14.662 Spring 2026 Lecture Slides 9— Superstars and Mediocrities

David Autor, MIT and NBER

March 4, 2026 (rev 2026/03/04)

Agenda

1. **Assignment models**
2. Some motivating facts: Income concentration is not just about CEOs
3. The assignment model: General form (Terviö 2008)
4. CEO pay through the lens of the assignment model
5. Contrasting superstar versus principal-agent views of CEO pay
6. Mediocrity in talent markets
7. Conclusions
8. [Optional self-study] Empirical application: Superstar effects from broadcast television

Assignment models

What explains the enormous skew in the earnings distribution?

1. Does it reflect skewed distribution of 'ability' — or something else?
2. Why would this skew rise over time?

Assignment models: some history

- Introduced by Jan Tinbergen in the 1950s
- Sattinger's '75 *Ecta* paper formalized, substantially deepened insights from Tinbergen, Roy '51
- Re-emerges in Rosen '81, "The Economics of Superstars"
- Gains empirical traction: Gabaix and Landier '08, Terviö '08, Koenig '19, Gottlieb et al. '20
- Recent empirical papers:
  - Koenig (2023) "Technical Change and Superstar Effects: Evidence from the Rollout of Television", *AERi*
  - Gottlieb, Hémous, Hicks, Olsen (2023) "The Spillover Effects of Top Income Inequality", WP

Sattinger '73 ECTA: "Comparative advantage and the distributions of earnings and abilities"

This paper constructs a model of the allocation of workers to jobs. The intention is to find the minimum requirements for the distribution of earnings to be different from the distribution of abilities. It is not necessary to depart from the assumptions of perfect competition or marginal productivity wage determination. All that is required is that there be comparative advantage in the performance of tasks by individuals.

Sattinger's big idea(s)

- **In a conventional skills market, dist'n of wages directly proportional to the dist'n of skill**
  - Sattinger wants to find competitive settings where this is *not* the case
- **Key condition: comparative advantage**
  - With comparative advantage, earnings depends on ability & assignment
  - Assignment magnifies importance of ability
  - Dist'n of earnings may be far more skewed than the distribution of underlying abilities
- **There's a second big idea in Sattinger: indivisibilities**
  - Indivisibilities—cannot combine many workers into one 'super-worker'—e.g., CEO, doctor, entertainer
  - Have to 'assign' one worker to do a job
  - In assignment model, allocation of workers to jobs *indivisible* from earnings dist'n
  - If output is indivisible from job, capital, or consumer with which the worker is **paired** (assigned), wages are not necessarily proportional to skill
- **A classic paper (Rosen) and a very recent novel reincarnation** (Haanwinckel)
  - Rosen 1981 *AER* "The economics of superstars"
  - Haanwinckel 2025 *AER* "Supply, demand, institutions, and firms: A theory of labor market sorting and the wage distribution"

Key concepts + questions for the economics of assignment/superstars

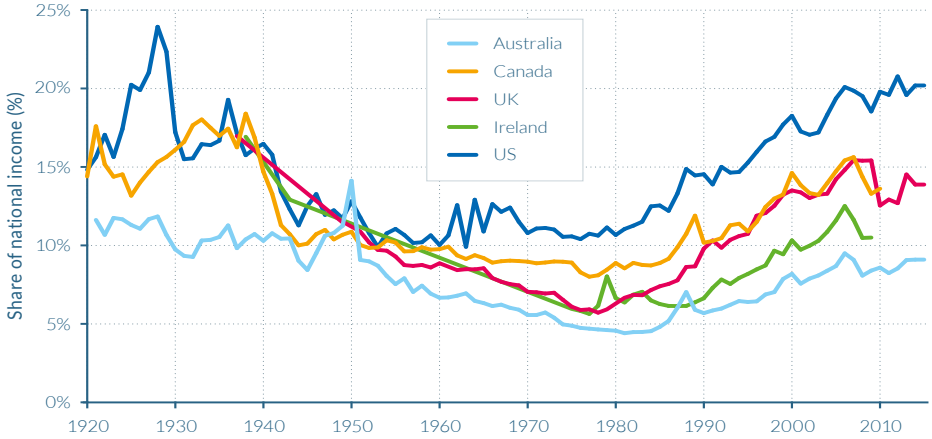
1. **Distinguishing four distinct economic conceptus**
    1. Skills
    2. Talents
    3. Comparative advantage
    4. Assignment
2. **How much of the labor market is a 'talent' versus a 'skills' market?**
3. **How much of talent scarcity is a problem of scarce discovery versus intrinsic scarcity?**
    - Talent can receive large rents *even (especially) when talent is mediocre*
    - Ex-post realization of *known* talent may induce artificial scarcity
    - Pallais 2014 *AER* paper builds on this insight in a non-superstars market
    - See also *ReStud* paper, "The Spillover Effects of Top Income Inequality" by Gottlieb, Hémous, Hicks, and Olsen

Agenda

1. Assignment models
2. **Some motivating facts: Income concentration is not just about CEOs**
3. The assignment model: General form (Terviö 2008)
4. CEO pay through the lens of the assignment model
5. Contrasting superstar versus principal-agent views of CEO pay
6. Mediocrity in talent markets
7. Conclusions
8. [Optional self-study] Empirical application: Superstar effects from broadcast television

Top 1% income share: Anglophone countries

Top 1% national income share in Anglophone countries, 1920–2015

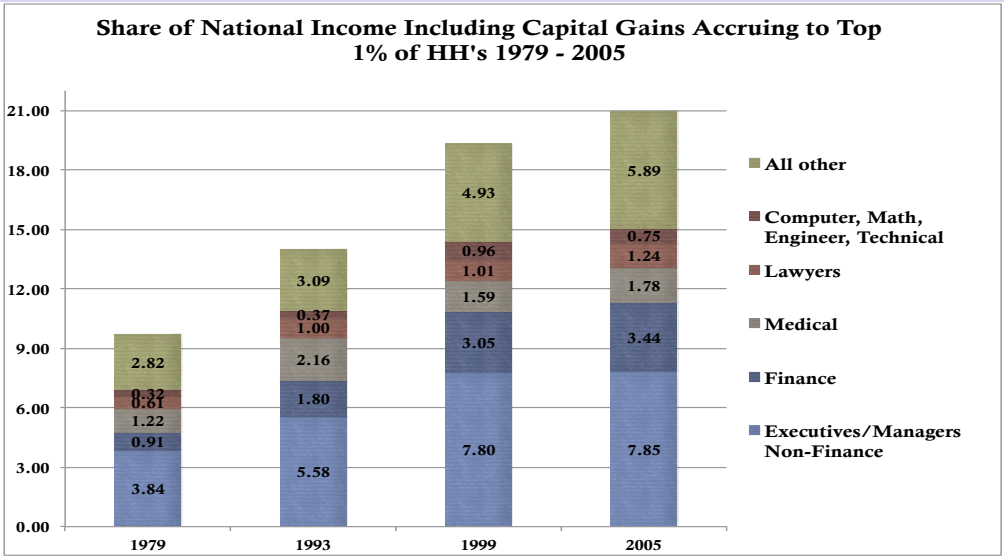


Source: Novokmet, Piketty & Zucman (2017). See wir2018.wid.world for data series and notes.

In 2014, 20% of national income was received by the Top 1% in the US.

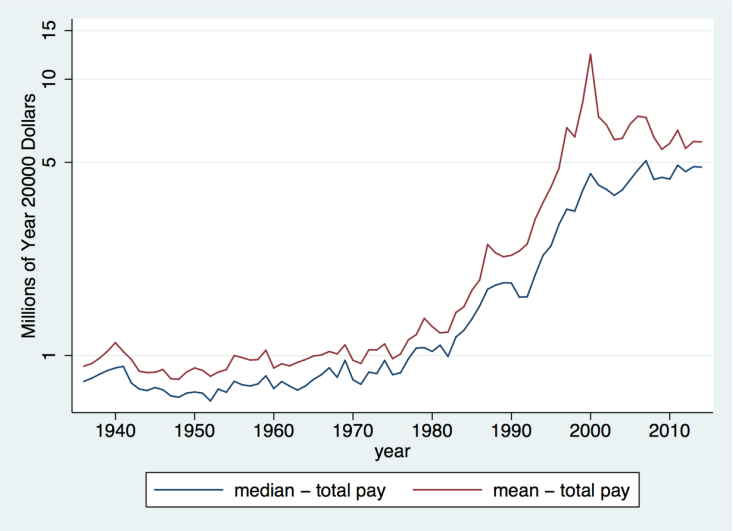
Alvaredo et al. 2018

Occupations and national income shares of top one percent of U.S. households, 1979 – 2005



Bakija, Cole and Heim 2012

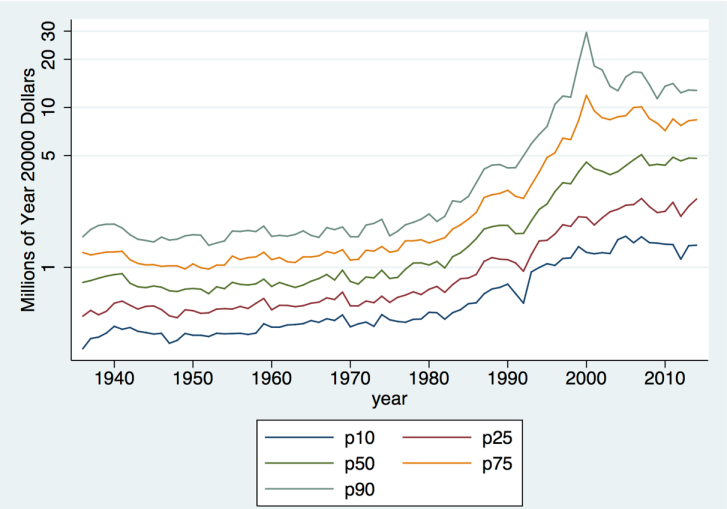
Evolution of US CEO pay, 1937 – 2013



Note: logarithmic y-scale

Frydman, 2016

Inequality among US. CEOs 1937 - 2013



Note: logarithmic y-scale

Frydman, 2016

Agenda

1. Assignment models
2. Some motivating facts: Income concentration is not just about CEOs
3. **The assignment model: General form (Terviö 2008)**
4. CEO pay through the lens of the assignment model
5. Contrasting superstar versus principal-agent views of CEO pay
6. Mediocrity in talent markets
7. Conclusions
8. [Optional self-study] Empirical application: Superstar effects from broadcast television

Terviö 2008: Is high CEO pay mostly due to ability or to assignment?

Model structure

- Two factors of production a and b
- Worker quality is denoted as a
- Firm quality is denoted by b, which will be referred to as firm 'size'

Three core assumptions

1. One-dimensional quality of factors
2. Complementarity between the qualities of factors
3. Continuity of quality distributions

Basics

- Production function is continuous, strictly increasing in a and b
- Positive cross-partial between a and b: complements
- Efficiency requires positive assortative matching (*supermodularity*)
- Write the production function *without loss of generality* as

$$Y(a, b) = a \cdot b$$

Notation

- Order abilities by quantile so that $a[i]$ is the ability of the i^{th} quantile individual, with $a'[i] > 0$
- Denote the distribution function by F_a
- Profile of a is defined by

$$a[i] = a \;\leftrightarrow\; F_a(a) = i$$

The optimal 'assignment' is immediate and self-evident

- Efficiency requires positive assortative matching
- So, we're going to have a one-to-one matching of $a[i]$ to $b[i]$ for all $i \in [0, 1]$

What's interesting about this problem?

- **Answer**: the eq'm set of factor payments (i.e, wages paid to $a's$ and capital payments paid to $b's$) that decentralize this allocation

Two equilibrium conditions

1. **Sorting constraint**—no firm wants to rematch with another worker

$$Y(a[i], b[i]) - w[i] \geq Y(a[j], b[i]) - w[j] \quad \forall i, j \in [0,1] \qquad SC(i,j)$$

Could equivalently be written in terms of workers not wanting to rematch with another firm

$$Y(a[i], b[i]) - \pi[i] \geq Y(a[i], b[j]) - \pi[j] \quad \forall i, j \in [0,1] \qquad SC(i,j)$$

2. **Participation constraint**—all workers and firms earn at least their outside option

$$\begin{aligned} Y(a[i], b[i]) - w[i] &\geq \pi^0 \quad \forall i \in [0,1] \qquad PC\ b[i] \\ w[i] &\geq w^0 \quad \forall i \in [0,1] \qquad PC\ a[i] \end{aligned}$$

Simplifying condition on outside options

- Assume that π^0 and w^0 are same for all units
- Lowest active pair breaks even

$$Y(a[0], b[0]) = \pi^0 + w^0$$

- Sufficient cond'n: outside *options* increase more slowly along the profile than do *superstar* options

Simplifying the sorting constraints

- With n workers and n firms, there are $2n(n-1)$ sorting constraints
- But most constraints are redundant – *Why*?
- Redundancy due to transitivity: if marginal constraints satisfied, inframarginal constraints satisfied. (More precisely: constraints are recursively satisfied from bottom up.)
- Most constraints are redundant since for $i \geq j \geq k$, $SC(i,j) + SC(j,k)$ implies $SC(i,k)$

The binding constraints are therefore

1. Marginal sorting constraints: Firms don't want to hire next best worker
2. Participation constraints of the lowest types

Order binding sorting constraints and use continuity of i

$$\frac{Y\left(a\left[i\right],b\left[i\right]\right)-Y\left(a\left[i-\varepsilon\right],b\left[i\right]\right)}{\varepsilon}\geq\frac{w\left[i\right]-w\left[i-\varepsilon\right]}{\varepsilon}.$$

- Let $\varepsilon\to 0$. Becomes an equality, yielding slope of wage profile

$$w'\left[i\right]=Y_a\left(a\left[i\right],b\left[i\right]\right)a'\left[i\right]$$

  - where Y_a is the partial derivative
  - and $a'\left[i\right]$ is the slope (derivative) of worker ability schedule

- To get full wage profile, integrate over the profile and add in the binding participation constraint

$$w\left[i\right]=w^0+\int_0^i Y_a\left(a\left[j\right],b\left[j\right]\right)a'\left[j\right]d\left[j\right]$$

Equilibrium conditions

- Could equivalently be written in terms of workers choosing firms rather than firms choosing workers

$$\begin{aligned} \pi'[i] &= Y_b(a[i], b[i])\, b'[i] \\ \pi[i] &= \pi^0 + \int_0^i Y_b(a[j], b[j])\, b'[j]\, d[j] \end{aligned}$$

- Conditions also imply that $y(i) = \pi(i) + w(i)$ at each firm
- An extremely tight set of constraints on the problem
  - Wages and profits of each factor i depend on the full profile of factors from quantile 0 to $i - \varepsilon$

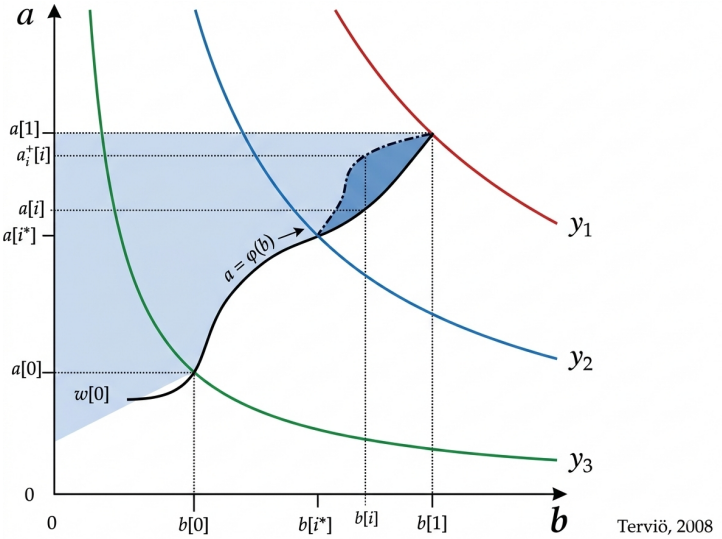
Drawing the matching graph: Multiplicative case (WLOG)

- Output accruing from matching a worker of ability a and a firm of ability b is $a \times b$: a rectangle in a Cartesian graph
- Let $a = \varphi(b) \equiv a[F_b(b)]$, i.e., matched pairs satisfy $F_a(a) = F_b(b)$, with slope

$$\varphi'(b) = a'[F_b(b)] f_b(b) = \left. \frac{a'[i]}{b'[i]} \right|_{i=F_b(b)}$$

- $\varphi(b)$ is strictly increasing in b (note $\varphi'(b)$ is *not* strictly increasing in b), with the slope given by the relative steepness of a and b at each quantile i

Wage setting in the assignment model



Terviö, 2008

Some observations on equilibrium

1. **There is no bargaining in this model. Why not?**
   - Due to the *continuity* of the distribution of both factors
   - If there was a jump at some point in the profile of one factor, all of the surplus would go to the factor with the jump
2. **Payments to factors are only affected by the quality of those below them in the ranking. Why?**
   - Binding constraint on ea. worker/firm is the quality/price of the worker/firm just below in the distribution
3. **The productivity characteristics a and b are essentially ordinal. Why?**
   - "Any increasing transformation of the scale of measurement for a factor's quality combined with the inverse change in the functional form of the production function changes nothing substantive in the model..."
   - This means, for example, that using a Cobb-Douglas form $Y(a,b) = a^{\gamma} b^{1-\gamma}$, as opposed to a simple multiplicative $y = ab$, would be superfluous, or even misleading if it causes one to believe that the income shares should have any tendency to be related to the exponents."
   - In this sense $Y(a[i], b[i]) = a[i] \times b[i]$ is a general functional form—so long as we are assuming supermodularity

Deep observation...

"It would be incorrect to say that factors earn their marginal productivity by the usual definition of marginal productivity, because the increase in output if the individual of ability $a[i]$ were to increase in ability is proportional to $b[i]$. But if she were to increase in ability, then, in equilibrium, she would also move up in the ranking and be matched with a higher b—and other individuals would have to move down and experience a decrease in productivity...The relevant margin here is whether an individual will participate in the industry or not—and if not, then the effect of the resulting rearrangement of remaining individuals is part of the marginal product."

(Look up the 'Shapley Value' in *Wikipedia*)

Consider hypothetical case where highest ability worker, $a[1]$, falls in ability to lowest ability worker $a[0]$

- Due to "demotion," each firm other than $b[0]$ will have to match with a slightly lower ranked worker
- Previously, total output was equal to:

$$Y = \int_0^1 Y(a[j], b[j])\, d[j]$$

- Now, each firm except for the lowest ranked firm $b[0]$ pairs w/ slightly lower quality worker

$$\Delta Y[j] \equiv Y[j] - \hat{Y}[j] = Y(a[j], b[j]) - Y(a[j-\varepsilon], b[j]). \tag{1}$$

- Note that $a[\cdot]$ continues to refer to the values of a in the *original* distribution, not the new distribution

What is the loss in output?

- Dividing equation (1) by ε and letting $\varepsilon \to 0$, we take the limit of

$$\frac{\Delta Y[j]}{\varepsilon} = \frac{Y(a[j], b[j]) - Y(a[j-\varepsilon], b[j])}{\varepsilon}$$

to get

$$Y'[j] = Y_a(a[j], b[j])\, a'[j]$$

- Integrate over the full distribution of units to obtain the total loss in output:

$$\Delta Y = \int_0^1 Y_a(a[j], b[j])\, a'[j]\, d[j]$$

This is the net reduction in output caused by worker $a[1]'s$ demotion

Compare reduction in output to the change in the wage bill

- The wage of the previously highest ability worker falls from

$$w[1] = w^0 + \int_0^1 Y_a(a[j], b[j]) a'[j] d[j]$$

to

$$\hat{w}[1] = w^0$$

- The change in the wage for worker $a[1]$ is

$$\begin{aligned} w[1] - \hat{w}[1] &= w^0 + \int_0^1 Y_a(a[j], b[j]) a'[j] d[j] - w^0 \\ &= \int_0^1 Y_a(a[j], b[j]) a'[j] d[j] \end{aligned}$$

Identical to fall in total output, ΔY, confirming Tervi̇ö's claim

Agenda

1. Assignment models
2. Some motivating facts: Income concentration is not just about CEOs
3. The assignment model: General form (Terviö 2008)
4. **CEO pay through the lens of the assignment model**
5. Contrasting superstar versus principal-agent views of CEO pay
6. Mediocrity in talent markets
7. Conclusions
8. [Optional self-study] Empirical application: Superstar effects from broadcast television

CEO pay and firm market value in 2004

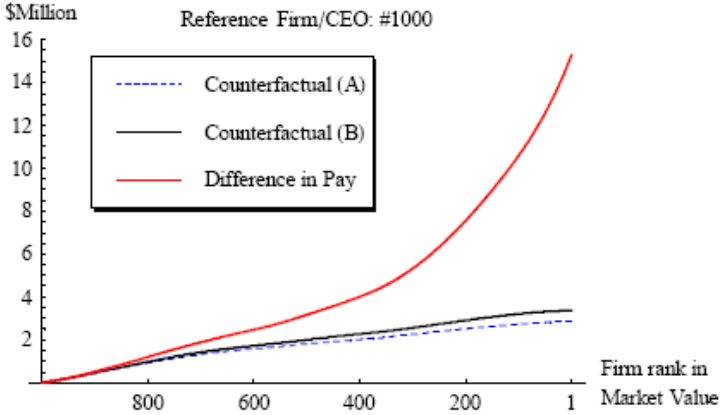
Figure 2. Relation of CEO pay and firm rank by market value in 2004. The smoothed relation (obtained with the Lowess method) appears upwards biased in the graph because the pay levels are depicted on log scale.

Terviö, 2008

Issues in applying this model to CEO pay

1. Firm size, an outcome, cannot be treated as the b variable.
   - The distribution of $a[i]$ and $b[i]$ are time invariant
2. Part of the market value of the firm reflects the value of capital that can be readily transferred/resold among firms. This capital is not indivisible and so is not part of the surplus in $Y(\cdot)$
   - Adjustable capital must earn market rate of return: subtracted from Y
   - Assumes that gross surplus has constant elasticity θ with respect to adjustable capital. Sets share of adjustable capital in Y at values between 0 and 0.8
3. Firm's current market value depends on quality of current CEO and expected quality of future CEOs
   - Impact of past *and future* CEO quality on current firm performance decays at a constant rate
   - $\alpha_{\tau+1} = \alpha_\tau \lambda / (1+\lambda)$. λ determines the decay rate. With $\lambda \to \infty$, only the current CEO affects contemporaneous earnings. Terviö uses values between ∞ and 0.1
4. Productivity tends to grow over time, and the expectation of growth affects current market value
   - Productivity grows deterministically at rate g at all firms (that's why the scaling lemma is needed)
5. Outside options may shift
   - The value of outside options grow at rate g. Terviö uses values between 0.02 and 0.025

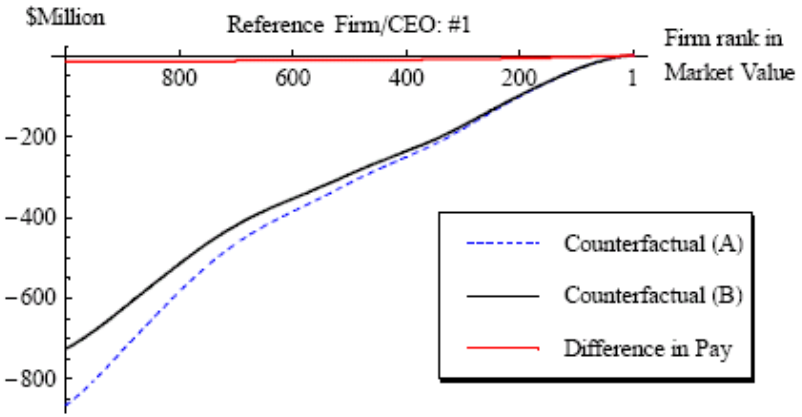
Hypothetical effect on surplus (and CEO pay) of replacing all firms with smallest firm, holding CEO ability fixed



[1] The counterfactual difference that CEOs would make to economic surplus created at the reference firm if they were to replace the actual CEO at the reference firm. The value is calculated under two assumptions of the model parameters (A and B, defined in Table 1). The red line depicts the difference in actual pay of the CEOs relative to that of the reference rank.

Terviö, 2008

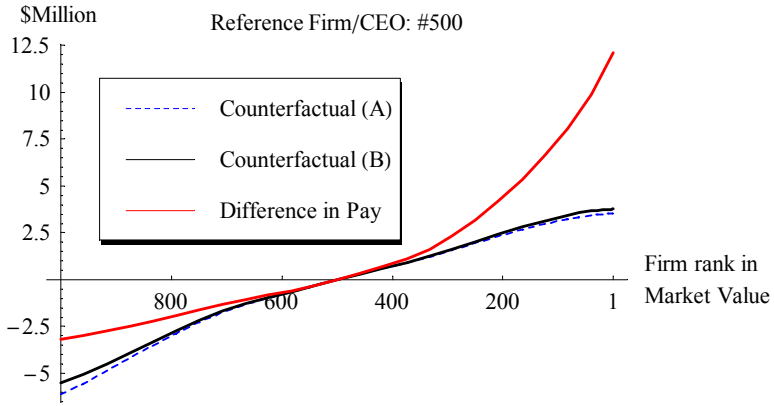
Hypothetical effect on surplus (and CEO pay) of replacing all firms with largest firm, holding CEO ability fixed



[1] The counterfactual difference that CEOs would make to economic surplus created at the reference firm if they were to replace the actual CEO at the reference firm. The value is calculated under two assumptions of the model parameters (A and B, defined in Table 1). The red line depicts the difference in actual pay of the CEOs relative to that of the reference rank.

Terviö, 2008

Hypothetical effect on surplus (and CEO pay) of replacing all firms with with median firm, holding CEO ability fixed



[1] The counterfactual difference that CEOs would make to economic surplus created at the reference firm if they were to replace the actual CEO at the reference firm. The value is calculated under two assumptions of the model parameters (A and B, defined in Table 1). The red line depicts the difference in actual pay of the CEOs relative to that of the reference rank.

Terviö, 2008

Inferred relative ability of CEO 750, 500, 250, and 1, relative to lowest ranked (#1,000) CEO

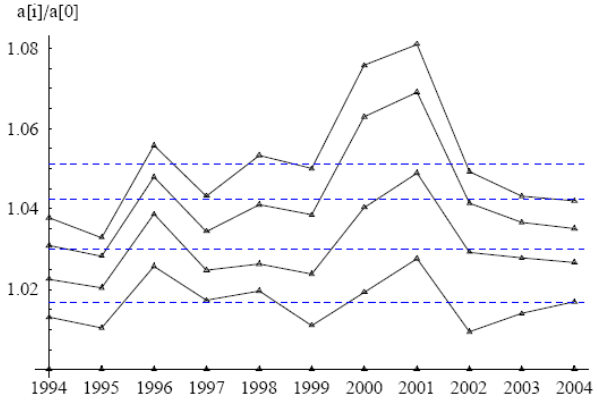


Figure 5. Inferred CEO abilities at 1st, 250th, 500th, and 750th largest firm (relative to 1000th) by year. Dashed lines give the average over this time period, used as the time-invariant distribution of ability in Section 5.3.[2]

Terviö, 2008

Agenda

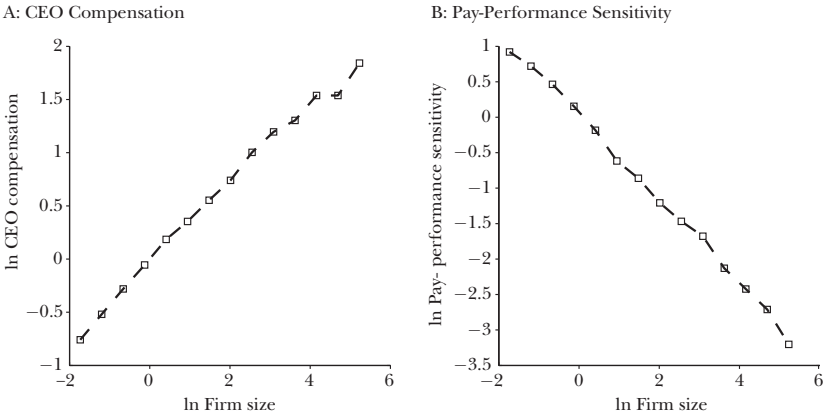
1. Assignment models
2. Some motivating facts: Income concentration is not just about CEOs
3. The assignment model: General form (Terviö 2008)
4. CEO pay through the lens of the assignment model
5. **Contrasting superstar versus principal-agent views of CEO pay**
6. Mediocrity in talent markets
7. Conclusions
8. [Optional self-study] Empirical application: Superstar effects from broadcast television

Principal-agent prediction

- Jensen-Meckling (1976): CEO pay should be structured to solve moral hazard
- Jensen & Meckling, "Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure" *J. Financial Economics*, 1976 (149,292 Google Scholar citations as of March 2026!)
- Larger firms are harder to monitor $\Rightarrow$ greater agency problems
- So performance sensitivity should be *increasing* in firm size to maintain incentive alignment
- Both superstars and principal-agent models predict that CEO pay should be increasing in firm size
- But they make different predictions about the *performance sensitivity* of pay

CEO pay increasing in firm size, performance sensitivity of pay decreasing

CEO Pay and CEO Pay–Performance Sensitivity versus Firm Size



Gabaix 2016

Declining performance sensitivity challenges principal-agent (Jensen-Meckling) view of CEOs

Principal-agent prediction

- P-A model says performance sensitivity should be *increasing* in firm size to maintain incentive alignment

But the data show the opposite

- Performance sensitivity of pay is *decreasing* in firm size
- CEOs of the largest firms have the weakest pay-performance link

The assignment model explains this naturally

- Pay reflects competitive market clearing, not incentive contracts
- CEO pay $\sim S^{2/3}$ (Gabaix-Landier, *QJE* 2008): pay rises with firm size S but less than proportionally
- So pay as a *share* of firm value, $w/S \sim S^{-1/3}$, falls with size: performance sensitivity declines mechanically

U.S. CEOs are paid more than in other countries (2006)

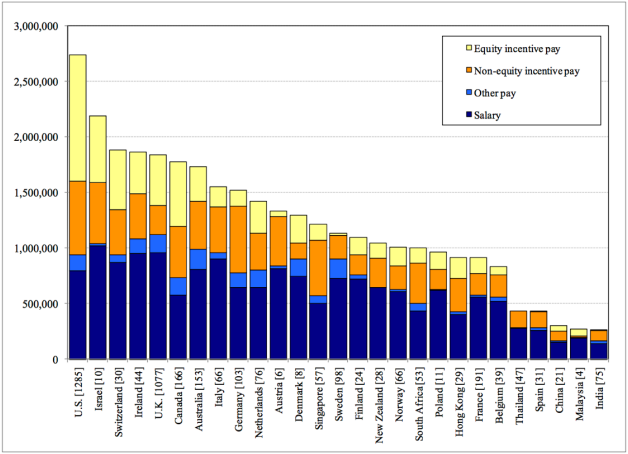
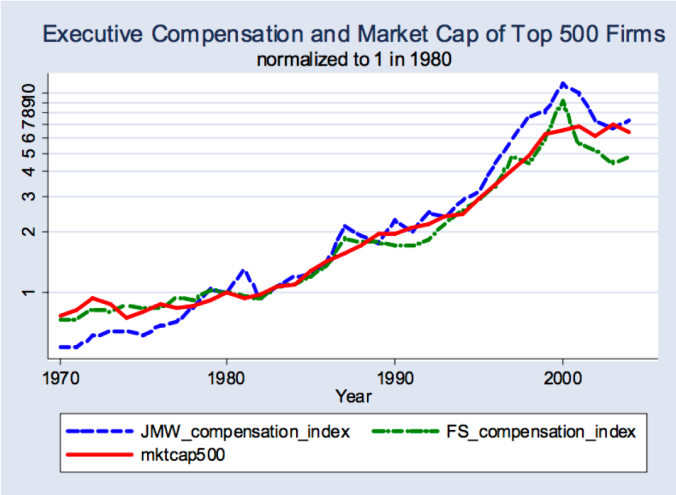


Figure 1: CEO Total Compensation Controlling for Sales and Industry

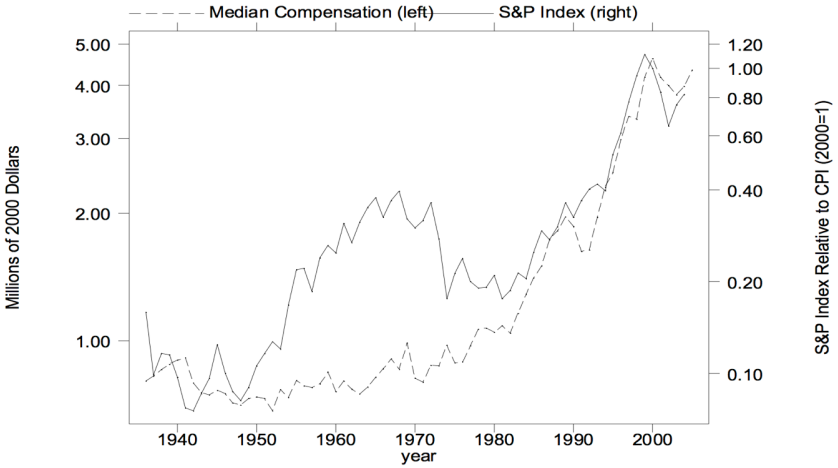
Fernandes, Ferreira, Matos and Muphy 2009

US CEO pay tracks market capitalization, 1970 - 2004



Gabaix and Landier, 2006

But this relationship does not hold over the longer run



Frydman, 2016

Agenda

1. Assignment models
2. Some motivating facts: Income concentration is not just about CEOs
3. The assignment model: General form (Terviö 2008)
4. CEO pay through the lens of the assignment model
5. Contrasting superstar versus principal-agent views of CEO pay
6. **Mediocrity in talent markets**
7. Conclusions
8. [Optional self-study] Empirical application: Superstar effects from broadcast television

Superstars vs. mediocrities

Sattinger/Rosen assume that talent is known to the market

- With full info, wages paid to talent likely to be efficient

Terviö 2009: how does talent become known?

1. To be 'discovered,' one must first 'audition'
   - In the Terviö model, knowledge about worker quality is a joint output of production
   - Richard Caves: "Nobody Knows" property—one cannot evaluate talent without putting it to use
   - Implies that there is real resource cost to discovering talent—capital or just attention
2. The person (or firm) that discovers the talent does not necessarily have the ability to capture the full value of that talent discovery

A setting with (1) and (2) may generate market inefficiencies

A toy example (the full model is excellent)

Consider a market for movie stars

- **Three foundational assumptions**
  1. Nobody knows: Quality of individual talent is unknown until individual appears in a movie
  2. Up front investment: Must sink a cost (i.e., make a movie) to discover that talent
  3. Public revelation: Once movie is made, talent of the movie star is discovered (i.e., public knowledge)

A toy example: Setup

1. **Talent**
   - Talent θ_i of movie star i is ex ante unknown
   - Talent distribution is $\theta \sim U[0, 100]$
   - Outside option (wage) of potential movie stars is normalized at 0
2. **Production**
   - Cost c of making a movie is $\$4,000K$
   - Quality of movie produced is equal to talent of star: $Y(\theta_i) = \theta_i$
   - Quality of movie and hence θ_i is publicly observed
3. **Careers**
   - Careers are $T \leq 16$ periods
   - Star's outside option is $w_{0i} = 0$ for all i
4. **Market structure**
   - Demand for movies is downward sloping
   - Free entry of movie firms into the industry
   - Everyone is risk neutral

Solution concept

We will consider two cases

1. Workers *cannot* borrow to enter industry and *cannot* sign indentured servitude contracts
2. Workers *can* borrow to enter industry

Solution approach

1. Solve for output price P where firms break even from making movies
2. Solve for threshold θ^* where novices stay in industry—become veterans
3. Calculate wages, quality, retention, etc.

Equilibrium summary: No contracting vs. pay to perform scenarios

	No contracting	Pay to perform
Quality of talent		
Talent threshold θ^*		
$E[\theta \mid \text{Veteran}]$		
Pr [Novice]		
$E[\theta \mid \text{Incumbent}]$		
Average movie quality		
Wages and output prices		
Talent price P^*		
Top wage P^*		
E [Career earnings|Vet]		
Wage of novice		
E [Rents|Novice]		

Case 1: No worker borrowing, no indentured servitude

Output price

- Competitive free entry: P^* allows movie-making firms to break even
- $P^*(\theta) : P \times E[Y] - 4,000K = 0$ where $E[Y] = 50$
- Implies that $P^*(\theta) = 80K$

Retention threshold

- All novices with $\theta_i \geq 50$ become veterans: 50% of novices are retained
- *Why?* Because in expectation they produce weakly better movies than the random novice

Case 1: Fraction of novices, quality of veterans, average movie quality

1. **Quality of movies**
   - Average veteran movie quality $E[Y|\text{Vet}] = E[\theta|\theta \geq \theta^*] = 75$
   - If 50% of novices are fired, then 2 must be hired in each period to maintain steady state employment
2. **The fraction of novices in the industry is**

$$\Pr[\text{Novice}] = \frac{\text{Novices}}{\text{Novices+Vets}} = \frac{1/(1-\theta^*/100)}{1/(1-\theta^*/100)+15} = \frac{2}{17} = 0.118 \approx 12\%$$

3. **Average movie quality is**

$$\begin{aligned} E[Y] &= (1-0.118) \times E[\theta|\text{Vet}] + 0.118 \times E[\theta|\text{Novice}] \\ &= (1-0.118) \times 75 + 0.118 \times 50 \\ &= 72 \end{aligned}$$

Equilibrium summary: No contracting vs. pay to perform scenarios

	No contracting	Pay to perform
	Quality of talent	
Talent threshold θ^*	50	
$E[\theta \mid \text{Veteran}]$	75	
Pr [Novice]	12%	
$E[\theta \mid \text{Incumbent}]$	72	
Average movie quality	72	
	Wages and output prices	
Talent price P^*		
Top wage $P^* \times 100 - \$4,000$		
E [Career earnings|Vet]		
Wage of novice		
E [Rents|Novice]		

Earnings of movie stars

- Expected career earnings of a veteran is (recall that $P^*(\theta) = 80$)

$$15 \times (P^* \times \{E[\theta_i | \theta_i \geq \theta^*]\} - 4,000) = 30,000K$$

- Top lifetime wage in the industry is

$$15 \times (P^* \times 100 - 4,000) = 60,000K$$

- Expected lifetime earnings (rents) for a novice are therefore

$$\left(1 - \frac{50}{100}\right) \times 30,000 = 15,000K$$

- Expected value of being randomly chosen to make a movie is $\$15,000K$ in **rents**. But that's not the largest social cost

Equilibrium summary: No contracting vs. pay to perform scenarios

	No contracting	Pay to perform
	Quality of talent	
Talent threshold θ^*	50	
$E[\theta \mid \text{Veteran}]$	75	
Pr [Novice]	12%	
$E[\theta \mid \text{Incumbent}]$	72	
Average movie quality	72	
	Wages and output prices	
Talent price P^*	$\$80K$	
Top wage $P^* \times 100 - \$4,000$	$\$4M$	
E [Career earnings|Vet]	$\$30M$	
Wage of novice	\$0	
E [Rents|Novice]	$\$15M$	

Case 2 — Pay to perform: Fraction of novices, quality of veterans, average movie quality

1. **Assume that in eq'm**
   a. Novices pay $\$1,500$ to appear in their **first** movie (not subsequent movies)
   b. Retention threshold is $\theta = 80$
   c. Implies that market-clearing talent price is $P^*(\theta) = 4000/80 = 50$
2. **Quality of movies**
   - Average veteran movie quality $E[Y|\text{Vet}] = E[\theta|\theta \geq 80] = 90$
   - If 80% of novices are fired, then 5 must be hired in each period to maintain steady state employment
3. **The fraction of novices in the industry is**

$$\Pr[\text{Novice}] = \frac{\text{Novices}}{\text{Novices+Vets}} = \frac{1/(1-\theta^*/100)}{1/(1-\theta^*/100)+15} = \frac{5}{20} = 0.25$$

4. **Average movie quality is**

$$\begin{aligned} E[Y] &= (1-0.25) \times E[\theta|\text{Vet}] + 0.25 \times E[\theta|\text{Novice}] \\ &= 0.75 \times 90 + 0.25 \times 50 \\ &= 80 \end{aligned}$$

Equilibrium summary: No contracting vs. pay to perform scenarios

	No contracting	Pay to perform
	Quality of talent	
Talent threshold θ^*	50	80
$E[\theta \mid \text{Veteran}]$	75	90
Pr [Novice]	12%	25%
$E[\theta \mid \text{Incumbent}]$	72	80
Average movie quality	72	80
	Wages and output prices	
Talent price P^*	$\$80K$	
Top wage $P^* \times 100 - \$4,000$	$\$4M$	
E [Career earnings|Vet]	$\$30M$	
Wage of novice	\$0	
E [Rents|Novice]	$\$15M$	

Pay to Perform: Movie prices, wages, and rents

1. **Expected career earnings of a veteran is (recall that $P^*(\theta) = 50$**

$$= 15 \times (P^* \times \{E[\theta_i | \theta_i \geq \theta^*]\} - 4,000)$$
$$= 15 \times (50 \times 90 - 4,000)$$
$$= 15 \times 50 = 7,500K$$

2. **Top lifetime wage in the industry is**

$$15 \times (50 \times 100 - 4,000) = 15,000K$$

3. **Expected lifetime earnings (rents) for a novice are therefore**

$$= \left(1 - \frac{\theta}{100}\right) \times 7,500K - 1,500K$$
$$= 0.2 \times 7,500K - 1,500K$$
$$= 0$$

4. **Hence, expected value of being randomly chosen to make a movie is \$0.No rents**

Equilibrium summary: No contracting vs. pay to perform scenarios

	No contracting	Pay to perform
	Quality of talent	
Talent threshold θ^*	50	80
$E[\theta \mid \text{Veteran}]$	75	90
Pr[Novice]	12%	25%
$E[\theta \mid \text{Incumbent}]$	72	80
Average movie quality	72	80
	Wages and output prices	
Talent price P^*	$\$80K$	$\$50K$
Top wage $P^* \times 100 - \$4,000$	$\$4M$	$\$1M$
$E[\text{Career earnings} \mid \text{Vet}]$	$\$30M$	$\$7.5M$
Wage of novice	\$0	$-\$1.5M$
$E[\text{Rents} \mid \text{Novice}]$	$\$15M$	$\$0M$

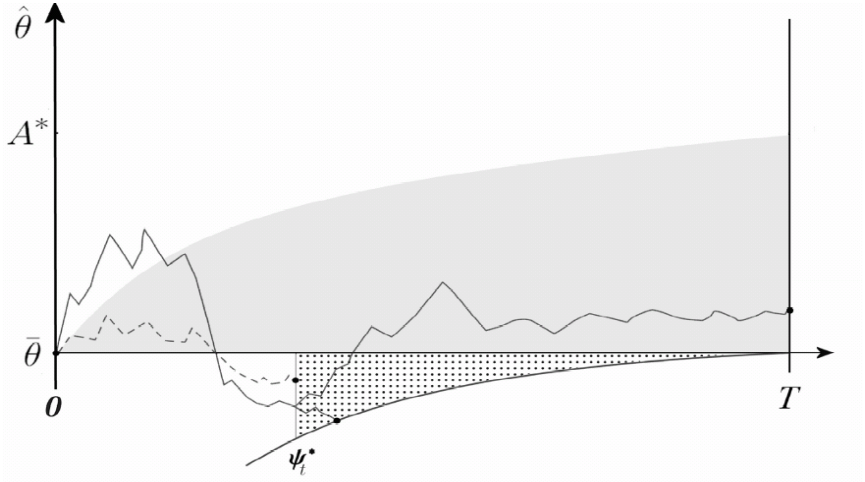


Figure 2. *Mediocrities and Has-beens.* Terviö 2007

Agenda

1. Assignment models
2. Some motivating facts: Income concentration is not just about CEOs
3. The assignment model: General form (Terviö 2008)
4. CEO pay through the lens of the assignment model
5. Contrasting superstar versus principal-agent views of CEO pay
6. Mediocrity in talent markets
7. **Conclusions**
8. [Optional self-study] Empirical application: Superstar effects from broadcast television

Observations

1. **Valuable to distinguish four distinct economic conceptus**
   1. Skills
   2. Talents
   3. Comparative advantage
   4. Assignment
2. **How much of the labor market is a 'talent' versus a 'skills' market?**
3. **How much of talent scarcity is a problem of scarce discovery versus intrinsic scarcity?**
   - Talent can receive large rents *even (especially) when talent is mediocre*
   - Ex-post realization of *known* talent may induce artificial scarcity
4. **Autor's conclusion: Talent is not fundamentally scarce. But discovery of talent is costly**

Agenda

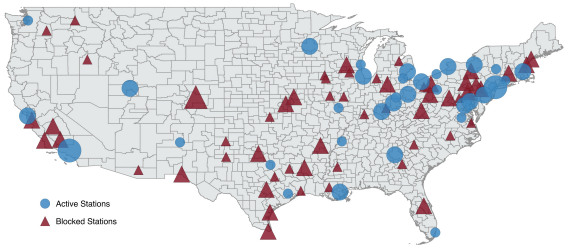
1. Assignment models
2. Some motivating facts: Income concentration is not just about CEOs
3. The assignment model: General form (Terviö 2008)
4. CEO pay through the lens of the assignment model
5. Contrasting superstar versus principal-agent views of CEO pay
6. Mediocrity in talent markets
7. Conclusions
8. **[Optional self-study] Empirical application: Superstar effects from broadcast television**

Television: A 'scale-biased' technical change

- Before TV, entertainers' performances could typically be watched **live** by a few hundred viewers **in person**
- Relative to live, in-person entertainment, TV was a **S**cale-**B**iased **T**echnical **C**hange (**SBTC**)
- In the 1940s, TV **filming occurred near broadcast antennas**
  1. Short distance transmission
  2. No 'storage'
- TV stars performed **live** in **regional markets**. Many **regional TV stars** scattered across the US
- Mid-1950s: Videotaping led to **nationally scalable** broadcast entertainment

Scale-biased technical change: Roll-out of TV stations

Figure 2: TV Filming of Licensed and Blocked Stations in 1949



[Notes] Symbols show the location of TV filming and the size of a symbol indicates the number of TV stations per local labor market. Active stations are blue circles, frozen stations red triangles. Source: FCC reports.

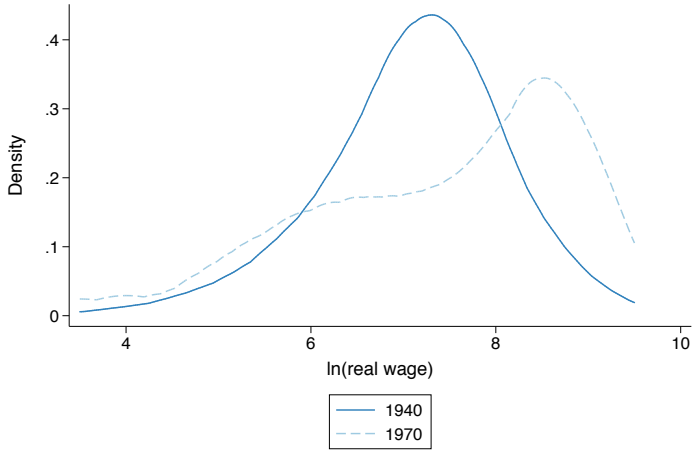
The effect of technical change that makes production more 'scalable'

1. **Top wage growth**
   - For two percentiles at the top of the wage distribution $p' > p$, the growth rate of earnings g_e increases as we move up in the distribution: $g_e^{p'} > g_e^{p}$
2. **Fractal inequality**
   - For top income shares s_p at two percentiles p, pay differences increase: $\tilde{s}_{1\%}/\tilde{s}_{10\%} > s_{1\%}/s_{10\%}$
3. **Adverse earnings effects for lesser talents**
   - As size of market served by superstars rises, more intense competition among those lower in the distribution $\rightarrow$ employment at mid paid levels declines
4. **Exit from superstar market at the bottom of the distribution**
   - Given an outside option to participate in the non-superstar market, some lesser talents should exit when superstar effects magnified

Comparing the wage distribution of entertainers in 1940 and 1970

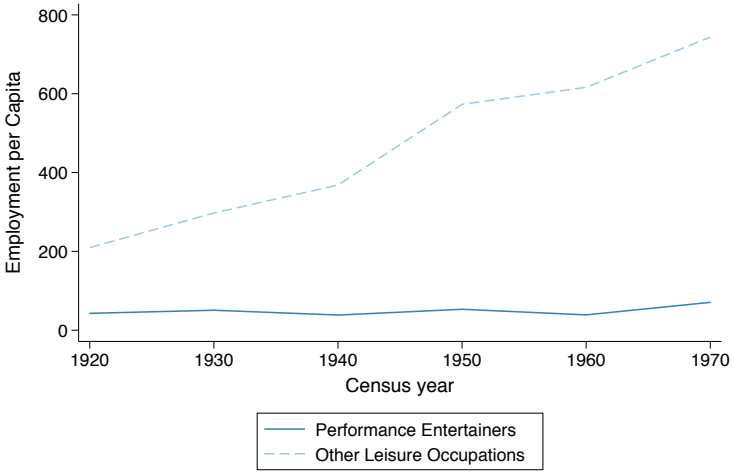
Figure 4: Change in Entertainment 1940 – 1970

(a) Entertainer Wage Distribution



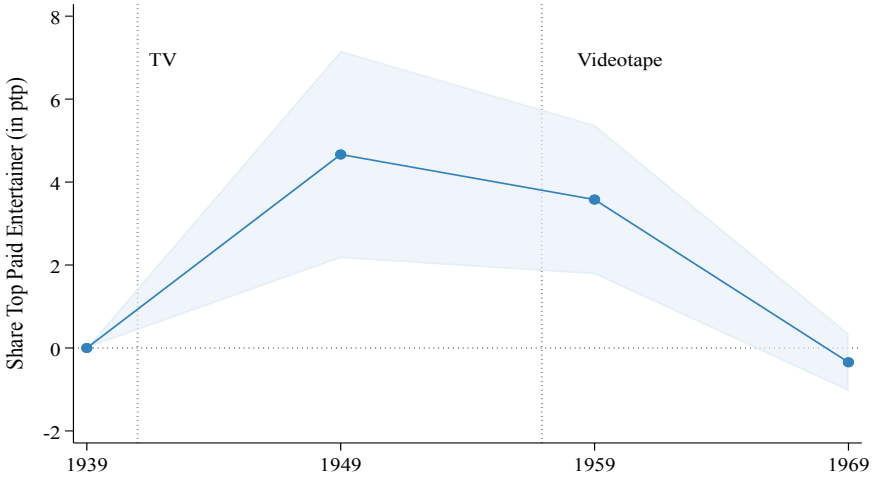
No growth in entertainers per capita, substantial growth in other leisure occupations

(b) Entertainer per Capita



Estimated effect of TV license grants on share of entertainers in top 1% of US wage dist'n

(b) *Active TV stations*



Regression estimates: Top wage growth

Table 1: Effect of TV on Entertainer Top Earners

	Panel A:		
	99^{th} Percentile of Entertainer Wages (log)		
Local TV stations	0.138	0.126	0.100
	(0.030)	(0.031)	(0.042)
Effect/Baseline	14.8%	13.4%	10.5%
CZs (Cluster)	541	541	541
	Panel B: Entertainer among Top 1% of US Earners (% of Entertainers)		
Local TV Stations	4.14	4.31	5.93
	(1.26)	(1.27)	(2.21)
Effect/Baseline	92%	96%	132%
CZs (Cluster)	722	722	722
	Panel C: Entertainer among Top 1% of US Earners (Per Capita)		
Local TV Stations	0.40	0.40	0.31
	(0.10)	(0.10)	(0.10)
Effect/Baseline	133%	133%	103%
CZs (Cluster)	722	722	722
Time & CZ FE	Yes	Yes	Yes
Demographics	–	Yes	–
Local labor market trends	–	–	Yes

Table 4: Effect of TV on Top Income Shares in Entertainment

	Share of Income		
	Top 0.1%	Top 1%	Top 10%
Local TV stations	2.37	3.71	6.08
	(1.27)	(1.69)	(2.12)
Time & CZ FE	Yes	Yes	Yes
Effect/Baseline	239%	96%	33%
P-value: same growth as top 1% share	0.0043	—	0.0000

[Note] Dependent variable top p% is the share of income going to the top p percent of entertainers in a given local labor market-year. The shares are calculated using Pareto interpolation as described in the text. The sample includes the larger 350 labor markets and 1,069 observations. Estimates are based on a difference in difference specification. P-values from a test of equal growth rates in top income shares are also reported. This test is implemented in a regression with the ratio of top income shares as dependent variable. Standard errors are clustered at the local labor market level. Sources: US Census 1940-1970.

Estimating the effect of market scale (audience size) on Superstar Earnings

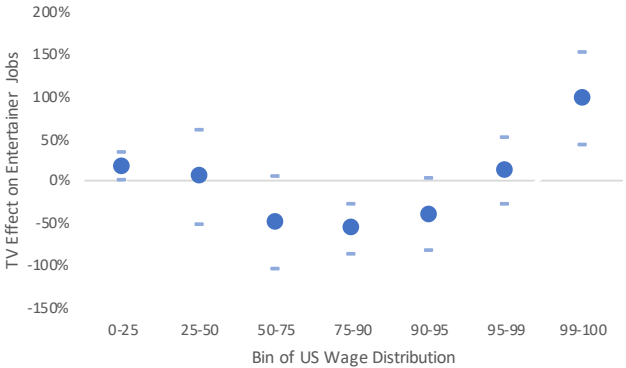
Table 7: Elasticity of Entertainer Top Pay to Market Reach

	(1)	(2)	(3)
	99^{th} *Percentile of Entertainer Wages (log)*		
	Panel A: OLS - Cross-section 1939		
ln(Audience size)	0.234	0.023	
	(0.036)	(0.036)	
	Panel B: IV		
ln(Audience size)	0.166	0.149	0.149
	(0.017)	(0.019)	(0.024)
First-stage F-statistic	33.3	25.7	20.0
	Panel C: IV		
ln(Value of market ($))	0.220	0.192	0.198
	(0.028)	(0.022)	(0.036)
First-stage F-statistic	57.10	38.1	28.7
Demographics	–	Yes	–
Local labor market trends	–	–	Yes

[Note] Dependent variable is the entertainer wage at the 99th percentile. Panel A reports coefficients from a cross-sectional regression that uses variation across 573 local labor markets in 1939. Panel B and C show results from an IV regression that uses TV stations as instrument and uses the full panel with 2,148 observations. The corresponding first stage and reduced form results are reported in table 1 and table 5. The first-stage F-statistic is the Kleibergen-Paap F-statistic that allows for non-iid standard errors. Control variables are described in table 1 and market reach measures in table 5. Standard errors are clustered at the local labor market level. Sources: see table 1 and table 5.

Adverse effects on lesser talents

Figure 8: Effect of TV on Entertainer Employment Growth at Different Wage Levels



[Note] Each dot is the treatment effect estimate of a separate DiD regression. It shows a TV station's effect on entertainer jobs at different parts of the wage distribution. Percentile bins are defined in the overall US wage distribution. Dashes indicate 95% confidence intervals. See table 1 for details on the specification. Sources: US Census: 1940-1970.

Adverse effects of TV roll-out on local county fairs – Outside option (literally) to watching TV

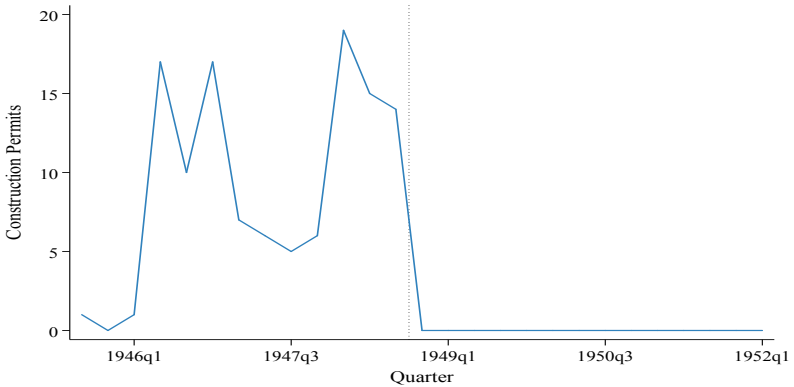
Table 6: Effect of TV on Spending at Local County Fairs

	(1) Fair Visits (log)	(2) Ticket Receipts (log)	(3) Show Receipts (log)	(4) Carnival Receipts (log)
		Panel A: Local Labor Market Level		
TV signal	-0.051	-0.047	-0.059	0.014
	(0.031)	(0.024)	(0.022)	(0.022)
Clusters	722	722	722	722
Time & Labor Market FE	Yes	Yes	Yes	Yes
		Panel B: County Level		
TV signal	-0.013	-0.014	-0.018	0.001
	(0.010)	(0.007)	(0.007)	(0.006)
Clusters	3,111	3,111	3,111	3,111
Time & County FE	Yes	Yes	Yes	Yes

[Note] Dependent variables are summed across county fairs in location m in year t at annual frequency from 1946 to 1957. All variables use the the inverse hyperbolic sine transformation to approximate the log function, while preserving 0s and monetary variables are in 1945 US Dollars. In Panel A the unit of observation m is a local labor market and in Panel B a county. Treatment is the number of TV stations that can be watched in the commuting zone. Data on carnival receipts (col 4) are unavailable for 1953 and 1955. Panel A uses 8,664 local labor market observations (7,220 in column 4), while Panel B uses 37,332 county observations (in col 4 31,110). Standard errors, reported in brackets, are clustered at the local labor market level in Panel A and at the county level in Panel B. Source: Billboard Cavalcade of Fairs 1946-1957 and Fenton and Koenig (2018).

New TV license grants by year

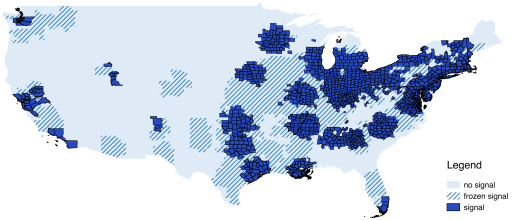
Figure 6: Number of TV Licenses Granted



[Note] Missing issue dates of construction permits are inferred from start of operation dates. Source: TV Digest reports.

Service areas of TV stations blocked by regulatory delay

Figure 3: TV Signal of Licensed and Blocked Stations in 1949

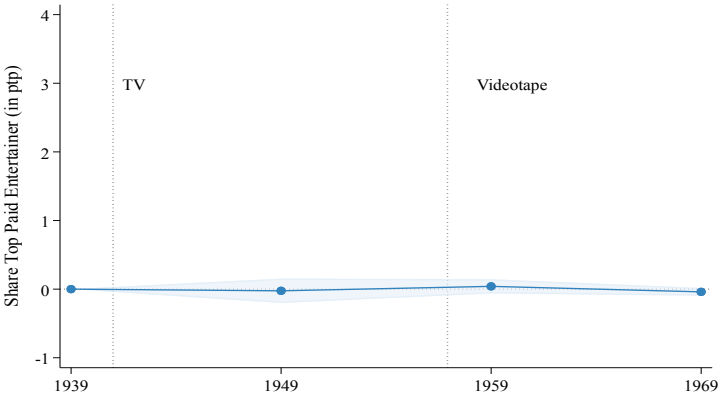


[Note] Areas in dark blue can watch TV, while shaded areas would have had TV signal from blocked TV stations. Signal coverage is calculated using an Irregular Terrain Model (ITM). Technical station data from FCC files, as reported in TV Digest and Television yearbooks, are fed into the model . Signal is defined by a signal threshold of -50 of coverage at 90% of the time at 90% of receivers at the county centroid. Source: Fenton and Koenig (2018).

Placebo test: Estimated effect of TV licenses not granted on share of entertainers in top 1% of national wage distribution

Figure 7: Dynamic Treatment Effect of TV on

(a) *Blocked TV Stations*



The effect of technical change that makes production more 'scalable'

1. **Top wage growth**
   - For two percentiles at the top of the wage distribution $p' > p$, the growth rate of earnings g_e increases as we move up in the distribution: $g_e^{p'} > g_e^{p}$
2. **Fractal inequality**
   - For top income shares s_p at two percentiles p, pay differences increase: $\tilde{s}_{1\%}/\tilde{s}_{10\%} > s_{1\%}/s_{10\%}$
3. **Adverse earnings effects for lesser talents**
   - As size of market served by superstars rises, more intense competition among those lower in the distribution $\rightarrow$ employment at mid paid levels declines
4. **Exit from superstar market at the bottom of the distribution**
   - Given an outside option to participate in the non-superstar market, some lesser talents should exit when superstar effects magnified

Conclusions

1. **Ability versus earnings**
   - Not the same thing
   - Comparative advantage is the missing link
   - That's an *encouraging* lesson
2. **Technological or market structure Δ'*s* could play a central role in Δ'*ing* wage structure**
   - Not Pareto improving
   - Magnifies the importance of comparative advantage
   - Also *reshapes* comparative advantage