a given year, controlling for ever having signed a contract—the latter being a rough proxy for talent. Second, we include actor fixed effects, allowing us to control for all time-invariant actor-specific characteristics, so that identification comes from the change in roles brought about by the signing of a contract. Third, in order to allow talent to change over time, we focus on a common set of actor “types” – major movie stars. In each case, we find that studio contracts are associated with substantially more roles played. We account for the possibility that the additional roles reflect merely that actors under contract were less costly to use by comparing major movie stars “before” and “after” they became major movie stars – the idea being that once a star’s appeal is determined, no further investment in talent revelation is required. We find that studio-era stars played substantially more
roles in the “before” than in the “after” period, consistent with the talent revelation explanation, while post-studio-era stars did not.

One of the features of PRT that distinguishes it from TCE is its prediction that ownership regimes have contrasting effects on the incentives of contracting parties. In our setting, this would take the form of actors investing less in developing or publicizing their talents when under studio contract than they would were they full residual claimants. However, because any under-investment is likely to have been small (for the reasons discussed above) and difficult to observe (it would be contracted for if not), the evidence is less direct. We describe how studios not only provided substantial training in general human capital – classes in singing, dancing, speaking, etc. – but paid actors to take these classes, certainly not something one sees today (actors spend their own money). We review the fact that studio contracts contained and enforced a number of clauses concerning comportment and complementary activities, again consistent with the notion that actors “under-provided” such things when they did not garner the full benefit. We also note that the big rise of “actors studios” – where actors enrolled for a fee to be trained in acting – occurred in the late 1940s and 1950s, immediately following the decline of the Hollywood studio system.

Finally, in Section V, we discuss what happened when studios stopped signing actors to long term contracts. The end of the studio era marked the rise of the integrated talent agency. While Hollywood agents have a long history (evolving from the agents who represented stage and musical acts), following the end of the studio era, these agents consolidated and began to package actors and scripts – what the old studio system had done. The largest agency, MCA, even acquired a movie production company (Universal)
in the early 1960s, only to be told by the Department of Justice that it could either make films or represent actors; it kept Universal and sold the actor contracts. Most film productions today are incorporated as one-off entities, signing actors (and directors, and stunt men, and so forth) to contracts that encompass only the single production.

In sum, we conclude that granting movie studios control rights over, and residual claims to, acting careers resulted in actors being given more opportunities to demonstrate on film that they could – or could not – become stars. At base, this is not surprising: While actors may very well invest more intensively along other margins today than they did when under long-term contract, the non-contractible nature of talent revelation through casting in film roles – conditional as it is on complementary and shifting (as new information is revealed) assemblies of suitable storylines, scripts, supporting actors, and so forth – means that it cannot be easily replicated under alternate ownership structures. And so it has not been, as PRT would predict.

II. THE HOLLYWOOD STUDIO SYSTEM

A. The Rise of the Movie Star

The famous Hollywood studio system developed gradually, achieving its zenith in the 1930s and 1940s. Its essential feature was the maintenance of a fully staffed production facility that included lots on which films could be shot, associated physical assets (equipment, buildings, props, cameras, and so forth), and employees (actors, writers, directors, cameramen, and so forth) operating under long-term exclusive contract. By contrast, modern “film production companies” tend to incorporate for single movies, and to rent or purchase assets (including actors) on what our model characterizes as a “spot”
basis – contracts generally encompassing only the single movie. Today’s largest film companies, such as Warner Brothers or Disney, are best characterized as distributors who finance (usually jointly with other parties) some, but not all, of the films they distribute.

The Hollywood studio system developed gradually. In the first decade of the 20th century, motion pictures were short (one or two reels, of 10 to 15 minutes in length), inexpensive to produce, undistinguished in quality, and shown in small venues that changed programs frequently. Camera placement was static, and medium-to long shots made it difficult for viewers to see the faces of the actors; indeed, early films did not even identify actors by name. Nonetheless, by the early teens, the viewing public had come to recognize certain personages. As Jacobs (1939, 86) notes, because of the lack of billing

The public had to identify favorites according to the company in whose pictures they appeared (the “Biograph girl,” “IMP girl,” “Vitagraph girl”), according to their screen names (“Little Mary,” the “Husband,” the “Banker,” the “Waif”), or according to some distinguishing physical trait (the “Girl with Curls,” the “Thin Woman,” the “Man with the Sad Eyes,” the “Handsome Indian”).

Letters began to pour into production company offices inquiring about favorite actors. Production companies assiduously hid these “Who?” letters (as they were called) from the actors in question—fearing (with good reason) that actors would demand higher salaries once they became aware of their popularity.

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8 Four-to-eight film “shorts” comprised the typical program; by contrast, feature films were one-two hours (or more) in length and played in the same cinema for several days (or longer). Short films were distributed through local exhibitor-owned “exchanges,” which purchased the films outright (at ten cents per foot) and leased them to member cinemas. The General Film Company, which dominated film distribution between 1910 and 1912, described its leasing practice as follows: “no account was taken of individual pictures or of individual actors or directors, and the flat rate per foot applied without regard to the number of separate pictures, the quality or character of the pictures, the size of the theater, or the town or city.” Quoted in Lewis (1933, 7).
Competitive pressures did not allow this state of affairs to persist. Seeking an edge on his rivals, Carl Laemmle (the head of movie producer IMP) signed Florence Lawrence (the “Biograph girl”) to an exclusive contract in 1910, promising both an increase in salary and an unprecedented publicity campaign. Laemmle opened the campaign by planting a story in a St. Louis newspaper that “former Biograph player Florence Lawrence” had been killed in a streetcar accident. This alarming news item marked the first time in motion picture history that a producer identified an actor by name. Laemmle thereafter purchased a half-page advertisement in *The Moving Picture World*, in which he unmasked the “cowardly lie” of Miss Lawrence’s death – a rumor he attributed to malicious rivals – and helpfully listed the upcoming IMP films in which Miss Lawrence would appear. A subsequent advertisement announced that, to lay to rest any lingering doubts about Miss Lawrence’s health, IMP’s leading man, King Baggott, would escort her to St. Louis. The event drew a wildly enthusiastic crowd (fans tore the buttons from Miss Lawrence’s coat), and Laemmle had created the first movie star.

Other producers followed suit (Kindem 1982, 82). The process was accelerated by the growing importance of the feature (full length) film. In 1912, Adolph Zukor founded the Famous Players production company; his motto “Famous Players in Famous Plays” serves as a capsule description of the star system.

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9 The following anecdote is related in Jacobs (1939, 86-87).

10 The first feature films exhibited were European imports (*Quo Vadis*, produced in Italy in 1912, and *Queen Elizabeth*, produced in France in 1911 and starring stage actress Sarah Bernhardt) that were big hits in the United States. Feature films reputedly cost up to twenty times more than short films to make (Hampton 1931). The arrival of the feature film effectively killed the market for standalone short films; comedy and musical shorts – used as openings for a feature films – survived, as did serials such as *Flash Gordon*.

11 Zukor then merged his production company with the first national film distributor, Paramount Pictures, and developed a grading scale that would become the industry standard: Class B pictures featured “known” players, while “famous” players graced the flagship Class A films. See the discussion in Huettig (1944, 24-25).
B. The Studio Contract

Although movie studios had attempted to maintain actors under “exclusive” contracts since the days of Carl Laemmle and the IMP girl, poaching by rival studios was common. This rebounded to actors’ benefit, and Kindem (1982, 83) writes that movie stars during the silent era of the 1920s (an “intensely competitive and immensely profitable period”) were offered “not only impressive million-dollar yearly contracts but percentages of the net profits as well.”  

With the coming of sound films – and the Great Depression – the studios called truce, signing a formal agreement not to employ stars under contract to other studios without permission. This agreement was

Entered into by virtually all major and minor producing companies for a period of two years from Dec. 21, 1931, with a view to preventing ‘raids’ by one studio on another for players, directors, writers, technicians, etc. The agreement appears to have endured well beyond the specified two years, ushering in a period during which hundreds of actors were employed by studios in contracts that could (largely at the discretion of the studio) last for an actor’s entire career.

A studio contract specified an actor’s exclusive obligation to that studio (the actor had no right to work for any other party in any other capacity without the studio’s permission), and granted the studio the right to determine what services an actor would

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12 Kindem continues, “While the major movie stars in the 1920s had often received a percentage of the net movie profits and substantial artistic control over their films, many movie stars in the 1930s and 1940s were restricted by exclusive, escalating, seven year contracts, renewable by studios each year, which usually limited the maximum salaries to something less than $10,000 per week and with no percentage of the net profits.”

13 The quote is from the agreement, the full text of which can be found on pages 535-9 of the 1932 Film Daily Yearbook. As can be deduced, more than just actors were kept under contract. For example, Paramount Studios employed 3000 workers in total, including 131 actors, 13 directors, 52 cameramen, 103 musicians, 27 hairdressers, and 3 gardeners (Davis 1993, 7). The MGM production staff exceeded 6000, while Universal employed 4000 people in production and distribution (Gomery 1986, 151).

14 The existence of monopsony (or oligopsony) complicates the question of determining whether studios engaged in an efficient level of investment in actors, but we note that PRT predicts more non-contractible investment, not necessarily the efficient level of investment.
render, and what roles the actor would play (including not only film roles, but appearances on radio, stage, at publicity events, and so forth). When an actor contested a particular casting decision (as a number of famous stars did), her alternatives were limited. Davis (1993, 105, 111) writes,

Players had little or no choice over which roles they were assigned or when. If they refused a picture, they were suspended, banned from working for anyone else, and the time was added to the term of their contract. . . . If performers became restive or threatened to quit, no other major studio would hire them without their home studio’s permission.15

The contracts typically stipulated a seven year period of obligation, the maximum allowed under California state labor law.16 However, in calculating the term of obligation, studios counted only time actually worked on a film. Most contracts provided twelve or fourteen weeks of unpaid leave annually, for example – but leave taken did not count against the seven year obligation. Neither did sick days nor suspension. As a result, wrote actor David Niven (1975, 20), “Some of us gave twelve or fourteen sulfurous years of our short actor lives working off a seven-year contract.”17

The lengthy obligation was one-sided; until an actor was well-established, the studio retained the right to cancel the contract at regular (typically three- or six-monthly) intervals. When the studio chose to pick up the option on a contract, the actor received a

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15 In 1937, Bette Davis, under contract to the Warner Brothers studio, refused to make the picture assigned to her, and was placed on three month suspension without pay. She travelled to Europe with a plan to make two films, but Warner Brothers served her with injunction to stop her; Davis later recalled “No other studio would touch me with a ten foot pole” (Davis 1993, 112).

16 In fact, there were three different types of contract: 1) single picture deals (used to fill minor supporting roles), 2) multiple picture deals (often used for actors received on loan from another studio), 3) term contracts for exclusive services, usually 7 years, “where the studio could renew or not renew each year, and if it renewed a previously-specified increase took effect” (Kindem 1982, 84-5). In addition, uncredited actors might be employed by the week or day (e.g., Friedman 1937).

17 Valuable actors were also periodically offered new contracts at higher salaries, and if an actor re-signed (and most actors did), the contractual clock was reset. Louis Mayer, head of MGM, was speaking the truth when he said “People who do their jobs have one for life” (quoted in Davis 1993, 21). MGM even provided retirement accounts for long term employees. Over the course of a career, an actor might sign several new seven year contracts. For example, as we will discuss below, Humphrey Bogart signed three different contacts with Warner Brothers between 1935 and 1946.
pre-determined raise. For example, actor Humphrey Bogart’s initial contract with Warner Brothers, signed on December 10, 1935, specified a $550 per week salary for the first six months of work, rising to $600 per week if the option for the next six months was picked up, rising to $650 per week if the option for the following six months was picked up, and on by six monthly intervals and accompanying raises through 84 months (seven years) in total.

Kemper (2010, 11) sums up the pros and cons of the studio contract as follows:

On the one hand, the option [studio] contract represented stability, guaranteeing regular employment and salary to actors, often stipulating specific salary increases at each renewal, a promising prospect for the notoriously nomadic existence of creative professionals. On the other hand, the contract represented a form of indentured, if starlit, servitude. Since only the studio controlled renewal rights, salaries remained fixed, often in the face of box-office success, and the studio tacked on any absences to the end of the contract, a practice that sometimes amounted to one- or two-year extensions (and fairly frequent litigation). Still, as many agents noted, their clients often preferred the security of a long-term contract to the more lucrative but risky rewards of a freelance career.

Even the notoriously discontented Bogart, who wrangled frequently with studio bosses over his casting assignments, chose to sign new studio contracts at regular intervals rather than freelancing. For the typical newcomer, a studio contract was quite literally a dream come true.\(^{18}\)

A fundamental change in the studio contract followed the California Supreme Court’s *De Havilland v. Warner Bros. Pictures* 67 Cal. App. 2d 225a (1944) opinion, which banned the practice of adding non-work time to the contractual period of obligation; from

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\(^{18}\) Actor David Niven’s (1975, 152) describes his elation at being offered a studio contract, to the envy of the legion of other “unknowns” pounding the street. “When he [producer Samuel Goldwyn] pulled me out of the extra ranks and offered me a contract for seven years starting at $100 a week, I was in such a hurry to sign it before he changed his mind that I failed to notice that he had reserved the right to drop me at the end of every three months during the first two years and that I would have to face twelve weeks of layoff without pay each year. I just grabbed the contract gratefully and signed it with a heart pumping at the realization of the unbelievable good fortune that had befallen me.”
then on, seven years would be seven calendar years. After de Havilland, stars could capture a larger share of their incremental value to the motion pictures in which they appeared, lessening the studios’ incentives to discover and develop new talent. Studio contracts changed correspondingly. Film historian Douglas Gomery (1986, 10) writes that

The rigid star system with its binding 7 year contracts broke down – by 1945, of the 1054 members of SAG who received feature billing, only 261 were under exclusive contract to a major studio. By the 1950s, nearly all important stars would form their own production companies.

From the Warner Brothers archives at the University of Southern California, we obtained copies of a small number of studio contracts, including the complete set of three contracts signed by the Warner Brothers studio with the actor Humphrey Bogart over the course of his career. The first is dated December 1935 (when Bogart still played supporting roles) and the second is dated January 1942 (by which time Bogart was a major star). Each specifies the standard “seven year” obligation and contains variations of the following clause:

Artist agrees that he will, during the term hereof, render the services herein provided for solely and exclusively for and to the Producer and that he will not,

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19 See Davis (1993). The decision was in response to a suit launched by actress Olivia de Havilland, who protested the standard practice of adding time suspended to contract length. De Havilland had been suspended for refusing to make a film to which she had been assigned, on the grounds that the film was mediocre.
20 A near simultaneous antitrust decision, U.S. v. Paramount Pictures, Inc., 334 U.S. 131 (1948), which altered the system of movie distribution fundamentally and forced the divestiture of studio-owned cinema chains, may also have played a role. By requiring arm’s length negotiations and terminating longstanding relational contracts (e.g., Hanssen 2010), Paramount may have helped newly independent cinemas capture a larger share of the returns to investment in star talent.
21 Davis (1993, 375, 378) writes, “Overnight it seemed that everyone was expendable except the big names. Supporting players with high salaries were among the first to go. . . . By 1958, 65% of Hollywood’s movies were made by independent producers, as stars moved from one to another, taking advantage of deals negotiated by agents, lawyers, bankers, or promoters.” Harmetz (1984, 116) puts it as follows: “Like frantic fisherman afraid that the fish they had hooked would swamp the boat, the studios cut loose their contract lists.”
22 The new contract increased weekly payments by thousands of dollars and eliminated the cancellation option.
during such time, render any services for or in any other photographic, stage, or motion picture productions, art or business of any other person, firm or corporation, or make any public or private appearances in any way connected with dramatic, theatrical, radio, television, or motion picture production . . . without the written consent of the Producer being first obtained (1942 Bogart contract, page 5, clause 8).

Humphrey Bogart’s next contract was very different. It was signed in December 1946, two years after the *De Havilland* decision. Rather than contracting for Bogart’s exclusive services, it contracts merely for Bogart to make a one picture per year for Warner Brothers over the period covered by the contract, and gives Bogart the right to make films “outside” Warner Brothers every year, with six months allotted to each endeavor. The contract term is 15 years rather than seven, indicating that it was no longer a “labor” contract under California law. Indeed, it is very similar to a contract WB signed with Natalie Wood thirteen years later (in February of 1959), under the terms of which she agreed to make one motion picture per year for three years. Although actors continued to sign contracts with studios into the 1960s, the contracts were basically “picture-by-picture” deals, in the main similar to the contracts used today.

### III. MODELING INVESTMENT IN TALENT REVELATION

Here we sketch a model, for which more detail is available in the Appendix. We categorize film roles into three types, $r$. In ascending order of difficulty, these are: uncredited ($r = 1$), credited non-lead ($r = 2$) and lead roles ($r = 3$). Actors are of four types, $a = 0, 1, 2, 3$, indexed in ascending order of talent. An actor of type $a$ can successfully perform any role $r \leq a$ with probability $\theta \in (0,1)$, but fails with certainty in any more difficult role. A successful performance in any role adds to a film’s expected
profit. The more prominent the role, the greater the contribution of a successful performance to the film’s expected profit.

The success or failure of a performance, which is observable to the producer, can also yield information on the actor’s type. A first successful performance in role \( r \) reveals an actor to be of type \( a \geq r \). No producer will cast an actor known to be of type \( a < r - 1 \) in any role \( r \). Such casting would fail with certainty, detracting from the film’s expected profit, while yielding no information on the actor’s type.

Casting in role \( r \) an actor whose lowest possible type is type \( r - 1 \) (e.g., given a previous successful performance in role \( r - 1 \)) would be an experiment in talent discovery. A producer with no stake in an actor’s future would not make such a casting, if an actor known to be of at least type \( r \) were available. A producer with such a stake could find the experiment profitable, however. A successful performance would reveal the actor to be of at least type \( r \), adding to the producer’s portfolio of talent capable of successfully performing role \( r \) in future films. Given a scarcity of talent, even a producer with no stake in an actor’s future could make such a casting—if no actor known to be of at least type \( r \) were available—but in this case the producer would not gain from any resulting talent discovery.

The theoretical development thus far implies a career ladder for actors, who begin in lesser roles and upon successful performance advance to more prominent roles. This pattern is borne out in actors’ filmographies in the IMDB database, both before and after the studio era. In the modern era, however, career advancement has become more haphazard. By the well known “catch 22,” actors face great difficulties in getting cast.
before developing a reputation for good work, but cannot develop such a reputation before getting cast. We will provide evidence of this difference below.

Let $p_\alpha$ be the proportion of type $\alpha$ in the population of prospective actors. A novice drawn at random from the population of prospective actors may be of any type. The likelihood that such an actor is at least type 1 is simply $\sigma_1(0) = 1 - p_0$. Here the notation $\sigma_1(0)$ refers to a novice actor who has been cast in an uncredited role ($r = 1$) but has yet to play such a role and thus has zero failed performances in the role. Upon a first successful performance in an uncredited role, the actor is revealed to be at least type 1. This actor’s upside potential—the likelihood that he is at least type 2—is then $\sigma_2(0) = \frac{p_2 + p_3}{p_1 + p_2 + p_3}$. Finally, upon a first successful performance in a credited, non-lead role ($r = 2$), the actor is revealed to be at least type 2 and is a star (type 3) with probability $\sigma_3(0) = \frac{p_3}{p_2 + p_3}$.

In the Appendix we show that, by Bayes’s Rule, an actor with an uninterrupted string of $n$ failed performances without a first success in role $r$ is at least type $r$ with probability

$$\sigma_r(n) = \frac{(1 - \theta_r) \sigma_r(n - 1)}{1 - \theta_r} \sigma_r(n - 1).$$

Applying equation (1) recursively, $\sigma_r(n)$ can be expressed in terms of $\theta$ and $\sigma_r(0)$ alone. By equation (1), an actor’s upside potential $\sigma_r(n)$ declines as his string of failures $n$ without a first success in role $r$ lengthens.

After a failed performance, the producer has two relevant options: to cast the actor in another role $r$ or demote him to playing roles in category $r - 1$ for the remainder of his contract (or dismiss him outright, for $r = 1$). The producer has an optimal stopping rule. For convenience, we define $n^*_r(m_r)$ to be the longest uninterrupted string of failed
performances without a first success in role \( r \) such that the producer is still willing to cast the actor in another such role, i.e., for which the actor’s *continuation value* in role \( r \) is still nonnegative.

Here \( m_r \) is the number of remaining periods the actor had in his contract upon first advancing to role \( r \). The actor’s continuation value in role \( r \) declines with the length \( n \) of his string of failures. All else equal, this continuation value increases with the actor’s remaining contract term \( m_r - n \).

We take lesser roles \( r' < L \) to be scarce, in that there are fewer parts available in category \( r \) in films under production than there are actors qualified to play the role by having had success in role \( r - 1 \). This means that casting in role \( r \) an actor whose lowest possible type is \( r - 1 \) would be a costly experiment—an investment in talent discovery. The cost is the foregone opportunity to cast an actor proven in the role, whose type is at least \( r \). The greater this opportunity cost, all else equal, the smaller will \( n^*_r(m_r) \) tend to be. On the other hand, the greater the actor’s upside potential and the longer the remaining term of the contract, the larger with \( x \) tend to be. The optimal stopping rule \( n^*_r(m_r) \) reflects the producer’s investment in talent discovery at the intensive margin.

The key result is that a producer’s investment in talent discovery, as reflected in her optimal stopping rule, tends to increase with her financial stake in actors. We do not observe these rules directly, but they are correlated with the number of roles an actor plays in a category before advancing to the next category and, in turn, correlated with the total number of roles the actor plays over a given period in his career.

Suppose a producer signs actors to long term contracts only after they have shown some promise by performing successfully in an uncredited role \( (r = 1) \). In this case,
\( n_1^* = 0 \), given that the producer has no financial stake yet in the actor. Upon contract signing, \( n_2^* (m_2) > 0 \) for a contract term \( m_2 \) sufficiently long and periodic discounting \( \delta \) not too steep. We would then predict higher churn among non-contract actors performing in uncredited roles than among contract actors.

**IV. EMPIRICAL ANALYSIS**

**A. The Data Set**

It is generally agreed that by far the most important form of investment in talent revelation is the casting of would-be stars in film roles.\(^{23}\) Davis (1993, 91) describes the process during the studio era:

[N]ew arrivals were often used as extras, with little or no dialogue, sometimes in two or three pictures at the same time. Promising novices might be given a few lines, perhaps an occasional close-up, eventually working their way into A-pictures. If the studio felt youngsters had potential, they were given star build-up by the publicity office out of proportion to the tiny parts they were playing.

MGM tended to use film shorts to train and test talent for feature films, while Warner Brothers tended to use B films (Gomery 1986, 71-2, 118). The relatively small Republic studio put young actors in B-westerns even before signing them to contracts, as a cheaper alternative to the screen test. Jacobs (1939, 163) writes

A fairly pleasing personality could, by shrewd strategy and training, be ‘built’ into a star. The process consisted mainly of the use of a player in film after film, in particular roles, until the audience became so familiar with him (or her) that they enjoyed recognizing him and welcomed his reappearance.\(^{24}\)

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\(^{23}\) While screen tests, in which an actor would film a scene to be viewed by studio management, were widely used, they were often difficult to judge. For example, hugely popular star and immortal dancer Fred Astaire’s initial screen test with RKO studio is alleged to have generated the following report: “Can’t sing. Can’t act. Can dance a little.” Marlon Brando’s screen test for *A Streetcar Named Desire* was evidently so poor that the producer had to be cajoled into casting him as Stanley Kowalski, despite the fact that he had been a huge hit on Broadway (Shickel 2005).

\(^{24}\) Film historian Jeanne Basinger (2007, 66) writes that the ideal casting process involved three parts “one to identify, second to confirm, third to get going [or exit].” The studios invested heavily in measuring audience response (e.g., by counting fan mail).
We will make the casting of actors in film roles the focus of our investigation. Of course, we cannot observe the suitability of a particular film role as a means of gauging an actor’s appeal – it is the fact that film roles differ in so many ways that make this form of investment non-contractible. The studio, given its networks of contracts and ownership of fixed assets, would have had a superior ability to assemble the complementary inputs (actors, directors, scripts, bookings in particular cinemas). If its knowledge of these complementary inputs was also superior, it would have been better at identifying appropriate roles than the actor, and our use of roles played will underestimate true investment. If, by contrast, the actor’s knowledge of herself renders her the superior identifier of appropriate roles, our measure will overestimate true investment. We find the former to be the more plausible possibility, but note that, in any case, the number of roles played is all we can observe.

We have both time series and cross sectional variation at our disposal. That is to say we can examine whether casting of actors in film roles diminished following the end of the studio system, and we can also examine whether during the studio era, actors under contract were cast in more roles than on actors not under contract.

We draw our data on film roles from the Internet Movie Data Base (IMDB), which lists all films released from 1874 onwards, all roles played, and all credited actors who appeared in those films.\(^\text{25}\) We will focus on feature films released from 1932 onwards.

We begin with 1932 for three reasons. First, sound films, which changed fundamentally the nature of film acting, emerged in the late 1920s and were fully established by 1932.

\(^{25}\)See http://www.imdb.com/stats for detail. One of us has worked extensively with IMDB data for some time now, and has found very few errors. Furthermore, if the data base is more likely to miss older than more recent films (which is very probable), the resulting bias works against our predictions.
(see, e.g., Hanssen 2002 and cites therein). Second, the producer agreement discussed above was signed in 1932. Third, our data set of players under studio contract begins with 1932.

We define a “feature film” as a film of 50 minutes or longer, produced for theatrical release (as opposed to for television). Because we are analyzing casting decisions by U.S. companies, we include only feature films produced in the United States (some of which were multi-country productions). We eliminate three categories of feature film, adult, animation, and documentary (the latter have no actors in the true sense, and neither perhaps does the former). We include only actors who played at least three roles over the course of their careers, in order to focus on “professional” actors. The result is a data set of 130,712 actors who played 888,449 roles in 43,016 feature films from 1932 through 2011. We will use this data to analyze several sub-periods.

We draw our data on who was under studio contract from the annual publication, the International Motion Picture Almanac (IMPA). The IMPA provides a yearly listing of actors under studio contract beginning with the 1932 edition and ending with the 1942-3 edition (the last year for which the information is provided). According to the IMPA, 1993 different actors were under studio contract at some point between 1932 and 1942. The average actor listed was under contract for 2.5 of the 11 possible years, with some actors never appearing in a credited role, while others appeared in all 11 years.

Figure 1 displays the annual number of films, actors, and roles from 1932 through 2011. As can be seen in the top chart, the number of films released annually has soared

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26 Both film shorts and television provided springboards to motion pictures for certain actors, as did radio and the stage, and (occasionally) such things as sports and politics. Our inability to develop complete data bases for all these sources inspired us to focus solely on casting in feature films. This may increase the size of the error term, but does not appear to bias our results in any particular way (especially when we look within the studio era).
over the last two decades, driven by video and digital technologies that have reduced
everseously the cost of both production and distribution. The change in studio contracts
in the mid-to-late 1940s appears to have coincided with a modest decrease in films
produced, although the bigger decline of the 1950s is generally attributed to the rise of
television. The bottom two charts present the annual number of actors and roles, in both
cases showing credited and uncredited roles separately.

Figure 2 presents the number of credited actors per film, the number of credited roles
per film, and the number credited roles per actor annually over the 1932-2011 period.
Our paper’s main finding is previewed in the bottom chart, where the number of credited
roles per actor displays a striking pattern. Into the 1940s, the average credited actor
played nearly three credited roles per year. That number then fell by more than half
between the mid-1940s and the mid-1950s, and has remained remarkably constant ever
since, despite enormous changes in the number of films released and the number of actors
and roles per film.

B. The Actor’s Career

The model characterizes a career in which (some) actors advance from lower ranking
to higher ranking roles as talent is revealed. In order to examine whether that process
was different during the studio era than subsequently, we divide roles into three
categories: uncredited, credited, and lead.27 The first two columns of Table 1 compare
the more than 18,000 actors who played at least one (credited or uncredited) role over the
1932-42 period (the period for which we have data on actors under contract, and which

27 As noted earlier, the IMDB lists the order actors appeared in the credits. We categorize the first two
names listed as “leads”; these plus all other listings in the credits as “credited”, and appearances that are not
listed in the credits are “uncredited.” The uncredited category consists principally of movie extras, some of
whom may briefly interact with the principal actors, or even speak.
will therefore be the focus of our analysis) to the more than 90,000 actors who played film roles subsequently. During the studio era, 86 percent of all actors who played credited roles, and 84 percent of all actors who played lead roles, began by playing uncredited roles, while the corresponding numbers for the post-studio (1943-2011) era are 52 percent and 20 percent. Because many things may have changed between 1943 and 2011, we restrict our analysis to the roughly 5000 actors in our data set born in the 1930s – actors who would have begun their careers only shortly after the studio era ended. The result, shown in the third column of Table 1, is largely the same as that shown in the second column. It appears that careers indeed unspooled differently during the studio era, consistent with the model’s characterization.

C. The Effect of Studio Contracts

We turn now to our model’s basic prediction: Actors under contracts will be cast in more roles. We will focus on credited roles in what follows, both because credited roles are more informative about actor ability (being more likely to involve speech and interaction with other actors) and more costly to provide than uncredited roles. We begin by merging our information on studio contracts from the IMPA with movie data from the IMDB. We include all actors who played at least one credited role between 1932 and 1942 and at least three credited roles over the course of a career (in order to focus on “professional” actors, as we discussed above). This gives us data on 1660 actors who are listed by IMPA as having signed a studio contract and also played at least one credited role.

28 Fleck and Hanssen (2014) document that few actors achieve much success before the age of 20 and few actors play many roles beyond their early 60s. Thus, the oldest of these actors would have just been at the point of beginning their careers when the studio system ended, and even the youngest would (with rare exceptions) no longer be acting by the time our sample period ends in 2011.

29 Our results are qualitatively similar if we include uncredited roles, as well, but the action is in credited roles.
credited role between 1932 and 1942, and on 5768 actors who did not sign studio contracts and who also played at least one credited role between 1932 and 1942.\textsuperscript{30} The first two columns at the top of Table 2 compare career roles played by these two sets of actors. The difference is quite large. The average actor who signed a studio contract played 36 roles over his/her career, versus only 13 roles for the average actor who did not sign a studio contract.

Table 2’s third column presents the same information for all actors who played at least on credited role between 1943 and 2011 (and did not sign a studio contract between 1932 and 1942). The average actor played only four career roles over that sixty-nine year time span; a huge difference from the studio era average. Of course, many things may change, and furthermore, if an actor began a career too long after the studio era ended, that career may still be underway in 2011 (when our data set ends), and the average underestimated accordingly. The fourth column of Table 2 again lists results for actors born in the 1930s, and the difference from the studio era remains striking: only 7.3 roles played over the average career. These results are consistent with the model’s predictions, as well as with the data shown bottom of Figure 2.

Finally, in order to ensure consistent comparison, we will restrict our analysis to major movie stars – the most sought-after movie input, today as in the past.\textsuperscript{31} Our challenge is to define “major star” in a manner that allows for a common comparison

\textsuperscript{30} This sums to 7428 actors in total, less than the 8903 actors listed in Table 1 because the latter group includes actors who played either credited or uncredited roles between 1932 and 1942. (If we re-do Table 1’s analysis with the same 7480 actors we use here, the results are essentially the same.) It is possible that some of the actors we categorize as non-contract signed a studio contract before 1932 or after 1942. We note, however, that (as we have argued), 1) before the early 1930s, studio contracts did not bind actors tightly to studios (there was a lot of poaching), and 2) by mid-1940s, the contract had changed fundamentally.

\textsuperscript{31} By how much “star power” can propel a film has been debated; see, e.g., De Vany and Walls (1996), Elberse (2007).
over time (the absence of data on box office revenue for most films for most of the sample period renders this challenging). We therefore assemble information from a unique data source: exhibitor poll results listing the ten leading “money making” actors of every year.

From 1915 to the present, the *Motion Picture Herald*, a trade weekly, and its successor the *International Motion Picture Almanac*, have surveyed thousands of exhibitors annually. A version of the following question was/is asked: “Please list the ten players whose pictures drew the greatest number of patrons to your theater over the last twelve months.” Votes are tallied, and the actors are ranked according to number of votes received (order of ranking by individual exhibitors is disregarded). If one is willing to assume that exhibitor respondents answered honestly (and they had no reason not to), one can expect the actors most popular with audiences to get the most votes.

The bottom of Table 2 compares the 74 Top Ten actors who were under studio contract during the 1932-42 period with 24 Top Ten actors who were born in the 1930s, and hence missed the studio era. We find that the average studio era Top Ten actor played 56 credited roles over his/her career, as compared to 34 for the average Top Ten actor born slightly later. This is again consistent with the model’s predictions.

*The Effect of Studio Contracts within the Studio Era*

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32 The weekly publication was known as the *Exhibitor’s Herald* from 1915-1928. After absorbing a rival publication, *Motion Picture World*, it was renamed the *Exhibitor’s Herald World* (1928-1930) and then the *Motion Picture Herald*. The *Motion Picture Herald* was eventually closed, and the poll continued in an annual sister publication, the *International Motion Picture Almanac*.

33 The quotation is from the December 28, 1935 *Motion Picture Herald*, page 13.

34 The publication notes that some exhibitors attempt to rank in order, but most do not.

35 Even casual perusal of the Top Ten data indicates that the chosen actors are major stars. For example, the 2011 Top Ten were (in order): Brad Pitt, George Clooney, Johnny Depp, Leonardo DiCaprio, Matt Damon, Sandra Bullock, Bradley Cooper, Robert Downey, Jr., Meryl Streep, and Ben Stiller.
We turn now to the effect of being under contract during the studio era. Our dependent variable will be the number of roles played annually. We calculate the value of that variable for each of the actors in our data set for each of the years for which we have contract data: 1932 through 1942, inclusive. Each observation will thus be an actor-year (i.e., actor \( i \) in year \( t \)). We also have information on each actor’s gender, and, for roughly 90 percent of the actors, birth date, so that age can be determined.

Table 3 provides descriptive statistics. The average actor in our data set played 2.9 credited roles per year in feature films from 1932 through 1942. Thirty-five percent of observations pertain to actors under contract to a studio at some point during the eleven year period (contract ever), and seventeen percent of observations pertain to actors under contract the year the roles were played (contract year). Male actors make up nearly 70 percent of the observations, and the average actor in the sample is 39 years old.\(^{36}\)

The bottom half of Table 3 compares mean roles per year between those under contract and those not under contract. Actors who signed studio contracts at some point (contract ever) were cast in 3.7 roles annually, versus 2.5 roles for actors who never signed a studio contract. Actors under contract the same year the roles were played (contract year) were cast in 4.0 roles annually, versus 2.7 roles annually for actors not under contract that same year. Finally, restricting our comparison to actors who signed studio contracts at some point during the sample period, an actor averaged 4 roles per year in years under contract versus 3.4 roles per year in years not under contract. All the differences are statistically significant at well under one percent.

\(^{36}\)Note that because birthdates are not available for a subset of actors, we can calculate age for only 22,865 of the 24,831 observations in our data set.
Factors other than studio contracts affect the number of roles an actor plays. For example, Fleck and Hanssen (2014) document that casting frequency varies with age and gender; furthermore, films may change in style, plot, and even number from year to year.\footnote{Fleck and Hanssen (2014) find that the number of roles played by a female actor peaks when she is in her late 20s and early 30s, and falls sharply after she turns 40, while the number of roles played by a male actor peaks when is in his late 30s-to-early 40s, and declines slowly thereafter, although often continuing into his 50s.} We will therefore estimate the following equation:

1) \[ \text{roles}_{it} = \alpha + \rho \text{Contract}_{it} + X'_i \beta + \lambda_t + \nu_{it} \]

where \( \text{roles}_{it} \) is the number of roles played by actor \( i \) in year \( t \), \( \text{Contract}_{it} \) is our variable of interest, \( X_i \) is a vector of actor-specific age and gender controls, \( \lambda_t \) are year effects, and \( \nu_{it} \) is a composite error term: \( \nu_{it} = \mu_i + \varepsilon_{it} \), where \( \mu_i \) is an actor-specific error term (common across years) and \( \varepsilon_{it} \) is a mean 0 error term. We will account for the actor-specific error term by clustering at the actor level. The coefficient \( \rho \) is our parameter of interest.

We measure \( \text{Contract}_{it} \) in two ways. \( \text{Contract\ ever}_i \) is a dichotomous variable that takes on the value if 1 if actor \( i \) was under a studio contract in any year between 1932 and 1942, and 0 is otherwise. \( \text{Contract\ year}_{it} \) takes on the value 1 if actor \( i \) were under a studio contract in year \( t \), and 0 otherwise. The vector of controls will include a male dummy variable, age, age-squared, and age and age-squared interacted with the male variable.

The estimates from equation 1 are shown in the first two columns of Table 4. The coefficients on both contract measures (\( \text{contract\ ever}_i \) and \( \text{contract\ year}_{it} \)) are statistically significant and of magnitudes that imply a larger effect than does the simple comparison of means shown in Table 3: Studio contracts are associated with about one and one-half
more roles per year.\textsuperscript{38}

**Unobservable ability**

In the model, actors expected to be most talented are signed to studio contracts. But more talented actors may also be cast in more roles because they are more talented. If so, the relationship between roles and studio contracts can be represented by the equation:

\begin{equation}
\text{roles}_{it} = \alpha + \rho \text{Contract}_{it} + X'_{it} \beta + \lambda_i + \text{talent}_i \gamma + \epsilon_{it}
\end{equation}

where talent\(_i\), the unobservable talent of actor \(i\), is a latent variable.

In attempt to distinguish the influence of studio contracts from that of unobservable talent, we will do three things. First, we will treat the signing of an actor to a studio contract as a signifier of actor quality – a means of identifying who the talented actors are – and examine whether actually being under contract in a given year influences actor roles conditional on having signed a contract at some point in the sample period. The third column of Table 4 shows the effect of including contract ever\(_i\) and contract year\(_it\) in the same estimation (standard errors again clustered at the actor level). The coefficient estimates are of such magnitude as to imply that being under contract adds 0.7 of a role that year (one-quarter of a standard deviation), conditional on ever having been under contract. This is again consistent with the model’s prediction.

Second, we will include actor fixed effects, which will serve to control for any long-lived actor characteristics. If one can assume that unobservable talent is (mostly) unchanging and that the effect of a studio contract is constant over time and additive, a fixed effects estimation allows us to estimate the unbiased influence of studio contracts. We will therefore estimate the following equation:

\textsuperscript{38} Roles are, of course, a count. Estimating a negative binomial model produces qualitatively similar results (available upon request).
where $\alpha_i \equiv \alpha + A_i \gamma$, with $A_i$ the individual actor effects. The coefficient $\rho$ is identified by the change in annual roles that follow the signing of a studio contract.

We begin by creating a balanced panel for the years 1932 through 1942, setting $roles_{it}$ equal to 0 for years in which actor $i$ was not cast in any roles. Allowing $roles_{it}$ to equal 0 is (arguably) a realistic depiction of the casting process – only a portion of would-be actors succeed in finding film roles in any given year. The result is a data set of 7428 actors and 81,708 actor-year observations. Of course, certain actors may have been too young at the start of the sample period, or too old by the end, to be cast in films every year. We already control for age, but will take the additional step of restricting the estimations to actors between 19 and 70 years old each sample year.

Table 5 shows the results from the fixed effects estimation, with and without age and gender controls (note that the inclusion of age reduces the number of actors in the panel from 7428 to 6214). The coefficients on the contract variable are of such magnitude to suggest that the signing of a contract is associated with an additional 2.2 roles per year, an increase of nearly one full standard deviation (and a near-doubling of the unconditional mean value). The third column in Table 5 shows the result of limiting the panel to actors of ages 20 through 69. The (now unbalanced) panel is reduced to 5807 actors, but the effects implied by the coefficients on the contract variable are of essentially the same magnitudes and significance levels.

Finally, we will address the possibility that an actor’s talent may change over time by examining a common set of actors – major movie stars. We will compare the number of roles played by the most popular movie stars – again those named to the Top Ten in
exhibitor polls – in the years *before* they were named to the Top Ten, to the number of roles played by the average never-Top Ten-named actor each year. We will compare the studio era to the post-studio era. If we can assume that the “ability gap” between major stars and the average actor remains the same over time (which appears plausible), any systematic differential in casting coincident with the studio era should reflect the influence of studio contracts.

We thus contrast the number of roles per year played by actors who would be, but had not yet been, listed in the Top Ten with the number of roles played by actors who would never be listed in the Top Ten. We should point out that this test will understate the effect of studio contracts to some degree, because 1) many major stars never made the Top Ten (limited, as it was, to ten per year), and 2) many other actors (non-major stars) were under contract, too. But as a result, evidence of differences should be that much more convincing.39

Fifty-seven different actors were named to the Top Ten between 1929 and 1950, and an additional 103 were named from 1950 through 1990. Figure 3 plots roles per year, comparing roles played by Top Ten actors per year *before* being named to the Top Ten with roles per year played by actors who never made the Top Ten. As can be seen, until the early-to-mid 1940s, Top Ten actors on their way to the top were cast in one or more additional roles per year. With exception of a few years in the 1950s, the difference never again topped one-half of one role per year (and was often negative). The small number of actors in the Top Ten suggests caution in interpretation, but the results are again consistent with the model’s prediction.

39 Major stars of the 1930s and 1940s who did not make the Top Ten include John Barrymore, Rita Hayworth, Robert Montgomery, Lana Turner, and Orson Welles, to name but a few.
D. Did a Studio Contract Merely Reduce the Cost of Using an Actor?

Studio contracts provided twelve-to-fourteen weeks of *unpaid* leave each year – and an actor was notified when he was to take his unpaid leave.\(^40\) This provided studios with substantial discretion regarding when actors could be used – an important consideration for the larger studios, which produced 40-50 films per year.\(^41\) For the purpose of this analysis, it also meant that the marginal cost of using actors under long-term contract was not necessarily less than that of using actors not under contract (and for every film, a studio used a mix of both). However, this may not always have been true (e.g., when leave was exhausted); furthermore, having an actor under contract presumably reduced film-by-film negotiation costs.\(^42\) It is therefore possible that some of the differences in roles played that we find to may reflect the lower cost of using actors under contract.

In this sub-section, we will seek to distinguish the talent revelation effect of studio contracts from a possible lower cost effect. We will exploit the fact that once an actor’s true talent is recognized – for example, once the actor becomes a major star – no further investment in talent revelation is required. This means that, to the degree (some) casting is done to reveal talent, we should see actors cast in fewer roles once they become major stars (i.e., once their talent is fully revealed). Furthermore, while differences in the casting of actors under contract versus not under contract may initially reflect both talent revelation objectives and lower costs, once an actor’s talent is fully revealed, only lower

\(^{40}\) David Niven (1975, 152) describes celebrating the signing of his first contract with Goldwyn Studios by purchasing a new car. “Then I drove slowly back to the studio to display the shiny beauty before the admiring employees in the casting office. Bob McIntyre, the kindly head of that department, looked embarrassed. ‘Take it back again, son,’ he advised. ‘Mr. Goldwyn has just called down. You’re on layoff for six weeks.’”

\(^{41}\) The largest studios – the “Big Eight” – were Columbia, Fox, MGM, Paramount, RKO, United Artists, Universal, and Warner Brothers. In addition, there were smaller (“poverty row”) studios who specialized in low-budget genre films (e.g., cowboy movies), and independent producers, such as Samuel Goldwyn and David O. Selznick.

\(^{42}\) This is not always true either – studios had legendary battles with unhappy stars over particular roles.
cost-based differences should remain.

Of course, we can make this the basis of a test only if we can measure objectively when an actor’s talent is fully revealed. To do so, we will again make use of the “Top Ten moneymaking actors” vote, taking the year in which an actor is first named to the Top Ten as the time when talent is fully revealed. We should note that defining “full talent revelation” in this manner is conservative – many actors had been major stars for some time before being named to the Top Ten. Any “before-after” differences we find may therefore underestimate the true investment in talent revelation.

We will begin with the 74 Top Ten actors who were signed to studio contracts at some point between 1932 and 1942. For each of these 74 actors, we will calculate the average roles played annually in the years preceding the first appearance on the Top Ten list, and the number of roles played annually in the years following the actor’s first appearance on the Top Ten list (beginning with that year). Table 6 shows the result. The first two columns include all roles played over the careers of these 74 actors, columns three and four include only roles played between 1932 and 1942 (because a number of the actors began their careers in silent films and silent era filmmaking was very different), and columns five and six include only roles by actors who had both a “before” and an “after” period between 1932 and 1942. In each case, the result is roughly the same: one and one-half-to-two more roles played annually in the “before” as compared to the “after” period. The difference is statistically significant at well under one percent, and is roughly equal to the differences documented in the tables.

43 For example, Humphrey Bogart was not named a Top Ten actor until 1943; two years after his breakout role in The Maltese Falcon and one year after Casablanca. John Wayne was not named until 1949, ten years after John Ford’s Stagecoach made him a star. Cary Grant was not named until 1944, after having starred in a number of now-classic films (Bringing up Baby, The Philadelphia Story, His Girl Friday, The Awful Truth). And so on.
The fact that the average number of roles played annually is much smaller after being named to the Top Ten provides support for the talent revelation hypothesis – the actor under contract remains “lower cost” whether he is a major star or not. However, other things may change when an actor is named a Top Ten star. We will therefore conduct the same test for a group of stars who arose immediately following the studio era: the 24 Top Ten stars born in the 1930s – born too late for the studio era, yet early enough for their careers to have largely run their course by the end of our data set in 2011.\textsuperscript{44}

The result for actors born in the 1930s is shown at the bottom of Table 6. The difference between the “before” and “after” for this set of actors is tiny – about one-tenth of the studio era difference – providing little evidence of any change at all. Figure 4 plots the studio and post-studio era estimates side-by-side, with the horizontal lines indicating mean values and the vertical lines spanning one standard deviation above and below the means. As can be seen, actors do not differ much across the two eras “after” being named to the Top Ten – the difference is almost all in the “before” period. These results suggest that cost differences do not explain much of the difference in roles played by actors under studio contracts.\textsuperscript{45}

E. Did Actors under Studio Contract Invest Less?

PRT predicts that the same rights assignment that increases the investment incentives of one party reduces those of the other party. Did actors under studio contract invest less? We do not have a measure of actor investment equivalent to our

\textsuperscript{44} One can think of this as a crude differences-in-differences analysis: \((\text{roles}_{st, \text{pre Top Ten}} - \text{roles}_{pt, \text{pre Top Ten}}) - (\text{roles}_{st, \text{post Top Ten}} - \text{roles}_{pt, \text{post Top Ten}})\), where \(\text{roles}_{st}\) is the number of roles played by studio-era actor \(s\) in year \(t\), and \(\text{roles}_{pt}\) is the number of roles played by post-studio era actor \(p\) in year \(t\). The difference between the two terms in parentheses may then be taken as a measure of the talent revelation effect.

\textsuperscript{45} The fact that independent producers, such as Samuel Goldwyn, Alexander Korda, David O. Selznick, and Walter Wanger, who each made only a handful of films per year, maintained actors under long-term contract also runs counter to the lower cost story.
measure of producer investment; actor under-investment presumably entailed reducing effort in costly-to-observe ways. Furthermore, the weakened investment incentives resulting from long-term contracts would have been at least partly counterbalanced by the fact that (as with most jobs) good performance was rewarded – with contract renewals, salary rises, and more attention from fans. Nonetheless, there are several things suggestive of the possibility that actors invested less when facing the blunter incentives provided by studio contracts.

First, studios invested abundantly in the general human capital of actors under contract. For example, film historian Jeanine Basinger (2007, 59) describes studios “giving potential stars [lessons in] . . . manners, diction, acting, riding, walking, dancing, singing, fencing, and lessons on how to meet fans and dignitaries (two different procedures).” Davis (1993, 85) writes

Young contract players . . . were put into an extensive apprenticeship program to prepare for stardom. Having signed them, the studio gambled further on them by investing in elaborate grooming to teach them the craft of moviemaking and how to conduct themselves. . . . Lilian Burns [MGM head drama coach] believed in the development of the total persona. ‘If Ava Gardner didn’t know how to hold a champagne glass, she had to learn. . . . They had to learn about antiques, about music, about culture. That was part of their training.’

Paramount Pictures put newcomers in plays under accomplished stage directors to teach them how to move and speak. An RKO coach worked with actors at her home at night. Studios also provided substantial complementary investment in appearance: on hair, teeth, breasts, and so forth.46

The willingness of studios to undertake such investment is understandable given long term contracts with the actors, but perhaps more surprising is that actors were actually paid to develop general human capital – to take acting, singing, and so forth

46 See the discussions in Gomery (1986), Schatz (1988), Davis (1993), and Basinger (2007).
lessons (Basinger 2003, 59).\textsuperscript{47} It is difficult to conceive of a rationale for paying actors to accept training in general skills other than that actors lacked the incentive to accept training otherwise.

Second, as noted above, studio contracts specified aspects of comportment – acceptable behavior \textit{outside} the workplace – enforceable upon pain of cancelled contract. Indeed, a studio would on occasion go so far as to dictate an actor’s social and romantic life; for example, require a couple to be “seen” together (or not), to enhance a career or to counter negative rumors.\textsuperscript{48} While this again has a possible alternative explanation – bad behavior affects the reputation of the studio – it is consistent with an attempt to overcome an excessive lack of care by actors.

Third, casual examination indicates that actor behavior changed when long-term contracts vanished. Actors, facing the demise of the studio system, entered into more encompassing agreements with talent agencies, and these agencies took over some of the functions previously managed by studios (we will discuss this in the next section). Furthermore, “actors studios,” led by luminaries such as Lee Strasberg and Stella Adler, arose to provide training to aspiring actors (in return for a fee, of course). It was the rare actor who hit Hollywood in the 1950s and 1960s without first passing through an actors studio. Actors themselves were now shelling out for what Hollywood producers had earlier paid them to accept.

\textsuperscript{47} The actor either earned a bonus for attending classes (after a day’s shooting, for example), or was kept under salary during periods of “unpaid leave” because he was taking lessons. For example, when Arnold Moss played a soldier in Columbia’s \textit{The Loves of Carmen} (1948), he was given saber lessons by an Olympic champion for six weeks, during which received salary despite the fact filming had not yet begun. Marsha Hunt played a violinist in 1945, and was taught for days how to fake it. See Davis (1993, 133).

\textsuperscript{48} Davis (1993, 109) writes, “Studio executives not only dictated the roles their actors played, they tried to control their social lives as well.”
V. WHAT FOLLOWED? THE RISE OF THE TALENT AGENCY

The studio era’s higher level of investment in actors (as measured by casting in roles) need not have been efficient – PRT allows for over-investment as well as under-investment.\footnote{Furthermore, the studio agreement not to poach actors (discussed in Section II above) appears to have functioned effectively, indicating that studios enjoyed some monopsony power. However, given the large queues of would-be actors, the relatively high salaries even minor actors made, and the many non-pecuniary benefits of being a star, this may have mostly shifted rents rather than reducing surplus.} A full-blown welfare analysis is beyond the scope of this analysis; however, we note that where deadweight losses exist, there is incentive to minimize them (e.g., Becker 1983, Barzel 1992). Is there evidence that parties attempted to compensate for the disappearance of the studio system by establishing or emphasizing new forms of contracting? We find such evidence in the post-studio era rise of the talent agencies.

Hollywood agents have a long history.\footnote{See, e.g., Rose (1995), and Kemper (2010). Many agents began in vaudeville, where their duties involved touting clients from theater to theater in a search for bookings. Many of those clients would switch between film and vaudeville or the stage as opportunity dictated. See, e.g., Basinger’s (1999) description of Mary Pickford, perhaps silent film’s greatest star, alternating between the New York stage and Hollywood early in her career.} During the studio era, the role of the film actor’s agent was largely limited to negotiating (or occasionally re-negotiating) an actor’s studio contract once every several years.\footnote{For examples, see Rose (1995, 65, 75, 103).} Although some larger agencies represented actors (e.g., William Morris and MCA), Rose (1995, 57) writes that “Most of the Hollywood boys were chiselers, sharpies, two-bit players who promised but didn’t deliver.”

With the end of the studio era, the responsibility of the Hollywood agent expanded from negotiating long term contracts to negotiating individual film roles, and, increasingly, to advising and directing an actor’s career. The industry consolidated, as agencies like William Morris, which had emphasized stage and vaudeville acts, and MCA, which had emphasized musical acts, increasingly focused on Hollywood (MCA...
bought up a number of smaller Hollywood agencies). The agencies also moved from simply negotiating contracts for film roles to putting together “packages” – show ideas (perhaps including scripts) that contained roles for a number of the actors they had under contract.

The packaging began with television, then still a new industry experimenting with alternate forms of producing content – agencies would approach the TV networks with ideas for programs that would feature actors under contract. Attempts to package film stars (and writers, directors, and so forth) followed, as agencies aggressively touted the use of “their” actors. However, although an agency could cajole a producer, it did not make the ultimate production decision.

MCA attempted to surmount this barrier in 1962, with the purchase of Universal Pictures. This would have re-created a large part of the Hollywood studio system – actors and producers under contract to the same entity. However, the Department of Justice voiced antitrust concerns about a movie studio and a talent agency being jointly owned (somewhat oddly, given that the practice of actors under contract to studios was never contested during the studio era, despite the barrage of antitrust suits that studios faced on other grounds). MCA dissolved its talent agency, which was reconstituted as

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52 See, e.g., Rose (1995), chapter 7, titled “Package Deal”, in which he discusses the William Morris Agency’s successful efforts to develop TV shows for clients Ray Bolger and Danny Thomas (the former’s show lasted only briefly, but the latter starred in his eponymous series for a dozen years). Film differed from television in that an agency only took ten percent of client salary for films rather than ten percent of total budget, the practice with TV shows (Rose 1995, 218).

53 Rose (1995, 218-9) describes the casting of the 1958 film, The Young Lions: “MCA handled both the picture’s stars, Marlon Brando and Montgomery Clift. It didn’t handle Tony Randall, who had the chief supporting role. Four days before the cameras were set to roll, an MCA agent turned up on the lot. He informed the studio’s production chief, Buddy Adler, that Brando and Clift didn’t want to do the picture with Randall; they wanted to do it with Dean Martin, who happened to be an MCA client. Spluttering, Adler consented to the switch.”

54 See Bruck (2003, 179ff). MCA acquired the film producer through merger with Decca Records, which controlled 89 percent of Universal.
several different firms, including CCA, today’s largest agency. Agencies still tout actors and peddle scripts. But the barrier between representing actors and producing films remains.

In short, during the Hollywood studio era, the entities producing films had full incentive to take into account the effect of casting decisions on the future careers of actors. Individual actors no doubt have the same incentive today, but credit constraints presumably prevent them from making their own films (until they are stars, at least). Their ability to pay film producers to cast them in roles that would reveal their talents is further limited by the non-contractible nature of that investment – unless the actor is able to control script, cast, filming, and so forth; i.e., unless the actor produces the film herself. Talent agencies may or may not reduce the magnitude of underinvestment today, but one can only wonder whether, had MCA been left unhindered, we would have seen a resurrection of the old Hollywood studio system.

VI. CONCLUSION

In this paper, we have investigated how long-term contracts between actors and studios, affected non-contractible investment in talent discovery. We developed a model and tested it by investigating roles played by actors during and after the studio era. We find that studio actors played substantially more roles over their careers than did actors not under contract – and playing roles was the most important form of investment in talent revelation.

The insight we exploit is that under a regime of long term contracts (as in the studio era), claims to an actor’s future earnings belonged to the production company. By
contrast, under a regime in which actors contract for individual films sequentially, the actor remains full owner of his/her future earnings. Investment changed accordingly, just as the property rights theory of Grossman, Hart, and Moore would predict.
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APPENDIX: A Detailed Model

A. Film Roles, Actor Types and Upside Potential

There are $L$ categories of film role, $r = 1, 2, ..., L$, indexed in ascending order of the role’s contribution to the film’s success at the box office. A film’s revenue is given by

$$R(\omega) = \sum_{r=1}^{L} \alpha_r \omega_r,$$

(2)

where $0 < \alpha_1 < \alpha_2 < \cdots < \alpha_L$ and $\omega_r$ is an indicator variable for the outcome of the performance, equal to one if the performance in role $r$ is successful and zero otherwise. Performance outcomes are observable to the producer but are not contractible.

There are, in ascending order of ability, $L + 1$ types of actor, $a = 0, 1, ..., L$. An actor of type $a$ can successfully perform any role $r \leq a$ with probability $\theta_r \in (0,1)$, but will fail with certainty in any higher role. Thus type 0 actors fail in all roles, while type $L$ actors, whom we call stars, can successfully perform any role. The outcome of a performance thus yields information on the actor’s ability. Upon a first successful performance in role $r$, an actor is revealed to the producer to be of type $a \geq r$. This gives rise to an “up” ratchet effect for actors:

Result 1 (up ratchet effect). No actor whose type is known to be $a \geq r$ will be cast in any role $r' < r$. Doing so would reduce the film’s expected box office, relative to casting the actor in role $r$, without yielding further information on the actor’s type.

Now consider an actor who has just had a first successful performance in role $r'$, but has not yet played any higher role. The actor’s lowest possible type is then $r'$ and his upside potential with respect to $r$, i.e., the likelihood that he is of type $a \geq r$, is

$$\sigma_r(0,r') = \frac{\sum_{a=r}^{L} p_a}{\sum_{a=r'}^{L} p_a},$$

(3)

where $p_a$ is the proportion of the population of prospective actors who are type $a$, $p_a \in (0,1)$ and $\sum_a p_a = 1$. The notation $\sigma_r(0,r')$ signifies that the actor has not yet played any role higher than $r'$ and thus has zero failed performances in role $r$. By equation (2), $\sigma_r(0,r') > \sigma_r(0,r'')$ for $r'' < r' < r$. This implies a “down” ratchet effect for actors:

Result 2 (down ratchet effect). The producer will not cast in role $r$ any actor whose highest successful performance is in a role $r' < r - 1$, given that $\sigma_r(0,r-1) > \sigma_r(0,r')$.

Results 1 and 2 together suggest a career ladder for actors, each of whom begins in a lesser role and, upon proving himself through successful performance, advances to the next-higher role. To complete the description of the career ladder, we will derive a sufficient condition for advancement and experimentation in a next-higher role to be profitable for the producer and derive the producer’s optimal stopping rule for experimentation in the next-higher role.
Given Result 2, we simplify notation, letting \( \sigma_r(0) \) be the upside potential of an actor whose type is known to be at least \( r - 1 \), but who has yet to play a role in category \( r \):

\[
\sigma_r(0) = \frac{\sum_{a=r}^{L} p_a}{\sum_{a=r-1}^{L} p_a}.
\]

More generally, let \( \sigma_r(n) \) denote the upside potential of an actor whose lowest possible type is \( r - 1 \), who has not yet played any role higher than \( r \), and who has had an uninterrupted string of \( n \) failed performances in role \( r \) without a first success in the role. As \( n \) increases, the producer updates her belief in the actor’s upside potential according to Bayes’s Rule. For \( n = 1 \),

\[
\sigma_r(1) \equiv P_r(r|f) = \frac{P_r(f|r) P_r(r)}{P_r(f)}
\]

where \( P_r(r|f) \) is the probability the actor’s type is \( a \geq r \) conditional on having a single failed performance in \( r \). Given \( P_r(f|r) = 1 - \theta_r \), \( P_r(r) = \sigma_r(0) \) and \( P_r(f) = 1 - \theta_r \sigma_r(0) \), we have

\[
\sigma_r(1) = \frac{(1 - \theta) \sigma_r(0)}{1 - \theta \sigma_r(0)}
\]

and for \( n \geq 1 \),

\[
\sigma_r(n) = \frac{(1 - \theta_r) \sigma_r(n - 1)}{1 - \theta_r \sigma_r(n - 1)}.
\]

Applying equation (4) recursively, \( \sigma_r(n) \) can be derived in terms of \( \theta_r \) and \( \sigma_r(0) \) alone.

**Result 3 (declining upside potential).** By equation (4), \( \sigma_r(n - 1) > \sigma_r(n) \). Thus an actor’s upside potential \( \sigma_r(n) \) within role \( r \) declines as \( n \), his string of failed performances without a first success in the role, lengthens.

**B. Role Scarcity and Optimal Stopping in Lesser Roles**

We denote an actor’s *continuation value* in role \( r \)—the producer’s expected gain from casting the actor in another role \( r \)—by \( V_r(n, m_r) \). Here, as above, \( n \) is a string of failed performances in role \( r \) without a first success in the role, whereas \( m_r \) is the number of remaining periods in the term of the actor’s contract as of the time the actor became qualified to play role \( r \), having had a first success in role \( r - 1 \).

The continuation value \( V_r(n, m_r) \) can be unpacked as follows. If the actor were cast in another role \( r \), his performance would be a success with probability \( \sigma_r(n) \theta_r \). In this case, the actor’s contribution to the film’s box office would be \( \alpha_r \) and the actor would advance a rung up the career ladder, yielding a continuation value \( V_{r+1}(0, m_r - n - 1) \) in role \( r + 1 \) next period. With probability \( 1 - \sigma_r(n) \theta_r \), the actor’s performance in role \( r \) would once again fail, yielding a continuation value of \( V_r(n + 1, m_r) \) next period.

Finally, the cost of casting the actor must be subtracted to obtain the continuation value. This cost is the foregone opportunity to cast in role \( r < L \) an actor known to be of
type $a \geq r$, who would yield the expected value $\theta_r\alpha_r$ in incremental box office. We take film roles to be scarce in that there are more actors qualified to play role $r$ (having successfully performed in role $r-1$) than there are roles $r$ available in films under production. There exists a pool of actors who have performed successfully in role $r$ but did not succeed in any role $r+1$ before reaching the producer’s optimal stopping rule for experimentation in $r+1$. The producer can always turn to such proven actors in casting role $r$; experimenting with an actor whose lowest possible type is only $r-1$ requires the producer to displace a proven actor.

From all the foregoing, the continuation value can be written as

$$\sigma_r(n)\theta_r[\alpha_r + \delta V_{r+1}(0,m_r - n - 1)] - \theta_r\alpha_r$$

$$+ (1 - \sigma_r(n)\theta_r) \delta V_r(n + 1, m_r),$$

(6)

for the lesser roles $r < L$, where $\delta$ is a one-period discount factor. Note that in case the performances is a success and the actor advances to role $r + 1$, $m_{r+1} = m_r - n - 1$. The upper line in expression (5), which represents the continuation value in case of a successful performance, can be rewritten as $\theta_r\alpha_r v_r(n, m_r)$, where

$$v_r(n,m_r) = \sigma_r(n)\left(1 + \frac{\delta}{\alpha_r} V_{r+1}(0,m_r - n - 1)\right) - 1.$$

(7)

Note that in the lower line of expression (5), which represents the continuation value in case of a failed performance, the term $V_r(n + 1, m_r)$ likewise has within it a term $v_r(n + 1, m_r)$. Moreover, if $v_r(n,m_r) \leq 0$, then $v_r(n + 1, m_r) < 0$; the value $v_r(n,m_r)$ declines with $n$ as $\sigma_r(n)$ declines.

**Result 4 (declining continuation values).** By equation (4), $\sigma_r(n) > \sigma_r(n + 1)$, and by equation (6) $v_r(n,m_r) > v_r(n + 1, m_r)$. Thus an actor’s continuation value $V_r(n,m_r)$ within role $r$ declines as $n$, his string of failed performances without a first success in the role, lengthens.

The continuation value is nonnegative only if $v_r(n,m_r) \geq 0$. By equation (6), the condition $v_r(n,m_r) \geq 0$ is more likely to hold:

- the higher the actor’s upside potential $\sigma_r(n)$,
- the greater the payoff $V_{r+1}(0,m_r - n - 1)$ to reaching the next rung $r + 1$ in the actor’s career ladder, and
- the lower the contribution $\alpha_r$ of role $r$ to the film’s box office success, which reflects the opportunity cost of the experiment.

In deriving the optimal stopping rule, it is convenient to define continuation values so that they are nonnegative. The producer’s optimal rule is then simply to continue casting an actor in a role so long as his continuation value is strictly positive. To reduce notational clutter, for $x \in \mathbb{R}$ let $\{x\}^+ \equiv \max\{x, 0\}$. Define

$$V_r(n,m_r) = \theta_r\alpha_r\{v_r(n,m_r)\}^+$$

$$+ (1 - \sigma_r(n)\theta_r) \delta \{V_r(n + 1, m_r)\}^+$$

(8)
for the lesser roles \( r < L \). The optimal stopping rule within role \( r \) is then given by

\[
n_r^*(m_r) = \max\{n \in \mathbb{Z} \mid v_r(n, m_r) \geq 0\}.
\] (9)

In words, \( n_r^*(m_r) \) is the longest string of failed performances in role \( r \) without a first success in the role, for an actor who initially had \( m_r \) periods remaining in his contract upon advancing to role \( r \), such that the producer is still willing to cast the actor in another role \( r \). The critical importance of \( m \) will become apparent presently as we turn to continuation values and optimal stopping in lead roles.

C. Scarcity of Bankable Stars and Optimal Stopping in Lead Roles

So far we have assumed lesser roles to be scarce relative to the number of actors qualified to play such roles. We assume the reverse is true for stars. Bankable stars (actors known to be type \( L \)) are scarce; their number is a limiting factor on the number of films that can be profitably produced.

Let \( R_{-L} \) denote a film’s expected revenue not counting the lead actor’s contribution. \( R_{-L} \) is the sum across lesser roles \( r = 1, 2, ..., L - 1 \) of the product of the role’s contribution \( \alpha_r \) and the probability that role \( r \) will be performed successfully. We assume that \( R_{-L} - C < 0 \) but that \( \theta_r \alpha_r + R_{-L} - C > 0 \), where \( C \) is the film’s incremental production cost. Thus a film with a bankable star cast in the lead role yields a positive expected profit, but a failed lead performance generates a loss.

Paralleling the developments of Section B, the continuation value \( V_L(n, m_L) \) can be unpacked as follows. If the actor were cast in another lead role, his performance would be a success with probability \( \sigma_L(n) \theta_L \). In this case, the actor’s contribution to the film’s box office would be \( \alpha_L \) and in addition the actor would become a bankable star, yielding \( \theta_L \alpha_L S(m_L - n) \) in present value over the \( m_L - n - 1 \) films remaining in his contract term, where

\[
S(m_L - n) = \begin{cases} 
0 & \text{if } m_L - n \leq 1, \\
\sum_{t=1}^{m-n-1} \delta^t & \text{otherwise.}
\end{cases}
\] (10)

With probability \( 1 - \sigma_L(n) \theta_L \), the actor’s performance in role \( L \) would once again fail, yielding a loss of \( R_{-L} - C \) and a continuation value of \( V_L(n + 1, m_L) \) next period. Define

\[
V_L(n, m_L) = \alpha_L \{v_L(n, m_L)\}^+ + (1 - \sigma_L(n) \theta_L) \delta \{ V_L(n + 1, m_L) \}^+.
\] (11)

where

\[
v_L(n, m_L) = \sigma_L(n) \theta_L \left( 1 + \theta_L S(m_L - n) \right) - \frac{C - R_{-L}}{\alpha_L}.
\] (12)

As before, \( v_L(n, m_L) > v_L(n + 1, m_L) \), so \( v_L(n, m_L) < 0 \) implies \( V_L(n + 1, m_L) < 0 \). Thus \( V_L(n, m_L) \geq 0 \) only if \( v_L(n, m_L) \geq 0 \). By equation (11), the condition \( v_L(n, m_L) \geq 0 \) is more likely to hold.
• the higher the actor’s upside potential $\sigma_L(n)$,
• the greater the payoff to discovering a star, which is proportional to $\theta_L S(m_L - n)$, and
• the lower the cost of the experiment, as reflected by $-(C - R_{-L})/\alpha_L$.

In analogy with equation (8) for lesser roles, the optimal stopping rule in lead roles is given by

$$n^*_L(m_L) = \max\{n \in \mathbb{Z} | v_L(n, m_L) \geq 0\}. \quad (13)$$

There are two ways that the magnitude of $m_L$ can vary. One is by the randomness of performance outcomes. Those talented actors fortunate to have had quick successes and rapidly climbed the career ladder of roles will tend to have higher values of $m_L$. Through luck, these actors receive more extensive experimentation in lead roles. More fundamentally, at any stage $r$ in an actor’s career the magnitude of remaining contract periods $m_r$ will tend to be greater the longer the overall term of the contract.

**Result 5 (long term contracting encourages investment in talent discovery).** The magnitude of $m_L$ will tend to be greater the longer the term of the contract. The greater is $m_L$, the greater is $S(m_L - n)$, hence the greater the payoff to discovering a star, by equation (11). The producer’s willingness to invest in star discovery, as reflected by $n^*_L(m_L)$, increases with $m_L$.

Beginning with the final continuation value $V_L(n^*_L(m_L), m_L)$, the initial continuation value $V_L(0, m_L)$ can be obtained by backward induction, applying equation (10) recursively. In turn, the final value $V_{L-1}(n^*_{L-1}(m_{L-1}), m_{L-1})$ can be obtained given $V_L(0, m_L)$, which likewise yields $V_{L-1}(0, m_{L-1})$ by recursive application of equation (7), and so on, allowing all continuation values to be calculated back to $V_{\hat{r}}(0, m_{\hat{r}})$, where $\hat{r}$ is the role at which contract signing takes place.
### TABLE 1: Career Pattern

<table>
<thead>
<tr>
<th># Actors who played</th>
<th>1932-1942 (all actors)</th>
<th>1943-2011 (all actors)</th>
<th>1943-2011 (born in 1930s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-uncredited roles</td>
<td>9627</td>
<td>72,974</td>
<td>2921</td>
</tr>
<tr>
<td>-credited roles</td>
<td>8903</td>
<td>94,047</td>
<td>4392</td>
</tr>
<tr>
<td>-lead roles</td>
<td>2953</td>
<td>17,882</td>
<td>1233</td>
</tr>
</tbody>
</table>

Total different actors: 18,234 90,473 4816

% credited actors who began as uncredited: 86% 52% 57%

% lead actors who began as uncredited: 84% 20% 27%

Source: IMDB. Uncredited roles are listed as “999” in IMDB data base. “Lead” roles are played by those actors who ranked first or second in credits (i.e., listed 1 or 2). “Credited roles” are those listed with a number less than 999.
TABLE 2: Duration of Careers

<table>
<thead>
<tr>
<th></th>
<th>Studio era (contract actors)</th>
<th>Studio era (non-contract)</th>
<th>Post-studio era (all actors)</th>
<th>Post-studio era (born in 1930s)</th>
</tr>
</thead>
<tbody>
<tr>
<td># Actors</td>
<td>1660</td>
<td>5768</td>
<td>94,047</td>
<td>4392</td>
</tr>
<tr>
<td># credited roles</td>
<td>60,502</td>
<td>85,537</td>
<td>390,743</td>
<td>31,960</td>
</tr>
<tr>
<td>Total career roles</td>
<td>36.5</td>
<td>14.8</td>
<td>4.2</td>
<td>7.3</td>
</tr>
</tbody>
</table>

TOP TEN ACTORS

<table>
<thead>
<tr>
<th></th>
<th>Under studio contract, 32-42</th>
<th>Not under studio contract, 32-42 born in 1930s</th>
</tr>
</thead>
<tbody>
<tr>
<td># Actors</td>
<td>74</td>
<td>24</td>
</tr>
<tr>
<td># credited roles</td>
<td>4116</td>
<td>805</td>
</tr>
<tr>
<td>Total roles per career</td>
<td>55.6</td>
<td>33.5</td>
</tr>
</tbody>
</table>

Source: IMDB, IMPA, Film Daily Yearbook
TABLE 3: Descriptive Statistics

<table>
<thead>
<tr>
<th>CREDITED ROLES</th>
<th>mean</th>
<th>Stdev</th>
<th>min</th>
<th>max</th>
<th>obs</th>
</tr>
</thead>
<tbody>
<tr>
<td># roles</td>
<td>2.94</td>
<td>2.66</td>
<td>1</td>
<td>25</td>
<td>24,778</td>
</tr>
<tr>
<td>contract ever</td>
<td>0.35</td>
<td>0.48</td>
<td>0</td>
<td>1</td>
<td>24,778</td>
</tr>
<tr>
<td>contract year</td>
<td>0.17</td>
<td>0.37</td>
<td>0</td>
<td>1</td>
<td>24,778</td>
</tr>
<tr>
<td>Male</td>
<td>0.69</td>
<td>0.46</td>
<td>0</td>
<td>1</td>
<td>24,778</td>
</tr>
<tr>
<td>Age</td>
<td>39.5</td>
<td>14.2</td>
<td>1</td>
<td>86</td>
<td>22,828</td>
</tr>
<tr>
<td># roles, contract ever = 1</td>
<td>3.72</td>
<td>2.78</td>
<td>1</td>
<td>24</td>
<td>8695</td>
</tr>
<tr>
<td># roles, contract ever = 0</td>
<td>2.53</td>
<td>2.49</td>
<td>1</td>
<td>25</td>
<td>16,083</td>
</tr>
<tr>
<td># roles, contract year = 1</td>
<td>4.03</td>
<td>2.70</td>
<td>1</td>
<td>24</td>
<td>4094</td>
</tr>
<tr>
<td># roles, contract year = 0</td>
<td>2.73</td>
<td>2.60</td>
<td>1</td>
<td>25</td>
<td>20,684</td>
</tr>
<tr>
<td># roles, contract ever = 1 &amp; contract year = 1</td>
<td>4.03</td>
<td>2.70</td>
<td>1</td>
<td>24</td>
<td>4088</td>
</tr>
<tr>
<td># roles, contract ever = 1 &amp; contract year = 0</td>
<td>3.44</td>
<td>2.83</td>
<td>1</td>
<td>23</td>
<td>4607</td>
</tr>
<tr>
<td>Variable</td>
<td>Coefficients (std. errors)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------</td>
<td>---------------------------</td>
<td>-------</td>
<td>-------</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contract ever</td>
<td>1.401</td>
<td>1.075</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.075)</td>
<td>(.085)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contract year</td>
<td>1.477</td>
<td>0.722</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.072)</td>
<td>(.076)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>0.010</td>
<td>0.011</td>
<td>0.014</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.009)</td>
<td>(.010)</td>
<td>(.009)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age2</td>
<td>0.0001</td>
<td>0.0000</td>
<td>0.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.0001)</td>
<td>(.001)</td>
<td>(.0001)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>-1.099</td>
<td>-1.141</td>
<td>-0.994</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.262)</td>
<td>(.266)</td>
<td>(.261)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male*age</td>
<td>0.084</td>
<td>0.082</td>
<td>0.080</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.015)</td>
<td>(.015)</td>
<td>(.015)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male*age2</td>
<td>-0.001</td>
<td>-0.001</td>
<td>-0.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.0001)</td>
<td>(.0001)</td>
<td>(.0002)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Year effects   yes       yes       yes

R2             .089       .073       .095
# obs          22,828     22,828     22,828

The dependent variable is the annual number of credited roles played by actor \( i \) in year \( t \), 1932-42. 
*Contract ever* is a dichotomous variable indicating actors who were ever under contract, and *Contract year* is a dichotomous variable indicating whether the actor was under contract the year of observation.
TABLE 5: Fixed Effects Estimation

Dependent variable = $roles_{it}$

<table>
<thead>
<tr>
<th>Variable</th>
<th>All Actors</th>
<th>Actors aged 20-69</th>
</tr>
</thead>
<tbody>
<tr>
<td>$Contract year$</td>
<td>2.223 (.027)</td>
<td>2.185 (.029) 2.108 (.033)</td>
</tr>
<tr>
<td>Age</td>
<td>0.044 (.008)</td>
<td>-0.057 (.013)</td>
</tr>
<tr>
<td>Age2</td>
<td>-0.001 (.0001)</td>
<td>0.0004 (.001)</td>
</tr>
<tr>
<td>Male*age</td>
<td>0.139 (.010)</td>
<td>0.302 (.016)</td>
</tr>
<tr>
<td>Male*age2</td>
<td>-0.001 (.0001)</td>
<td>-0.003 (.0002)</td>
</tr>
<tr>
<td>R2</td>
<td>.115 .046</td>
<td>.020</td>
</tr>
<tr>
<td># obs</td>
<td>81,708 68,354</td>
<td>59,305</td>
</tr>
<tr>
<td># groups</td>
<td>7428 6214</td>
<td>5807</td>
</tr>
</tbody>
</table>

The dependent variable is the annual number of credited roles played by actor $i$ in year $t$, 1932-42. $Contract year$ is a dichotomous variable indicating whether the actor was under contract the year of observation. The decline in the number of groups one sees in moving from the first to the second column is due to the fact that birth dates are not known for a number of less famous actors.
TABLE 6: Top Ten Actors, before and after making Top Ten, studio versus post-studio era

<table>
<thead>
<tr>
<th>Studio era:</th>
<th>Actors under studio contract, 1932-42</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All actors, all roles</td>
</tr>
<tr>
<td></td>
<td>Before</td>
</tr>
<tr>
<td>Total actors</td>
<td>74</td>
</tr>
<tr>
<td>roles per year</td>
<td>4.12 (st.dev. 2.90)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Post-studio era:</th>
<th>Actors born 1930-1939</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All actors</td>
</tr>
<tr>
<td></td>
<td>Before</td>
</tr>
<tr>
<td>Total actors</td>
<td>22</td>
</tr>
<tr>
<td>roles per year</td>
<td>1.67 (st.dev. 0.94)</td>
</tr>
</tbody>
</table>
FIGURE 1: Films, Actors, and Roles, Over Time

Source: IMDB
FIGURE 2: Annual Actors per film and Roles per film and per actor (1932-2011)

Source: IMDB
FIGURE 3: Roles per year, Top Ten prior to being named versus other

Source: IMDB, IMPA, Film Daily Yearbook
FIGURE 4: Roles per year, Before and After first being named to Top Ten

“Before” refers to average roles per year before an actor is first voted a “Top Ten moneymaking star”, and after refers to roles per year subsequently. Horizontal lines are mean values, while vertical lines measure one standard deviation in each direction.