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

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June 16, 2015

ABSTRACT: Empirical tests of the Grossman, Hart, and Moore property rights theory (PRT) generally link measures intended to capture the relative importance of non-contractible investment to predicted differences in ownership regimes. By contrast, in this paper we explore how an exogenous change in ownership regime affects a proxy for non-contractible investment, exploiting a unique dataset. As a result, we can test PRT from a different tack than that taken by earlier studies. 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. 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 contracts changed, and 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 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 structure of cross-border trade (e.g.,

Antras, 2003; Feenstra and Hanson, 2005), U.K. manufacturing (Aghion, Griffith and Howitt,

2006), and innovation (Acemoglu, Aghion, Griffith and Zilibotti, 2010).[1]

Speaking broadly, these tests of PRT take the form of demonstrating that proxy measures of

the relative importance of parties' non-contractible investment are associated with the predicted

differences in ownership regimes.[2] By contrast, in this analysis we measure the effect of an

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[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. Antras (2003) shows a positive correlation between the share of intrafirm trade in an industry sector and its physical capital intensity in the U.S. Feenstra and Hanson (2005) find 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). For a discussion and survey of PRT applications in international trade, see Antras (2014).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 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

exogenous change in ownership regime on a proxy measure of non-contractible investment, exploiting a unique dataset. We can thus test PRT from a different tack than that taken by earlier studies.

Our analysis focuses 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 studies have generally treated human capital as inalienable, we argue that 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. Grossman and Hart (1986, 693-4) write, "We define a firm to consist of those assets that it owns or over which it has control; we do not distinguish between ownership and control and virtually define ownership as the power to exercise control." [3] We hypothesize that complex long term contracts gave movie studios the power to exercise control over actor careers, and thus

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with the likelihood of vertical integration, while technology intensity in the upstream firm is negatively correlated with the likelihood of vertical integration.

[3] Our application of PRT to long-term labor contracting is thus perfectly in keeping with the model's basic tenets. Where formal vertical integration is not possible, long term contracts can create ownership-like incentives, and thus serve as a next best substitute. Indeed, this is what Paul Joskow (1985) finds in his classic study of coal-burning electric generating plants. Joskow concludes that because regulation made it difficult for power plants to own coal mines (just as laws made it difficult for a movie producer to own the human capital of the actors it employed), plants and mines entered into long term contracts as a substitute means of dealing with the type of holdup problem that would have inspired vertical integration in other settings. Joskow writes on page 35, "I argue below that, particularly for mine-mouth plants [where potential holdup problems were most severe], transaction cost theory implies that vertical integration *or complex long-term contracts* [italics added] will be used to support exchange." See also Kaplan and Stromberg (2003), who argue that the emphasis venture capital contracts place on the allocation of control rights between the VC and the entrepreneur is evidence in support of PRT.

promoted non-contractible investment in the discovery of acting talent through casting actors in film roles.[4]

The studio era was brought to an end by two court decisions: *De Havilland v. Warner Bros. Pictures* 67 Cal. App. 2d 225a (1942), which set a maximum term to the studios' labor contracts, and *U.S. v. Paramount Pictures, Inc.*, 334 U.S. 131 (1948), which mandated the vertical dis-integration of film studios from their theater holdings and banned a number of associated contractual practices.[5] The decisions increased the ability of outside parties (actors and independent theater chains, respectively) to capture returns from studio investment in talent discovery. 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 primarily on a film-by-film basis, with the biggest stars often paid a percentage of the box office take.[6]

We begin with a discussion of how the Hollywood studio contract fits PRT in Section II. In Section III, 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

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[4] It is widely agreed that the most important form of investment in talent revelation is the casting of would-be stars in film roles – see Section V below.

[5] The antitrust suit on which the *Paramount* decision was based was brought by the U.S. Department of Justice in 1938, and by the mid-1940s, additional theater acquisition had been enjoined and contractual practices like block booking had been banned. See Hanssen (2010) for a discussion.

[6] "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). We discuss revenue sharing and multi-picture deals (an occasional practice) in Section VII below.

to all films produced.[7] 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 changed fundamentally: Long term obligations were replaced by the film-by-film agreements that remain the norm today.

We develop a model in Section IV that generates testable implications for studio investment. 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 V 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.[8] 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

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[7] A 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 a detailed analysis of the evolution of actor revenue-sharing contracts in Hollywood.

[8] 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.

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.

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 an analysis of the effect of studio contracts *during* the studio era. We find that a studio contract is associated with an increase in roles played annually of roughly twice the unconditional mean value. 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, we focus on a common set of actor "types"—major movie stars—in order to determine whether there was a change in roles played once talent was fully revealed (i.e., once a star was recognized as a star). We also look for evidence of experimentation in roles played and in genres acted in. In each case, we find strong support for the model's predictions.

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 reasons discussed in the next section) and difficult to observe (it would be contracted for if not), the evidence is less direct. In Section VI, 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 VII, we discuss what happened when studios stopped signing actors to long term contracts. Two alternative contractual practices gained in prominence, revenue sharing and multi-picture deals, but neither produced the incentive for investment in talent revelation that the studio contract had.[9] The rise of the integrated talent agency was another story. 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.

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[9] Revenue sharing agreements were used only with well- known stars (i.e., actors whose talent had already been revealed), and likely reduced the returns to investment in talent discovery. Multi-picture deals are used only when sequels are anticipated (for a book series like *Harry Potter* or a superhero character like Captain America); furthermore, if the film fails, the sequel is not made, and the investment in the actor ends. For example, the first movie in *The Golden Compass* series was so unpopular that a second film was never made, and only the first three of the seven Narnia books were turned into movies.

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. Film scholars have marveled for decades at the lavish expenditure on actors engaged in by the old Hollywood movie studios (see Sections III and VI for examples and citations). To the best of our knowledge, we are the first to conduct a systematic analysis of casting decisions.[10]

At base, our paper's findings and conclusions are 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.   PROPERTY RIGHTS THEORY AND THE STUDIO CONTRACT

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

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[10] Most of the large literature on the Hollywood studio era has been written by film scholars and historians. Work by economists has focused, for the most part, on distribution and exhibition (Weinstein 1998, discussed in a prior footnote, is an exception). Hanssen (2002) concludes that the innovation of sound in the 1920s narrowed the scope for shirking by independently owned theaters, resulting in a shift in how producers/distributors compensated theater owners for exhibition. Hanssen (2010) finds that theater chain ownership by film producers/distributors in the 1930s-40s promoted efficient ex post adjustment in the length of film runs, especially the abbreviation of unexpectedly unpopular films. Raskovich (2003) explains the rise of profit-sharing contracts between producers and actors as a consequence of changes in bargaining leverage between producers and exhibitors, in the wake of forced vertical disintegration in the late 1940s and 1950s. Gil (forthcoming) finds that mandated vertical disintegration of studios and cinemas in the late 1940s raised ticket prices.

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 revenue generated by the actor's 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 an actor of imperfectly known ability in a challenging film role, thereby foregoing the opportunity to cast an actor known to be capable of performing the role successfully. The quality of the resulting performance (gauged by fan mail, etc.) yields information on the actor's type. The actor, on the other hand, invests effort in honing his or her skills 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 skill. 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 it judges that the actor has a reasonable chance to succeed in it. The evidence onscreen and audience response either validate this 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 in the studio's portfolio, and—most importantly—the discovery of audience preferences.[11]

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 thus an investment in talent discovery, the cost of which is the foregone opportunity to cast someone of known ability. 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.[12]

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[11] Relational contracting cannot solve underinvestment in talent discovery. Plausibly, a studio is better informed than an actor on which role is best suited to revealing the actor's talent. In relational contracting, an actor might promise to pay the studio a bonus for having been felicitously cast and discovered to be a star. Such a promise would not be self-enforcing, however, given that talent revelation typically increases an actor's value both within and outside a given studio. Once revealed to be a star, an actor gains tremendous bargaining leverage. Even if the revealed talent were wholly studio-specific (e.g., the actor is perfectly suited to portraying a fictional character owned by the studio), the studio would capture only a fraction of the value in bargaining with the actor over franchise sequels.

[12] 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

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 outweigh 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, only to see the system collapse in the aftermath of court rulings that sharply limited the gains to studios from developing new stars. Furthermore, talent agencies engaged in attempts to reconstitute the studio system subsequently by entering into movie production, as we discuss below.

III.   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

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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.

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.[13] 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.

Competitive pressures did not allow this state of affairs to persist.[14] 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

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[13] 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).

[14] The following anecdote is related in Jacobs (1939, 86-87).

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.[15] 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.[16]

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

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[15] 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*.

[16] 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).

(an "intensely competitive and immensely profitable period") were offered "not only impressive million-dollar yearly contracts but percentages of the net profits as well."[17]

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.[18]

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.[19]

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 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

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[17] 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."

[18] 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).

[19] 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.

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.[20]

The contracts typically stipulated a seven year period of obligation, the maximum allowed under California state labor law.[21] 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."[22]

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 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.

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[20] 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).

[21] 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).

[22] 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.

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.[23]

A fundamental change in the studio contract occurred when two court decisions reduced the returns to investment in talent revelation. The California Supreme Court's *De Havilland v. Warner Bros. Pictures* 67 Cal. App. 2d 225a (1944) opinion banned the practice of adding non-work time to the contractual period of obligation; from then on, seven years would be seven calendar years.[24] The U.S. Supreme Court's *U.S. v. Paramount Pictures, Inc.*, 334 U.S. 131 (1948) decision forced the divestiture of studios' exhibition arms.[25] After *de Havilland*, stars could capture a larger share of their incremental value to the motion pictures in which they appeared, lessening the studios'

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[23] 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."

[24] 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.

[25] The decision also banned a variety of contractual exhibition practices, including the block booking of films, and the system of runs, clearances, and zonings by which films had been distributed. Although the decision was handed down in 1948, the original antitrust claim dated to 1938, and by the mid-1940s, studios had already been enjoined from expanding their theater holdings, and from engaging in practices such as block booking. See, e.g., Hanssen (2000; 2010).

incentives to discover and develop new talent.[26] Post-*Paramount* , the Big Five studios had to

negotiate exhibition contracts at arm's length with the newly independent theaters, who could

thereby expropriate a share of the studios' returns on new stars. 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.[27]

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:[28]

> 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, 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).

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[26] 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.

[27] 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."

[28] The new contract increased weekly payments by thousands of dollars and eliminated the cancellation option.

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.

IV.   MODELING INVESTMENT IN TALENT REVELATION

Here we sketch a model, for which we provide much more detail, generality and proof of results in the Appendix. In our empirical work, we parse film roles into three broad types. In ascending order of difficulty, these are: uncredited ($r = 1$), credited non-lead ($r = 2$) and lead roles ($r = 3$). We posit actors to be 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 will fail with certainty in any higher-ranked, more difficult role. A successful performance in any role adds to a film's expected profit, and the more prominent the role, the greater the contribution.

If the producer were perfectly informed of the talent of each actor under contract, she would cast the most talented actors in the most prominent roles. At the outset, however, the producer knows only the distribution of actor types. Let p_a be the proportion of type a in the population of prospective actors. A novice drawn at random may be of any type. The likelihood that such an

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actor is at least type 1 is simply $u_1(0) = 1 - p_0$, which we refer to as the actor's "upside potential" in uncredited roles ($r = 1$). The notation $u_1(0)$ refers to a novice actor who has just been cast in an uncredited role but has yet performed it, so has zero failed performances in uncredited roles.

The outcome of a performance is observable to the producer, yielding information on the actor's type. A first successful performance in role r reveals an actor to be type $a \geq r$. Thus upon a first successful performance in an uncredited role, the actor is revealed to be at least type 1. Such an actor's upside potential thereafter in a credited non-lead role—the likelihood that he is at least type 2—is then $u_2(0) = \frac{p_2+p_3}{p_1+p_2+p_3}$. Finally, upon a first successful performance in a credited non-lead role, the actor is revealed to be at least type 2, and is type 3 with probability $u_3(0) = \frac{p_3}{p_2+p_3}$. We sometimes refer to type 3 actors, capable of carrying a lead role, as "stars."[29]

We show in the Appendix that a producer's optimal casting strategy implies a career ladder for actors under long term contract, who begin in lesser roles and upon successful performance advance to more prominent roles. We expect actors typically to begin in uncredited roles, advancing upon successful performance to credited non-lead roles and then to lead 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.

Casting in role r an actor whose lowest possible type is type $r - 1$ (having had a previous success in role $r - 1$, but no success in any higher-ranked role) represents an experiment in talent

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[29] Not to be confused with lead actors who have appeared on the list of "Top Ten Moneymaking Stars" in Quigley's exhibitor poll. Some capable lead actors who were arguably stars never appeared on this list.

discovery. If the experiment fails—if the actor's performance is unsuccessful—the producer has two relevant options: to give the actor another chance in role r, or to relegate him to potentially playing in role $r - 1$ thereafter (or drop him entirely, for $r = 1$). The producer's optimal casting rule is to stop experimenting with a given actor in a given type of role at the point where the cost of the experiment exceeds the expected benefit of discovering talent through a successful performance.

The (constant) cost of a casting experiment in role r is the foregone opportunity to cast an actor whose type is known to be $a \geq r$, whose expected contribution to the film's box office revenue is therefore greater. As an actor's uninterrupted string n of failed performances in role r without a first success lengthens, the actor's likelihood of being type $a \geq r$ declines, as does the value to further experimentation. In the Appendix we show that, by Bayes's Rule, an actor with a string of n failed performances without a first success in role r is at least type r with probability

$$u_r(n) = \frac{(1 - \theta)\, u_r(n - 1)}{1 - u_r(n - 1)}.$$

This equation implies $u_r(n - 1) > u_r(n)$. Applying the equation recursively, $u_r(n)$ can be expressed in terms of θ and $u_r(0)$ alone.

Our main theoretical result is that the optimal stopping rule $n_r^*(m_r)$—which denotes the longest string of failed performances in role r without a first success such that the producer is still willing to cast the actor in yet another such role—tends to increase with m_r, the number of periods remaining in the contract as of the actor's advancement to role r (via a first successful performance in $r - 1$). The greater the remaining term of the contract, the longer the time horizon over which the producer could exploit the value of the revealed talent. Further, the remaining contract length m_r at the outset of each role category r (a random variable) tends to increase with the overall length of the contract M.

Thus a producer has an incentive to invest in talent discovery by experimenting with casting an actor of unknown talent who has been signed to a sufficiently long term contract. The longer the contract, the greater the producer's investment incentive. In particular, under a broad set of circumstances $n_r^*(m_r) \geq 1$ for $m_r > 1$: a producer may be willing to give an actor under long term contract a second chance (or third, or fourth, etc.) after a failed performance in role r. In contrast, under spot contracting (i.e., $m_r = 1$), $n_r^*(1) = 0$. Recall that $u_r(0) > u_r(1)$. All else equal, a novice with no experience in role r has higher upside potential in the role than an actor who has been cast once and failed. Under spot contracting, then, given a large pool of available novices, a producer is better off taking another draw from the urn than giving an actor with a single failed performance a second chance.

We do not formally model a producer's decision of when to sign an actor to a long term contract, but note that during the studio era many novices were cast in small roles on a spot basis. Some of these actors were subsequently signed to long term studio contracts.[30] There are good reasons why a studio might choose not to immediately sign an acting prospect.[31] Whatever the reasons, our model implies that if career-long contracts are feasible yet some actors are cast on a spot basis, the spot actors will tend to be the least experienced, about whose talent the least is known, playing the smallest roles. As already discussed, this pattern is borne out by IMDB filmographies.

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[30] Humphrey Bogart's work for Warner Bros., prior to his signing of a long term contract with the studio in 1935, included a short film as well as one uncredited role and one small credited role in feature films. During this pre-contract period, Bogart also played several small roles in films produced by Paramount, Universal, Fox and Columbia.
[31] A studio may not have been willing to bear the costs of a long term contract before the actor had proven himself to some small extent. Though studio contracts were largely boilerplate, negotiation was not uncommon. Cross-outs and handwritten marginalia in Bogart's 1935 contract with Warner Bros. indicate several points of presumably costly negotiation. Further, actors typically undertook training regimens at studio expense upon entering a contract.

Our model also implies that, during the studio era, producers tended to have longer stopping rules when casting contract players than when casting actors not signed to long term contract. We cannot observe these stopping rules directly, but their lengths are correlated with the realized 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, $n_1^* = 0$. Upon contract signing, the stopping rule for credited non-lead roles is positive, $n_2^*(m_2) > 0$, if the remaining contract term m_2 is sufficiently long and the periodic discounting δ is not too steep. The same holds true for lead roles ($r = 3$). In this case we would predict higher churn among non-contract actors performing in uncredited roles than among contract actors playing larger roles.

We take the number of roles an actor plays in a year as a proxy for the intensity of investment in talent discovery (length of stopping rules). Our main hypothesis is that long term contracting is associated with more roles per year, all else equal.

V. EMPIRICAL ANALYSIS

A. The Data Set

It is widely agreed that the most important form of investment in talent revelation is the casting of would-be stars in film roles.[32] 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

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[32] 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).

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. [33]

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 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 during the studio era relative to later. If, by contrast, the actor's knowledge of herself renders her the superior identifier of appropriate roles, our measure may overestimate true investment during the studio era relative to later. 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.

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[33] 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 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.[34] 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 (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).[35] 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.

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[34]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 when we compare the studio era to the subsequent period.

[35] 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).

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, roughly 2000 different actors were under studio contract at some point between 1932 and 1942.[36] The average actor listed was under contract for 2.5 of the 11 possible years, with some actors never appearing in a credited role (and being dropped by the studio in short order), while others appeared in credited roles in (and remained under studio contract for) 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 over the last two decades, driven by video and digital technologies that have reduced enormously the cost of both production and distribution. The change in studio contracts in the mid-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 – that is to say, through the studio era – the average credited actor played nearly three credited roles per year. That number then fell by more than half between the

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[36] Some of the actors listed by the IMPA did not appear in a film role during our sample period (a few retired, and few died, and a few simply did not pan out), so that the number we are able to use in our analysis is less than the total listed by about 300. See what follows. In addition, some actors are listed as being under contract to more than one studio in a given year. This can be because either 1) an actor dropped by one studio was signed by another, or 2) an actor was loaned to another studio temporarily (contracts gave studios the right to do this, as noted above). When this occurs, we use other sources (especially Shipman 1979, 1980) to pin down the studio affiliation.

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. Comparison: Studio Era versus Subsequent Period

Career trajectory

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.[37] 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 contact) 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 subsequent period are 52 percent and 20 percent. Because many things may have changed between 1943 and 2011, in the third column we restrict our sample to the roughly 5000 actors in our data set born in the 1930s – actors who would have begun their careers shortly after the studio era ended, and would have (for the most part) finished their careers by the end of our data set in 2011, when even the youngest among them would have been over 70 years old.[38] The result is very similar to that for the entire set of post-studio actors, shown in the second column: 57 percent and 27 percent. It appears that careers indeed unspooled differently during the studio era, consistent with the model's predictions.

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[37] 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.

[38] Fleck and Hanssen (2014) document that few actors either achieve much success before the age of 20 or play many roles beyond the age of 50 or so.

Career 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.[39] Table 2 compares the number of credited roles played over an actor's career for three similar sets of actors: 1) those who played at least one credited role between the start of 1932 and the end of 1942 (the period for which we have contract data), 2) those who played at least one credited role subsequently, and 3) those who played at least one credited role subsequently *and* were born in the 1930s. The average studio era actor played 20 roles over his/her career, while the average subsequent-era actor, total or born in the 1950s, played only four-to-seven roles over his/her career, a very large difference.[40]

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.[41] Our challenge is to define "major movie star" in a manner that allows for a common comparison over time (and there is no data on box office revenue that spans the sample period). 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.[42] A version of the following question was/is asked: "Please list the ten players whose pictures drew

[39] Our results are qualitatively similar if we include uncredited roles, as well, but the effect is driven by credited roles.
[40] If an actor began a career too long after the studio era ended, that career might still have been underway in 2011 (when our data set ends), and the average underestimated accordingly. For that reason, the sample of actors born in the 1950s may be more suitable.
[41] By how much "star power" can propel a film has been debated; see, e.g., De Vany and Walls (1996), Elberse (2007).
[42] 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*.

the greatest number of patrons to your theater over the last twelve months."[43] Votes are tallied, and the actors are ranked according to number of votes received (order of ranking by individual exhibitors is disregarded).[44] 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.[45]

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.

In short, the studio era, characterized by long term contracts, is associated with substantially more roles played than the subsequent period, characterized by film-by-film contracts, as PRT (and this paper's model) would predict.

C. Comparison: Within the Studio Era

We turn now to the effect of contracts within the studio era. We will compare credited roles played by actors under long term contract to credited roles played by actors not under long term contract.[46] We have information on who was under contract by year from 1932 through 1942, and thus will focus on that eleven year period. Each observation will be an actor-year (i.e., actor i in year t) and we will analyze roles played per year. We also have information on each actor's gender, and, for roughly 85 percent of the actors, birth date, so that age can be determined.[47]

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[43] The quotation is from the December 28, 1935 *Motion Picture Herald*, page 13.
[44] The publication notes that some exhibitors attempt to rank in order, but most do not.
[45] 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.
[46] Recall that supporting roles were often played by actors under contract for the single picture only (or were even contracted for by the week if the roles were small enough).
[47] The reader may be concerned that the careers of non-contract actors are less well-documented than those of contract actors, so that the former are more likely to have roles missing from the IMDB, which would bias our results

We begin by merging our information on studio contracts from the IMPA with movie data from the IMDB. Our goal is to measure the effect of studio contracts on aspiring actors. We define our sample of "aspiring actors" based on two criteria: 1) an actor played at least one credited role between 1932 and 1942, and 2) an actor played at least three credited roles over the course of a career (in order to focus on "professional" actors, as we noted above). This gives us data on 1660 actors who signed a studio contract between 1932 and 1942 inclusive (i.e., are listed as having done so by IMPA), and on 5768 actors who did not sign a studio contract (i.e., are not listed by IMPA).[48] Consistent with the model's prediction, the average actor listed as having signed a contract played 36 roles over his/her career, versus only 13 roles for the average actor who is not listed as having signed a contract.

Table 3 provides descriptive statistics. The average actor in our data set played 0.9 credited roles per year in feature films from 1932 through 1942. Twenty-two percent of observations pertain to actors under contract to a studio at some point during the eleven year period (*contract ever*), and five percent of observations pertain to actors under contract the year the roles were played (*contract year*). Male actors make up two-thirds of the observations, and the average actor in the sample is 38 years old.

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accordingly. We should point out that a number of well-known supporting actors did not work under studio contract (i.e., just because an actor was not under contract did not mean he/she was obscure), and, correspondingly, a number of contract actors are largely forgotten today (e.g., Elsie Ames, Edward Crandall). However, at various points, we will restrict our analysis to actors whose birth dates are known, which will serve to eliminate the most obscure actors from the analysis. As will be seen, results are largely unaffected. We will also conduct an additional analysis using only major movie stars.

[48] 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 7428 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.

The bottom half of Table 3 compares mean roles per year for those under contract to those not under contract. Actors who signed studio contracts at some point (*contract ever*) were cast in 1.8 roles annually, versus 0.6 roles for actors who never signed a studio contract. Actors under contract the same year the roles were played (*contract year*) were cast in 3.7 roles annually, versus 0.7 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 nearly 4 roles per year in years under contract versus 1.2 roles per year in years not under contract. All the differences are statistically significant at well under one percent.

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.[49] We will therefore estimate the following equation:

1) $roles_{it} = \alpha + \varrho Contract_{it} + X'_{it}\beta + \lambda_t + v_{it}$

where *roles*$_{it}$ is the number of roles played by actor *i* in year *t*, *Contract*$_{it}$ is our variable of interest, X_{it} is a vector of actor-specific age and gender controls, λ_t are year effects, and v_{it} is a composite error term: $v_{it} = \mu_i + \varepsilon_{it}$, where μ_i is an actor-specific error term (common across years) and ε_{it} is a mean 0 error term.[50] We will account for the actor-specific error term by clustering at the actor level. The coefficient ϱ is our parameter of interest.

We measure *Contract*$_{it}$ in two ways. *Contract ever*$_i$ is a dichotomous variable that takes on the value 1 if actor *i* was under a studio contract in any year between 1932 and 1942, and 0 otherwise.

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[49] 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-mid 40s, and declines slowly thereafter.

[50] Roles are, of course, a count. Estimating a negative binomial model produces qualitatively similar results (available upon request).

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 inclusion of age-based controls reduces the number of actors in the panel from 7428 to 6214, because of missing birth years). The coefficients on both contract measures (*contract ever$_i$* and *contract year$_{it}$*) are statistically significant and of large magnitudes: Ever signing a studio contract is associated with 1.4 more roles per year (60 percent more than the unconditional mean value), while being under contract in a given year is associated with nearly 3.0 more roles per year (more than three times the unconditional mean value).

Setting *roles$_{it}$* equal to 0 for any year in which an actor in our sample does not play a credited role 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. 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. 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 (reducing our sample to 5807 actors). We will also estimate a zero-inflated negative binomial model, using the absolute value of deviation from mean age (calculated separately for males and female) as our inflation factor.[51]

The result is shown in columns 3 through 6 of Table 4. Restricting the sample to actors ages 20 through 69 reduces the coefficient on *contract ever$_i$* slightly while increasing the coefficient on *contract year$_{it}$* even more slightly. The zero-inflated coefficient estimates (marginal effects

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[51] The negative binomial model takes into account the fact that the data are counts, and the zero-inflated aspect takes into account that we cannot tell a failure to secure a role despite trying (a "true" 0) from a failure to look for a role at all.

shown) are of roughly the same magnitude as in the OLS estimate (in fact, the coefficient on

contract year$_{it}$ is ten percent larger).

Unobservable talent

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:

2) $roles_{it} = \alpha + \rho Contract_{it} + X'_{it}\beta + \lambda_t + talent_i'\gamma + \varepsilon_{it}$

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 begin by treating 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. When we do this (estimation not shown), we find most of the effect is

concentrated in the years actually under contract" the coefficient estimate on *contract ever$_i$* is 0.7

(standard error = .05) while the coefficient on *contract year$_{it}$* is 2.4 (standard error = .07). This is

again consistent with the model's prediction.

We will take this approach a step further by including 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 influence of a studio contract is constant over time and additive,

including actor effects allows us to measure the unbiased influence of studio contracts. We will

therefore estimate the following equation:

3) $roles_{it} = \alpha_i + \rho Contract_{it} + X'_{it}\beta + \lambda_t + \varepsilon_{it},$

where $\alpha_i \equiv \alpha + A_i'i\gamma$, with A_i the individual actor effects. The coefficient ρ is identified by the

change in annual roles that follow the signing of a studio contract.

Table 5 shows the result, with and without age and gender controls. 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. The third column in Table 5 shows the result of again limiting the panel to actors of ages 20 through 69. The point estimates on the contract variable are of essentially the same magnitude and significance level as those in the other two estimations.

D. Further Isolating the Talent Revelation Effect

Both comparisons over time and comparisons within the studio era provide strong evidence that actors under long term contract were cast in substantially more roles than actors not under long term contract. Nonetheless, the reader may question whether it is correct to attribute the difference solely to investment in talent revelation. For example, actors under contract may have been cheaper to negotiate with (an important consideration for studios churning out 40-50 films per year), or perhaps talent changed over time in a way that the fixed effects do not adequately capture.[52]

In this sub-section, we seek to isolate the talent revelation effect of studio contracts by exploiting 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 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

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[52] Actors were only paid while they were working on films, so they were not less costly to use per se. 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. 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."

objectives and other things (e.g., lower negotiation costs), once an actor's talent is fully revealed, only the other things 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 this, we again make use of the "Top Ten moneymaking actors" poll data, taking the year in which an actor is first named to the Top Ten as the time when his/her 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—so that any "before-after" differences may underestimate the true investment in talent revelation.[53]

A cost of this test is that it reduces the set of actors substantially. We begin with the 74 Top Ten actors who were signed to studio contracts at some point between 1932 and 1942. For each of these actors, we calculate the average roles played annually in the years preceding his/her first appearance on the Top Ten list, and the number of roles played annually in the years following (beginning with the first Top Ten year).

Table 6 shows the result. The first two columns include all credited roles played by the 74 studio contract 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 played 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

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[53] 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.

equivalent in magnitude to the effect of long term contracts estimated in our previous tests.

Of course, it is possible that other things change, too, when an actor is named a Top Ten star; also, roles may peter out at the end of an actor's career (though many stars stop working abruptly). 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.[54] The result 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 post-Top Ten change at all. Figure 3 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, as the talent revelation story formalized in our model would predict.[55]

E. More Evidence of Experimentation

Total roles played on way to Top Ten

If studios were indeed investing to reveal actor talent, one might expect studio-era Top Ten stars to have played more roles *in total* on their way to the Top Ten than stars in subsequent periods. To examine whether this was so, we will again compare the 75 Top Ten actors who were under studio contract between 1932 and 1942 to the 22 Top Ten actors who were born in the 1930s (too

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[54] One can think of this as a crude differences-in-differences analysis: $(roles_{st}^{pre\ Top\ Ten} - roles_{pt}^{pre\ Top\ Ten}) - (roles_{st}^{post\ Top\ Ten} - roles_{pt}^{post\ Top\ Ten})$, where $roles_{st}$ is the number of roles played by studio-era actor s in year t, and $roles_{pt}$ is the number of roles played by post-studio era actor p in year t.

[55] The fact that independent producers like Samuel Goldwyn signed actors to long-term contract despite making only a handful of films per year is also consistent with the talent revelation story.

late for studio contracts). We will also look at the subset of 33 studio-era actors who made the Top

Ten for the first time between 1932 and 1942 (our studio era sample period).[56]

The result is shown at the bottom of Table 6. During the studio era, actors played a total of 31

roles on average before making the Top Ten for the first time (22 roles for those who made their

first Top Ten between 1932 and 1942). By contrast, actors born in the 1930s played only 9.5 roles

on average before making the Top Ten for the first time. The differences across eras are statistically

significant at better than five percent, providing further evidence of experimentation.

Genres played in

In our empirical analysis, we have treated all roles as the same, for the simple reason that

measuring role type is virtually impossible given all the ways in which film roles may differ. That

said, an experimenting studio might be expected to try a variety of different types of roles in order

to see what fits an actor best. Since we cannot measure variety of role types, we will look at variety

of film genres. We should note that using genre as a measure of experimentation is not ideal.

First, it is, at best, a crude measure of role variety – roles differ in a multitude of ways even within

genres (e.g., hero, villain, best friend, comic relief). Furthermore, the assignment of genre

classifications involves a large element of subjective judgment.[57] Finally, IMDB (our source)

assigns films to multiple genre categories. How should one compare, and can one compare across

actors? Caveats aside, variety of genre classifications is the best proxy for role variety we have.

We shall sidestep some of these issues by restricting our analysis to a single actor, Humphrey

Bogart. As discussed in Section III, we have the complete set of Humphrey Bogart's contracts with

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[56] Some studio era actors (e.g., Wallace Beery, Joan Crawford, Norma Shearer) made the Top Ten list before 1932, while others (Humphrey Bogart, James Stewart, John Wayne) made it after 1942.

[57] For example, IMDB gives the classic film *Casablanca*, starring Humphrey Bogart and Ingrid Bergman, the genre classification "Drama, Romance, War", while the virtually identically plotted *To Have and Have Not*, starring Humphrey Bogart and Lauren Bacall, is classified "Adventure, Comedy, Romance."

Warner Brothers (WB), the studio that made him a star. Bogart played his first credited role in a feature film in 1930. He was briefly under contract to Fox in 1931, but was summarily dropped when his option period ended. In late 1935, he signed his first contract with WB. He signed a second WB contract in early 1942, after *High Sierra* and *The Maltese Falcon*, both released in 1941, had made him a star.[58]

We compare the number of film genres in which Bogart acted while under his first contract (his "talent revelation" period) to the number in which he acted while under his second contract (his "established star" period). The reluctance of studios to use established stars outside of established role-types is well-known, and was the source of many a battle between star and studio. If more experimentation was going on during Bogart's first contract period (as we argue), we should see Bogart cast in films encompassing a greater variety of genres during his first contract period than during his second contract period.

Because the IMDB lists multiple genres for most films, we will simply count the number of times each genre is listed.[59] The top of Figure 4 presents the results for Humphrey Bogart; at the bottom is a summary of genres for all feature films released by five year intervals over the same period.[60] Over the course of the six years that his first contract ran, Bogart played 32 roles in total (5.3 roles per year), while over the course of the five years his second contract ran, Bogart played only ten roles in total (2 per year), the difference predicted by our model. Bogart appeared in films falling in 16 different genre classifications (out of IMDB's possible 20; see bottom chart) while

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[58] This was one year before he was named to the Top Ten for the first time, suggesting the appropriateness of "time to first Top Ten" as a measure of the talent revelation period. For most actors, we do not have dates for first contact, second contract, etc., but simply whether or not an actor was under contract, the year, and the company.

[59] That is to say, a "crime, drama, film-noir" movie (*The Maltese Falcon*) plus a "drama, romance, war" movie (*Casablanca*) will result in six total genre entries: 2 drama's, 1 crime, 1 film-noir, 1 romance, and 1 war. We considered other methods (e.g., weighing each by the proportion of the film represented), but found that none made much difference.

[60] The top chart is calculated on a per role basis, while the bottom chart is calculated on a per film basis (by five year intervals, adding the years 1935, 1940, and 1945).

under his first contract, versus in only 10 different genre classifications while under his second contract (i.e., once he was a known star).[61] During his first contract period, he was tried twice in westerns, twice in sports films, twice in history films, twice in music films, once in a horror film, and once in a sci-fi film. He was not cast in any of those genres during his second contract period (thank goodness!). Whether Bogart would have played in more genres had his second contract not been brought to a close by the end of the studio era is impossible to say, but we do note that he played in another 22 films over the following ten years (until dying of cancer in early 1957), and yet added only two genre categories to his 1942-6 total.[62]

In short, Warner Brothers cast Bogart in films encompassing a greater variety of genres when he was under his first contract than when he was under his second contract. This is consistent with the notion that WB initially experimented in Bogart's casting, and that the experimentation diminished once Bogart's talent was fully revealed. Interestingly, Bogart owed his success in large part to fellow WB contract actor George Raft's wish to escape "typecasting" as a gangster.   In an incredible run of stupidity that effectively ended his career, Raft turned down the lead roles in *High Sierra* and *The Maltese Falcon*, giving Bogart the opportunity he needed to demonstrate that he could be a major star.[63]

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[61] The IMDB genre categories that Bogart missed are biographies, family, fantasy, and musicals. The average Bogart film during the first contract period was assigned 2.7 genre categories, versus 3.0 during his second contract period.

[62] During this last period, Bogart was largely a free agent (his third WB contract obliged him to star in one WB film per year – to be agreed upon jointly – while leaving him the right to make films outside WB the rest of the time).   If Bogart received utility from playing challenging roles (as many actors profess to), he might be expected to choose roles differently than the presumably profit-maximizing WB studio. In fact, Bogart acted in more film genres during his post-studio period than during his second contract period, but not as many as during his first contract period – 12 genre categories in total (and only two that he had not acted in when under his second contract).

[63] See, e.g., Shipman (1979). Raft's contract allowed him to decline roles in re-makes. Paul Muni also declined to play the lead in *High Sierra* (and left WB shortly thereafter) before the role was finally offered to Bogart. See http://bogart-tribute.net/fan/byrne3.shtml.

VI.   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 in developing skills than they would have otherwise? We do not have a measure of actor investment equivalent to our 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 actors presumably enjoy acting, and (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 weaker incentives provided by studio contracts.

First, it is well-recognized that studios spent abundantly to develop the general human capital of actors under contract.[64] The willingness of studios to undertake such investment is understandable given the long term contracts, but perhaps more surprising is that they actually *paid* actors to accept this training – to take lessons in acting, singing, and so forth.[65] It is difficult

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[64] 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. . . Lillian 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.

[65] 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 (see, e.g., Basinger 2003, 59). For example, when Arnold Moss played a soldier in Columbia's *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).

to conceive of any rationale to explain this other than weakened investment incentives – actors today spend substantial funds to be trained in those same skills.

Second, as noted above, studio contracts specified aspects of comportment—acceptable behavior *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.[66] While bad behavior by an actor may have had an effect on the reputation of the studio, the mandate is certainly consistent with an attempt to overcome an excessive lack of care by actors in their own careers

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.

VII.   WHAT FOLLOWED? SHARE CONTRACTING, MULTI-PICTURE DEALS, AND THE RISE OF THE INTEGRATED TALENT AGENCY

In the wake of the studio contract system's collapse, relations between film producers and actors changed in several ways. Major movie stars were increasingly employed under share

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[66] Davis (1993, 109) writes, "Studio executives not only dictated the roles their actors played, they tried to control their social lives as well."

contracts, receiving a portion of the box office receipts in return for appearing in films. Multi picture deals between actors and film producers became more common. Hollywood talent agencies took on a more expansive role in directing actor careers. In this section, we discuss how each of these changes may have affected investment in talent revelation.

In the late 1940s and 1950s, established stars coming off their long term contracts with the studios began to negotiate share contracts – deals in which actors received "points" in a picture's gross or net box office receipts. Such contracts remain common today. Weinstein (1998) suggest that the expansion in the use of share contracts was due to a combination of a desire to share risk and the increasing importance of concerns raised by asymmetric information.

Although stars had lived opulently enough in the studio era, with its end their earnings skyrocketed, through both points and huge up-front fees. Ravid (1999) concludes that share contracts allow stars in the modern era to appropriate their expected economic rents, fully capturing the incremental value they bring to a film project. This suggests that there might no longer be much scope for profitable investment in talent discovery by film producers, consistent with the decline in casting we have documented.

Multi-picture deals also became more common.[67] Some were with established stars (such as Humphrey Bogart), but many involved novices. Sean Connery had few film credits to his name when he signed a five-picture deal with independent producers Broccoli and Saltzman to play James Bond. He emerged a star. Arnold Schwarzenegger was a complete novice when Dino De Laurentiis signed him to a six-picture deal that included the *Conan the Barbarian* franchise and *Terminator*. He too emerged a star. Likewise Natalie Portman, who would later win an Academy Award for Best Actress, had her start in a three-picture deal to perform in the *Star Wars* prequels.

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[67] The origins of multi-picture deals pre-date the studio era, however. By 1918, First National had signed the two greatest actors of the day—Charlie Chaplin and Mary Pickford—to multi-picture deals.

Perhaps the most active in signing novices to multi-picture deals have been Marvel Comics and DC Comics, in launching their numerous and proliferating franchise properties onscreen. [68]

It would be tempting to conclude that the multi-picture deal has replicated the studio contract system in miniature, providing producers with some incentives to experiment with casting to discover acting talent. The problem with this interpretation is that it appears likely, in the terminology of our model, that $n_L^*(M) = 0$ for these multi-picture deals. If the first film in a projected series fails at the box office, the novice actor in the lead role is not likely to get a second shot at stardom. It is a truism of the industry that only successful films breed sequels. Had *Dr. No*, the first Bond film, flopped at the box office, the theater-going public likely would never have heard of Bond or Connery again.[69]

Finally, the talent agency changed in the post-studio era. Hollywood agents have a long history.[70] 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.[71] 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."

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[68] A Wall Street Journal article of April 24, 2015 describes how Marvel Studios has made a practice of casting unknown (or down on their luck) actors in superhero roles for relatively low paychecks, trading in return the prospect that the movies will turn the actors into major stars. The article begins with the lines, "On screen, they're Earth's mightiest heroes. But in Hollywood, they were has-beens and never-weres. That is, until Marvel got a hold of them." See http://www.wsj.com/articles/avengers-age-of-ultron-kicks-off-the-summer-1429801731.

[69] The more likely function of the multi-picture deal is to ensure that the owner of a popular literary property that is being translated to the screen will be able to appropriate its full value. If contracting were instead on a spot basis, the actor who has come to be associated with the film character in the public's mind could wield tremendous holdup potential. As a small child, Daniel Radcliffe was signed to a mere two-picture deal to play the lead role in *Harry Potter*. Perhaps with the benefit of hindsight, the narrow span of the contract seems astoundingly myopic.

[70] 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.

[71] For examples, see Rose (1995, 65, 75, 103).

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.[72] Attempts to package film stars (and writers, directors, and so forth) followed, as agencies aggressively touted the use of "their" actors.[73] 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.[74] MCA dissolved its talent agency, which

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[72] 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).

[73] 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."

[74] See Bruck (2003, 179ff). MCA acquired the film producer through merger with Decca Records, which controlled 89 percent of Universal.

was reconstituted as 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.

VIII. 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 actors under long term contract played substantially more roles than did actors not under contract—and playing roles was (and is) the most important form of investment in talent revelation.

A striking parallel to the old Hollywood studio contract can be found in Major League Baseball's (MLB) reserve clause.[75] From the late 19ᵗʰ century into the 1970s, annual MLB

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[75] Although the baseball reserve clause is the most extensively studied, many professional sports (e.g., basketball, football, hockey) also employed the reserve clause in player contracts, and most sports continue to employ practices (such as drafts) that have reserve clause-like characteristics. See, e.g., Siegfried (1995) for a discussion.

contracts specified that long term rights to a given player were retained by the team, so that the player could not enter into an agreement with another team at the season's end, even though his contract had officially "expired".[76] Thus, as in the movie business, the employee was tied to the employer indefinitely, while the employer had the option to terminate the relationship at specified (annual, semi-annual) intervals. Researchers have conducted many studies of the effect of the reserve clause (principally on player salary, player mobility, and competitive balance), but to the best of our knowledge, none have examined "talent revelation" in the sense we explore it for actors.[77] Our model would predict less such investment in MLB players today than in the era of the reserve clause. The hierarchical system of minor league teams played a significant role in the evaluation and development of ballplayers for major league team rosters, analogous to the career ladder of film roles studios used in the 1930s-40s. Consistent with the results of this paper, Hanssen et al (forthcoming) find that the number of minor league teams owned by MLB franchises fell in the decades following the abolition of the reserve clause.

The key point we emphasize in this paper 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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[76] Thus, the player was "reserved" by the team. See Eckard (2001) for a study of the origin of the reserve clause. Arbitration and litigation led to the end of the reserve clause and "free agency" in the mid-1970s. See Fort and Quirk (1992) for additional discussion and analysis.

[77] Investing in talent revelation is different than investing in skills ("training"). Much of investment in skills should be contractible – for example, studios paid actors to take acting lessons during the studio era; actors paid for those lessons subsequently. By contrast, a player's "charisma", "leadership", "fit with teammates", "unselfishness", "ability in the clutch", "appeal to fans", and so forth are likely to be revealed only over time and at the cost of placing another player on the roster and in the field in particular situations.

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APPENDIX: A Detailed Model

A. Film Roles, Actor Types and Upside Potential

There are L categories of film role, $r = 1, 2, \ldots, L$, 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

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

where $0 < \alpha_1 < \alpha_2 < \cdots < \alpha_L$ and ω_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, $a = 0, 1, \ldots, L$. An actor of type a can successfully perform any role $r \leq a$ with probability $\theta \in (0,1)$, but will fail with certainty in any higher role. Thus type 0 actors fail in all roles, while type L actors, or *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 $r' < r$, 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

$$u_r(0, r') = \sum_{a=r}^{L} p_a \Bigg/ \sum_{a=r'}^{L} p_a, \qquad (2)$$

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 $u_r(0, r')$ 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), $u_r(0, r') > u_r(0, r'')$ 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 $u_r(0, r - 1) > u_r(0, r')$.

Results 1 and 2 together imply 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 $u_r(0)$ 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:

$$u_r(0) = \sum_{a=r}^{L} p_a \Bigg/ \sum_{a=r-1}^{L} p_a \,, \tag{3}$$

for $1 < r < L$. More generally, let $u_r(n)$ 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 $n = 1$,

$$u_r(1) \equiv Prob(r|f) = \frac{Prob(f|r) \times Prob(r)}{Prob(f)} \,,$$

where $Prob(r|f)$ is the probability the actor's type is $a \geq r$ conditional on having a single failed performance in r. Given $Prob(f|r) = 1 - \theta$, $Prob(r) = u_r(0)$ and $Prob(f) = 1 - \theta u_r(0)$, we have

$$u_r(1) = \frac{(1 - \theta)\, u_r(0)}{1 - \theta\, u_r(0)}$$

and for $n \geq 1$,

$$u_r(n) = \frac{(1 - \theta)\, u_r(n - 1)}{1 - \theta\, u_r(n - 1)} \,. \tag{4}$$

Applying equation (5) recursively, $u_r(n)$ can be derived in terms of θ and $u_r(0)$ alone.

Result 3 (*declining upside potential*). By equation (5), $u_r(n - 1) > u_r(n)$. Thus an actor's upside potential $u_r(n)$ within role r declines as n, his string of failed performances without a first success in the role, lengthens.

B. Optimal Stopping: Scarcity of Lesser Roles and Qualified Prospects

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 with his first success in role $r - 1$. We measure time in "movie equivalent units." A period represents the time it takes to produce a movie. The longer the remaining contract term m_r, the greater the producer's expected return to investing in talent discovery.

The continuation value $V_r(n, m_r)$ can be unpacked as follows:

First, we assume the number of instances of a lesser role $r < L$ available in films currently under production by the studio is scarce, in that experimenting with casting a *qualified prospect* for role r (i.e., an actor whose highest success is in role $r - 1$) requires displacing an actor who has had success in role r, whose type is thus known to be at least r.

Second, we assume the number of qualified prospects is scarce, in that there are enough instances of role r in films the producer has under production to accommodate experimentation with every qualified prospect for role r up to the optimal stopping point (derived below).

Together, these two assumptions imply that the opportunity cost of an experiment in casting a qualified prospect in role r is $-\theta\alpha_r$. This is the expected value of the foregone opportunity to cast in role r an actor known to be of type $a \geq r$, whose performance would yield α_r in incremental box office revenue with probability θ. This opportunity cost must be subtracted from expected gains when calculating the continuation value of a qualified prospect.

If the producer were to cast in role r an actor with a string of n failed performances without a first success in role r, the actor's next performance in r would be a success with probability $u_r(n)\theta$. In case of success, the actor's contribution to the film's box office would be α_r and the actor would thereafter advance to the next rung up the career ladder, yielding a continuation value $V_{r+1}(0, m_r - n - 1)$ in role $r + 1$ the following period. With probability $1 - u_r(n)\theta_r$, the actor's performance in role r would once again fail, yielding a continuation value of $V_r(n + 1, m_r)$ the following period.

From all of the foregoing, an actor's continuation value $V_r(n, m_r)$ in a lesser role $r < L$ can be written as

$$V_r(n, m_r) = \; u_r(n)\theta \; [\alpha_r + \delta \, V_{r+1}(0, m_r - n - 1)] - \theta\alpha_r \qquad (5)$$
$$+ \, (1 - u_r(n)\theta) \, \delta \, \{V_r(n + 1, m_r)\}^+,$$

where δ is a one-period discount factor and, to reduce notational clutter, $\{x\}^+ \equiv \max\{0, x\}$. (Casting the actor yet again after another failure has option value $\{V_r(n + 1, m_r)\}^+$; the option would not be exercised if $V_r(n + 1, m_r) < 0$.) Note that in case the performance is a success and the actor advances to role $r + 1$, $m_{r+1} = m_r - n - 1$. Equation (6), can be rewritten as

$$V_r(n, m_r) = u_r(n)\theta \, v_r(n, m_r) + (1 - u_r(n)\theta) \, \delta \, \{V_r(n + 1, m_r)\}^+, \qquad (6)$$

where

$$v_r(n, m_r) = \delta \, V_{r+1}(0, m_r - n - 1) - \left(\frac{1 - u_r(n)}{u_r(n)}\right)\alpha_r \qquad (7)$$

is the continuation value conditional on a successful performance.

Note that the term $\left(\frac{1-u_r(n)}{u_r(n)}\right)\alpha_r$ in equation (8) is proportional to the expected cost of the casting experiment. This expected cost grows with n as the actor's upside potential declines. Note also that the term $V_r(n + 1, m_r)$ in equation (7) likewise has within it a term $v_r(n + 1, m_r)$.

Result 4 (*declining continuation values*). By equation (5), $u_r(n) > u_r(n + 1)$, and by equation (8) $v_r(n, m_r) > v_r(n + 1, m_r)$. 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.

If the initial continuation value is strictly positive, $V_r(0, m_r) > 0$, the producer will experiment at least once with casting the qualified prospect in role r and will continue experimenting so long as the actor's continuation value $V_r(n, m_r)$ is nonnegative, which is the case so long as $v_r(n, m_r)$ is nonnegative.

Result 5 (*optimal stopping rule*). Let $n_r^*(m_r)$ denote the longest string of failed performances without a first success in role $r(< L)$ such that the producer is still willing to cast the actor in another role r. If $v_r(0, m_r) > 0$, then $V_r(0, m_r) > 0$ and

$$n_r^*(m_r) = \max\{n \in \mathbb{Z} \mid v_r(n, m_r) \geq 0\}. \tag{8}$$

C. Scarcity of Stars and Optimal Stopping in Lead Roles

Finding a star (an actor of type L) is the ultimate goal of the producer's talent search. So far we have assumed that the number of films under production is exogenous to the number of qualified prospects for lesser roles. In contrast, the discovery of a star expands the scope of profitable films: films are developed around—and vehicles for—the stars appearing in the lead roles.

Let R_{-L} refer to a given film's expected revenue, not counting the lead actor's contribution. If there is no experimentation in the film's lesser roles, $R_{-L} = \theta \sum_{r=1}^{L-1} \alpha_r$. If there is experimentation in some lesser roles, the expected revenue contribution of each such role r is factored by the upside potential $u_r(n)$ of the actor performing the role. We assume $\alpha_L \gg \alpha_{L-1}$, so that whatever the extent of experimentation, $C - \theta\alpha_L < R_{-L} < C$, where C is the film's total cost. In words, a film is a flop at the box office without a star in the lead, but with a star in the lead yields positive expected profit.

Paralleling the developments of Section B above, the continuation value $V_L(n, m_L)$ can be written as

$$V_L(n, m_L) = u_L(n)\theta\, v_L(n, m_L) + (1 - u_L(n)\theta)\, \delta\, \{V_L(n + 1, m_L)\}^+, \tag{9}$$

where

$$v_L(n, m_L) = \alpha_L\big(1 + \theta S(m_L - n)\big) - \frac{C - R_{-L}}{u_L(n)\theta} \tag{10}$$

and

$$S(m_L - n) = \begin{cases} 0 & \text{if } m_L - n \leq 1, \\ \sum_{t=1}^{m-n-1} \delta^t & \text{otherwise.} \end{cases} \tag{11}$$

In equation (11), $\theta S(m_L - n)$ is proportional to the expected present value of the stream of future box office revenues flowing from the discovery of a star, whereas $(C - R_{-L})/u_L(n)\theta$ is the expected cost of the experiment. Note that this expected cost grows with n as the actor's upside potential declines. Result 5 also holds for $r = L$, given the definition of $v_L(n, m_L)$ in (11).

The optimal stopping rule in lead roles is then $n_L^*(m_L) = \max\{n \in \mathbb{Z} \mid v_L(n, m_L) \geq 0\}$.

D. Long Term Contracts and Optimal Stopping

Given the primitives θ and $\{u_r(0)\}_{r=1}^L$, the continuation value $V_r(n, m_r)$ can be computed for any nonnegative integer values of n and m_r, and given $V_r(n, m_r)$, the optimal stopping rule $n_r^*(m_r)$ can be derived in the manner described above.

By equations (11) and (12), $v_L(n, m_L)$ increases with m_L. Thus the optimal stopping rule $n_L^*(m_L)$ tends to increase with the remaining contract term m_L. By equation (10) $V_L(n, m_L)$ also increases with m_L and recall from equation (8) that $V_L(0, m_L)$ is a component of $v_{L-1}(n, m_{L-1})$, where $m_L = m_{L-1} - n - 1$. Thus $n_{L-1}^*(m_{L-1})$ likewise tends to increase with m_{L-1} and, generally, $n_r^*(m_r)$ tends to increase with m_r for all lesser roles r.

Let M be the total length of an actor's contract. The remaining contract term m_r immediately after an actor has advanced to role r is a random variable obtained by subtracting from M the realized number of casting experiments the actor has had in advancing up the career ladder to r. All else equal, m_r tends to be greater the greater is M.

The foregoing leads to:

Result 6 (*long term contracting encourages investment in talent discovery*). The greater the length M of an actor's contract, the longer the optimal stopping rule $n_r^*(m_r)$ will tend to be in each role r on the actor's career ladder.

Result 6 is our central theoretical result. Although we cannot observe producers' stopping rules, we can observe the number of roles performed by an actor, which is related to these stopping rules.

The expected number of roles an actor will perform in category r before advancing (or not) to category $r + 1$ can then be computed as follows. The probability that an actor with initial remaining contract term m_r (upon advancing to role r) will have his first successful performance in role r on the nth trial is

$$\varphi_r(n) = u_r(n-1)\theta \prod_{x=1}^{n-1}(1 - u_r(x-1)\theta). \tag{12}$$

The actor's expected number of performances in role r is then

$$\varepsilon_r(m_r) = \left(\sum_{n=1}^{n_r^*(m_r)} n\, \varphi_r(n) \right) + \left(1 - \sum_{n=1}^{n_r^*(m_r)} \varphi_r(n) \right)(n_r^*(m_r) + 1) \tag{13}$$

The first parenthetic term on the RHS of (14) is the actor's expected number of performances through his first $n_r^*(m_r)$ potential trials in role r. If the actor has not had a success within the first $n_r^*(m_r)$ trials, he will have an $n_r^*(m_r) + 1^{\text{st}}$ trial.

Result 7. The longer the optimal stopping rule $n_r^*(m_r)$, the greater an actor's expected number of performances in role r during the experimentation phase of the actor's career, $\varepsilon_r(m_r)$.

If an actor has a string of $n_r^*(m_r) + 1$ failed performances in role r, the actor will thereafter be relegated to performing in role $r - 1$ in every period remaining in the term of his contract, unless he is displaced in a period by experimentation with a qualified prospect.

TABLE 1: Career Pattern

# Actors who played	1932-1942 (all actors)	1943-2011 (all actors)	1943-2011 (born in 1930s only)
-uncredited roles	9627	72,974	2921
-credited roles	8903	94,047	4392
-lead roles	2953	17,539	1233
Total different actors:	10,830	117,806	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

	1932-42	*1943-2011*	
	(all actors)	*(all actors)*	*(born in 1930s only)*
# Actors	7428	94,047	4392
# credited roles	146,039	390,743	31,960
Total career roles	19.7	4.2	7.3

TOP TEN ACTORS

	1932-42	*1943-2011*
		(born in 1930s only)
# Actors	74	24
# credited roles	4116	805
Total roles per career	55.6	33.5

Source: IMDB, IMPA, *Film Daily Yearbook*

TABLE 3: Descriptive Statistics

CREDITED ROLES	mean	Stdev	min	max	obs
# roles	0.89	1.99	0	25	81,708
contract ever	0.22	0.41	0	1	81,708
contract year	0.05	0.23	0	1	81,708
Male	0.66	0.47	0	1	81,708
Age	37.7	14.2	1	94	68,185
# roles, contract ever = 1	1.80	2.68	0	24	17,908
# roles, contract ever = 0	0.64	1.66	0	25	63,800
# roles, contract year = 1	3.69	2.81	0	24	4466
# roles, contract year = 0	0.73	1.81	0	25	77,242
# roles, contract ever =1 & contract year = 1	3.69	2.81	0	24	4458
# roles, contract ever = 1 & contract year = 0	1.18	2.32	0	23	13,450

TABLE 4: Effect of Contracts on Roles

Dependent variable = $roles_{it}$

| | OLS (clustered std. errors) | | | | Zero-inflated negative binomial | |
| | Full sample | | Ages 20-69 only | | (marginal effects) | |
Variable	(1)	(2)	(3)	(4)	(5)	(6)
Contract ever	1.351		0.886		1.303	
	(.051)		(.058)		(.048)	
Contract year		2.975		2.980		3.276
		(.069)		(.074)		(.086)
Age	0.035	0.021	0.004	-0.018	0.031	0.035
	(.005)	(.004)	(.011)	(.011)	(.007)	(.007)
Age2	-0.0003	-0.0001	0.0001	0.0003	-0.0002	-0.0003
	(.0001)	(.0001)	(.0001)	(.0001)	(.0001)	(.0001)
Male	-0.473	-0.620	-2.015	-2.241	-0.338	-0.420
	(.123)	(.104)	(.303)	(.302)	(.194)	(.202)
Male*age	0.041	0.043	0.111	0.117	0.027	0.028
	(.007)	(.007)	(.016)	(.016)	(.009)	(.009)
Male*age2	-0.0004	-0.0004	-0.001	-0.001	-.0002	-0.0002
	(.0001)	(.0001)	(.0002)	(.0002)	(.0001)	(.0001)
Year effects	yes	yes	yes	yes	yes	yes
R2	.093	.138	.149	.128		
# obs	68,185	68,185	59,064	59,064	68,185	68,185

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: Actor Fixed Effects

Dependent variable = *roles$_{it}$*

Variable	Coefficients (st. errors)		
		All Actors	**Actors aged 20-69**
Contract year	2.223	2.185	2.108
	(.027)	(.029)	(.033)
Age		0.044	-0.057
		(.008)	(.013)
Age2		-0.001	0.0004
		(.0001)	(.0001)
Male*age		0.139	0.302
		(.010)	(.016)
Male*age2		-0.001	-0.003
		(.0001)	(.0002)
Year effects	yes	yes	yes
Actor effects	yes	yes	yes
R2	.115	.046	.020
# obs	81,708	68,354	59,305
# groups	7428	6214	5807

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.

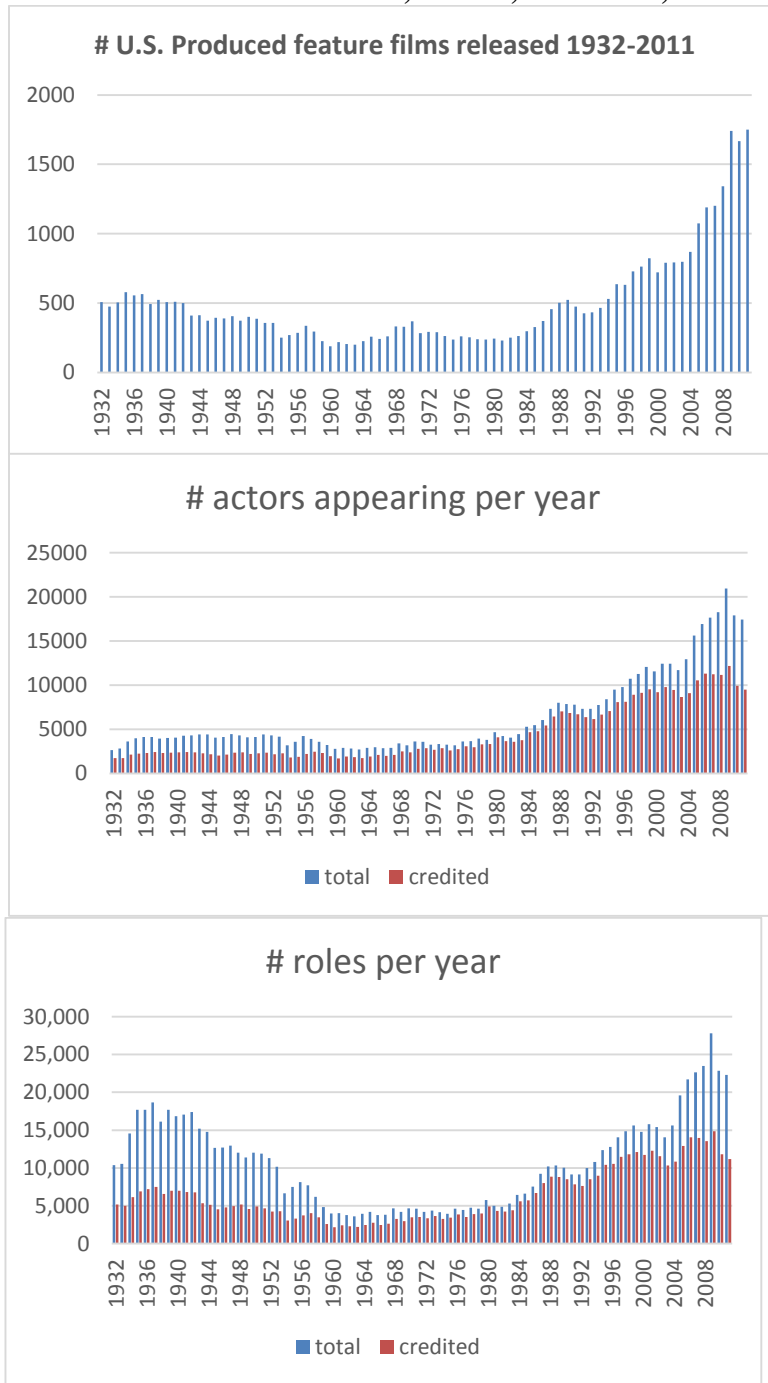**TABLE 6: Top Ten Actors, studio versus post-studio era**

Roles per year before and after making Top Ten for first time

Studio era:	Actors under studio contract, 1932-42					
	All actors, all roles		All actors, just 1932-42 roles		Same actors, just 1932-42 roles	
	Before	*After*	*Before*	*After*	*Before*	*After*
Total actors	74	74	44	60	31	31
roles per year	4.17	2.34	4.03	2.56	4.05	2.71
(std. dev.)	(2.91)	(2.20)	(2.42)	(1.61)	(2.47)	(1.55)

Post-studio era:	Actors born 1930-1939			
	All actors		Same actors	
	Before	*After*	*Before*	*After*
Total actors	22	24	22	22
roles per year	1.67	1.50	1.67	1.52
(std. dev.)	(0.94)	(0.79)	(0.94)	(0.80)

Total roles played before making Top Ten for first time

	Studio era		Post-studio era
	All	*First Top Ten 32-42*	*Born in 1930s*
Total actors	75	33	22
Total roles	31.1	22.1	9.5
(std. dev.)	(25.9)	(22.2)	(7.0)

FIGURE 1: Films, Actors, and Roles, Over Time

U.S. Produced feature films released 1932-2011

actors appearing per year

roles per year

Source: IMDB

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

Credited actors per movie

Credited roles per movie

Credited roles per actor
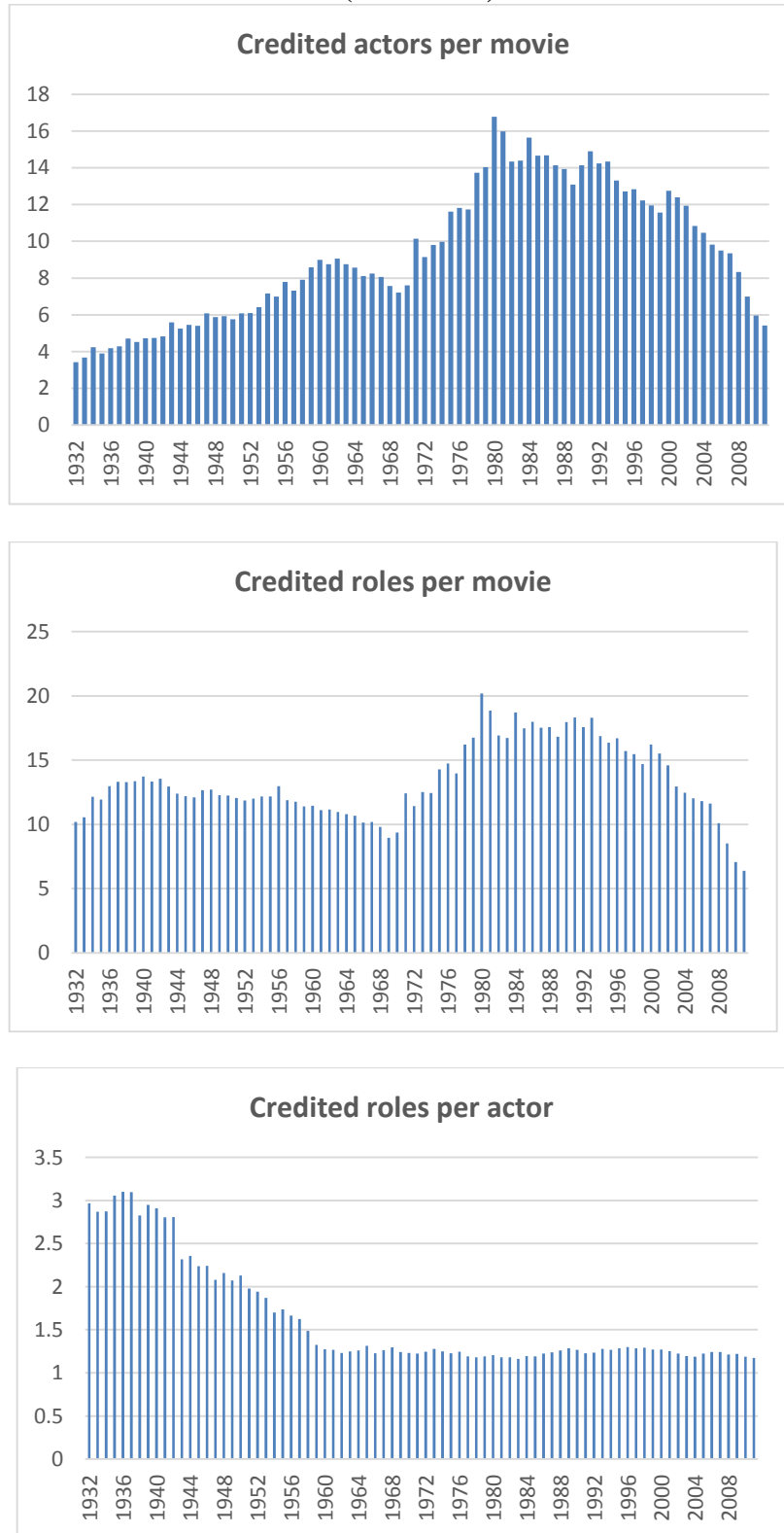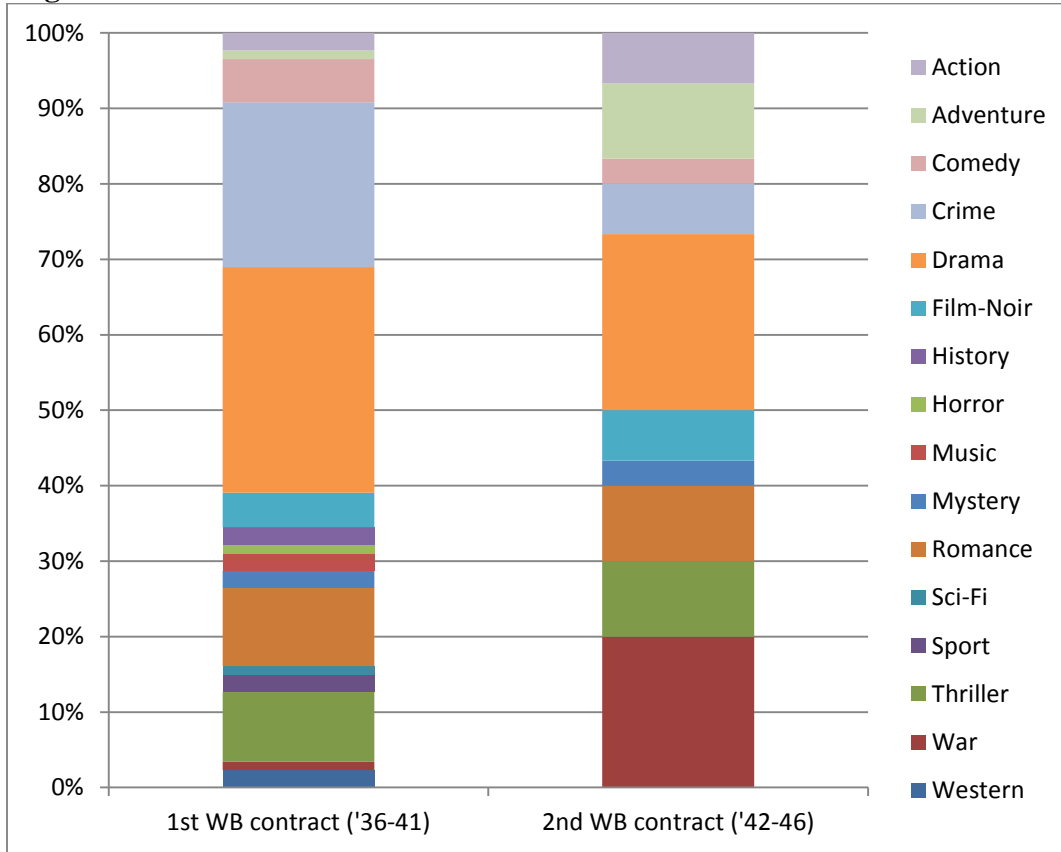
Source: IMDB

FIGURE 3: Roles per year, Before and After first being named to Top Ten
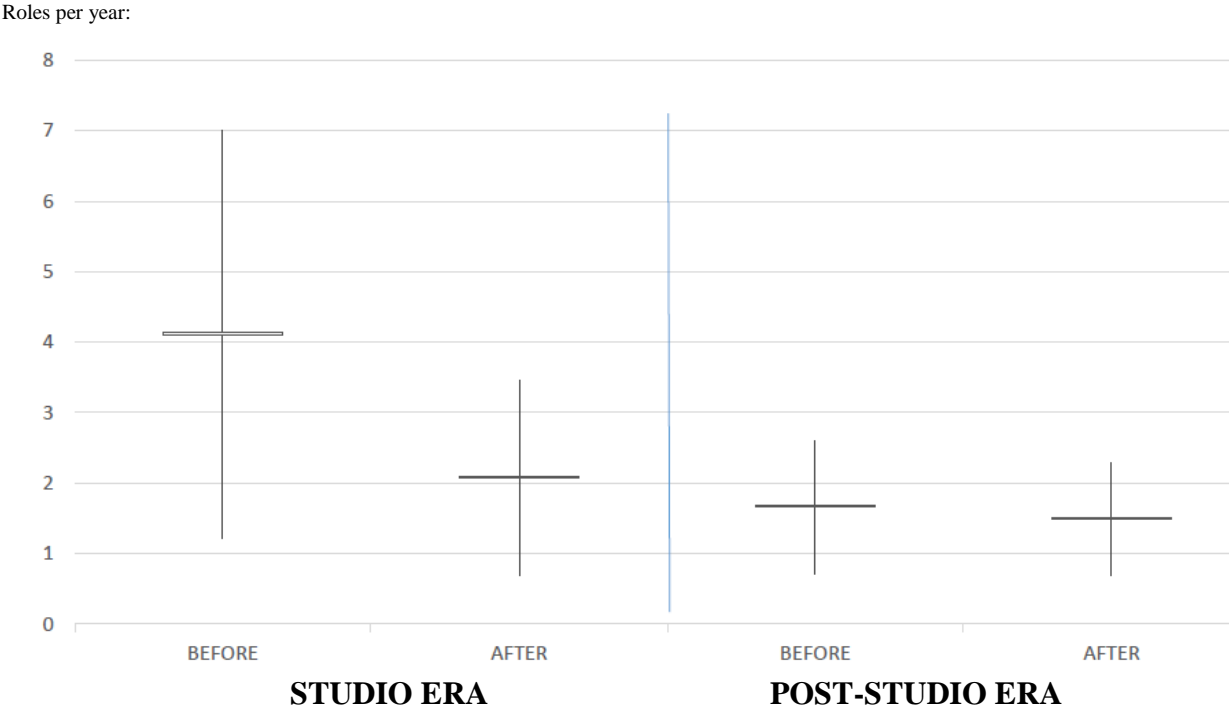
Roles per year:

"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.
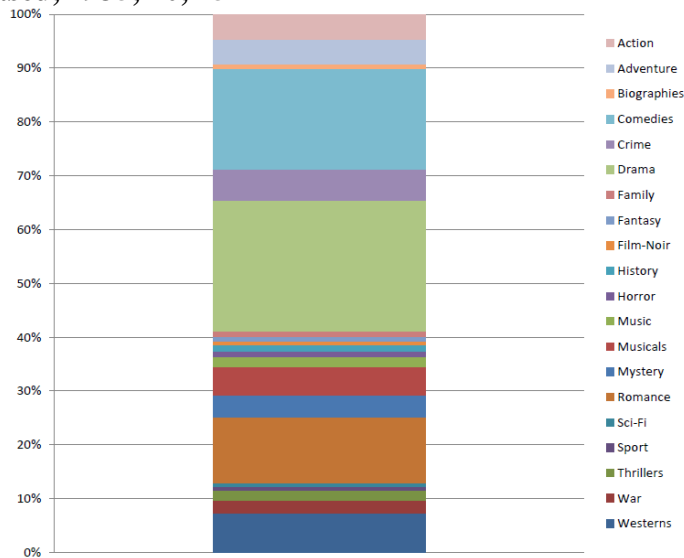
FIGURE 4: Humphrey Bogart, Genres during first and second contracts

Bogart films

# film roles:	32	10
# distinct genres	16	10

All films released, 1935, 40, 45

Source: IMDB