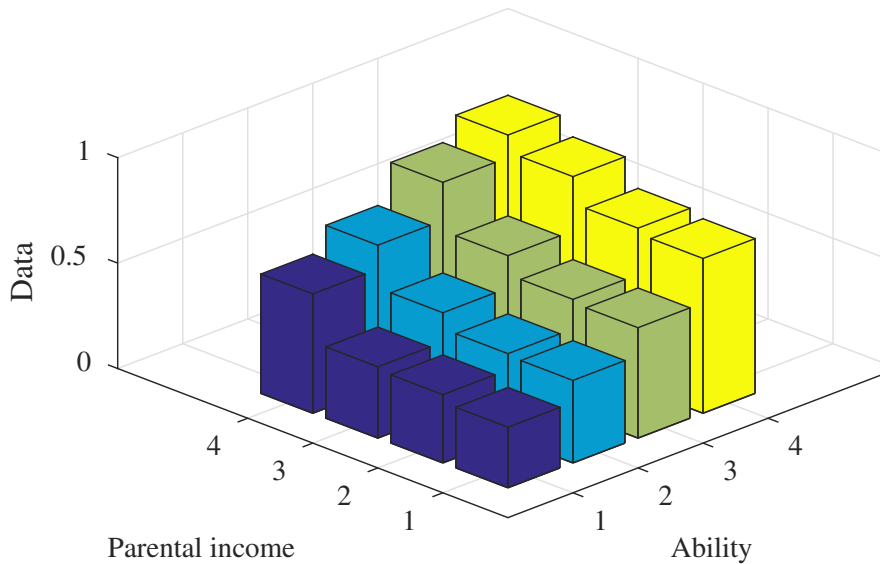


The Changing Roles of Family Income and Academic Ability for US College Attendance

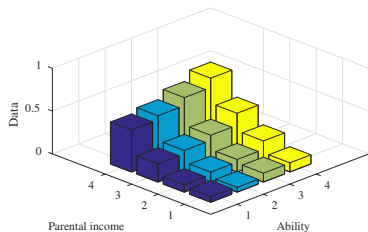
Lutz Hendricks (UNC)
Chris Herrington (VCU)
Todd Schoellman (ASU)

April 27, 2017

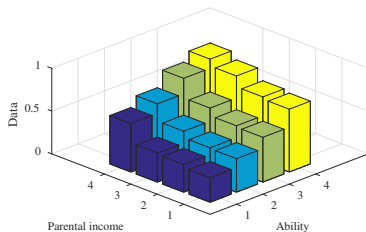
College Entry Rates: NLSY79



Reversal in College Entry Rates



Updegraff (1933)



NLSY79

Before about 1950: **family background** was the main determinant of college entry.

After about 1960: **student ability** was the main determinant.

Contributions

Empirical:

- ▶ Document the reversal
- ▶ Compile roughly 40 historical data sources on college-going behavior
- ▶ 1919--1979

Model:

- ▶ “national integration” of the market for colleges (Hoxby)
- ▶ decline in search costs generates the reversal

Data Sources

Collect studies and datasets that cover **college attendance** by **student ability** and/or **family background**

Sources span 1919 to 1979 HS graduating cohorts.

Modern era (1960--date)

- ▶ Access to original microdata
- ▶ Project Talent, NLSY79, NLSY97

Pre-modern era (1919--1960)

- ▶ No original microdata, rely on published summaries
- ▶ More than two dozen such studies by researchers in many fields.

A Typical Study

Updegraff (1936)

- ▶ sample: 15% of Pennsylvania high school seniors in 1933 who participated in an IQ test
- ▶ family background: socioeconomic status
- ▶ follow-up 1 year later: college entry status

Student ability measured by

- ▶ standardized test scores (IQ tests)
- ▶ sometimes class rank

Family background measured by:

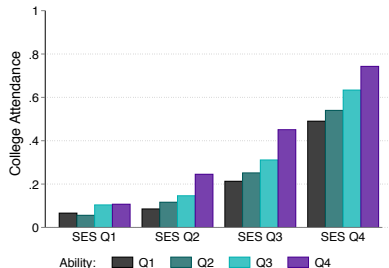
- ▶ parental income
- ▶ socioeconomic status

Documenting the Reversal

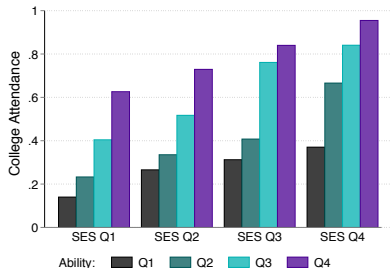
Our strategy:

- ▶ focus on 3 main studies:
 - ▶ Updegraff (1933)
 - ▶ Project Talent (1960)
 - ▶ NLSY79 (1979)
- ▶ show that the reversal is essentially complete by 1960
- ▶ show that the 3 studies represent a broader trend
- ▶ address comparability concerns

The Reversal: 1933 vs 1960

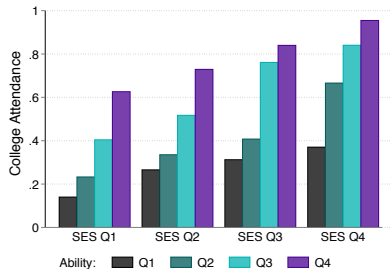


Updegraff (1933)

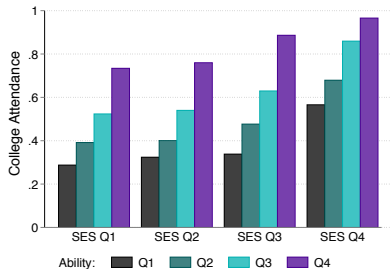


Project Talent (1960)

1960 vs 1979



Project Talent (1960)



NLSY79 (1979)

Supplementary Evidence: Historical Studies

Argue that the 3 main studies are not outliers

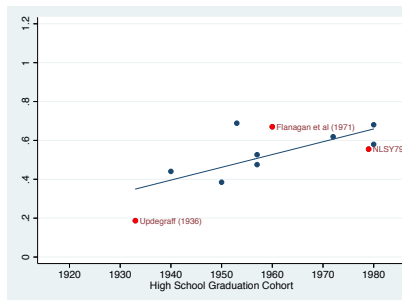
Obtain college entry rates from about 30 historical studies

- ▶ $C(a)$; $C(p)$; or $C(a,p)$
- ▶ a and p are midpoints of percentile ranges

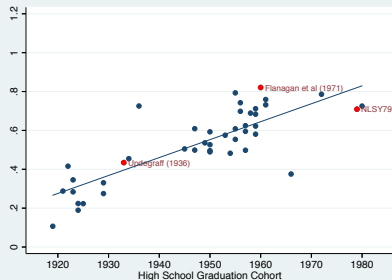
Regress C on a , p , or both

- ▶ Report β_a , β_p
- ▶ Study time series

Academic Ability: β_a

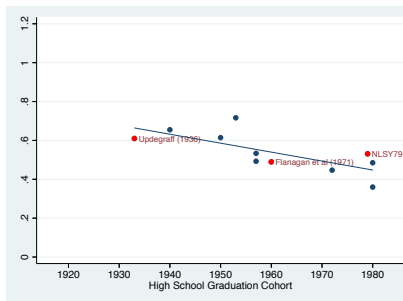


Bivariate studies $C(a, p)$

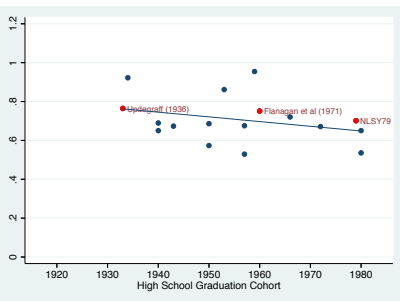


Univariate studies $C(a)$

Family Background: β_p

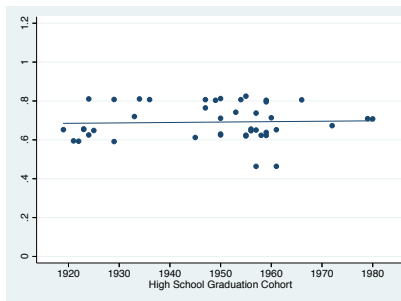


Bivariate studies $C(a,p)$



Univariate studies $C(p)$

NLSY79 Replication of Univariate Studies



Academic ability (β_a)



Family income (β_p)

Data Summary

Reversal in college entry patterns:

- ▶ early: family background dominates
- ▶ late: student ability dominates
- ▶ the reversal occurs roughly during the **1950s**

The 3 main studies we focus on are representative of a broader trend.

Model

National integration of college market (Hoxby, 2009)

1930s: market was **local**

- ▶ Idiosyncratic admissions based on local networks.
- ▶ Little differentiation in colleges. Single applications is the norm.

1960s: market was **national**

- ▶ Standardized admissions with information dissemination.
- ▶ Growing differentiation among colleges. Multiple applications is the norm.

Our approach: model with college **search costs**.

- ▶ abstract from changes in college financing (took place after 1960)

Model Overview

Framework: islands model of college choice

Each island is inhabited by

- ▶ 1 college
- ▶ measure 1 of HS grads

Colleges choose admissions criteria to maximize objective

Students choose whether to work, attend local college, or search

Colleges

College i is endowed with

- ▶ endowment \bar{q}_i ,
- ▶ capacity E

College **quality** depends on average student ability: $q_{it} = \bar{q}_i + \bar{a}_{it}$

- ▶ quality determines how much students learn

Colleges

College i chooses an **admission cutoff** \underline{a}_{it} to solve

$$\max P(q_{it}, e_{it}) = q_{it}e_{it} \quad \text{s.t.} \quad e_{it} \leq E \quad (1)$$

Higher cutoff:

- ▶ Weakly lowers enrollment e_{it}
- ▶ Weakly increases quality

No pricing decisions (for now).

Students

New high school graduates endowed with

- ▶ location i
- ▶ $(a,p) \sim F$

Choose among three options

- ▶ Work as **HSG**, value $V_{HS} = 0$
- ▶ Attend **local** college: $V(a,p,i,t)$
- ▶ **Search** nationally for college: $W(a,p,i,t)$

$$\max \{ V_{HS}(t) + \bar{\eta} \eta_{HS}, V(a,p,i,t) + \bar{\eta} \eta_V, W(a,p,i,t) + \bar{\eta} \eta_W \}$$

Attending Local College

Students can attend local college if $a \geq \underline{a}_{it}$

If so:

- ▶ Live off family resources p for four years
- ▶ Generate human capital $h(a, q_{it}) = a^{q_{it}}$.
- ▶ Work and earn h after graduation
- ▶ Enjoy flow value $V_c(t)$.

Implies the value function:

$$V(a, p, i, t) = \log(p) + \alpha \log[h(a, q_{it})] + V_c(t) \quad (2)$$

Searching Nationally

Students can pay cost $\xi(t)$ to search among all colleges

- ▶ $\xi(t)$ lowers consumption in college
- ▶ Allows students to attend best college they can be admitted to.

Implies the value function:

$$W(a, p, i, t) = \mathbb{E} \left\{ \max_{j: \underline{a}_{jt} \leq a} V(a, p - \xi(t), j, t) + \bar{\xi} \zeta_j \right\}$$

Equilibrium

Equilibrium: \underline{a}_{it} and decision rule $d(a, p, i, t)$ such that:

1. Colleges maximize prestige, subject to capacity constraint.
2. Students maximize utility, subject to admissions criteria.
3. Enrollment is consistent with student attendance decisions.

Generally, equilibrium is not unique.

- ▶ Strategic complementarities induced by peer effects.

Algorithm

We focus on the equilibrium produced by the following algorithm:

1. Guess college qualities q_{it}
2. Calculate student values (local and search).
3. Assign students to colleges. Working from the highest ability down:
 - 3.1 Assign student to most preferred remaining college or work.
 - 3.2 Reduce college capacity as needed.
4. Compare implied q_{it} to guess. Iterate if necessary.

Calibration

Choose 11 parameters

- ▶ $F(a,p)$ is Gaussian copula on $[a_0, a_0 + 1] \times [p_0, p_0 + 1]$, correlation ρ .
- ▶ College capacity E
- ▶ Weight on post-college consumption α .
- ▶ Preference shocks: scale $\bar{\zeta}, \bar{\eta}$.
- ▶ **Time-varying**: college value $V_c(t)$ and search cost $\xi(t)$.

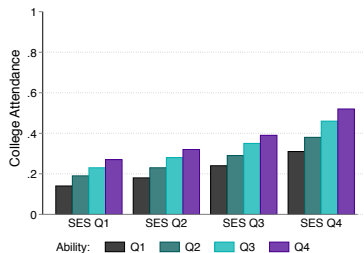
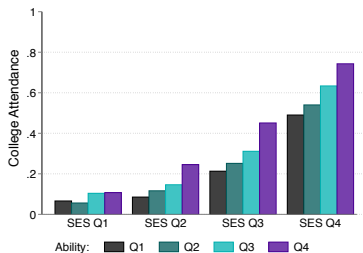
Data moments: for 1933, 1979

- ▶ College entry rates: $C(a,p)$
- ▶ Search: fraction with multiple applications
- ▶ 34 moments

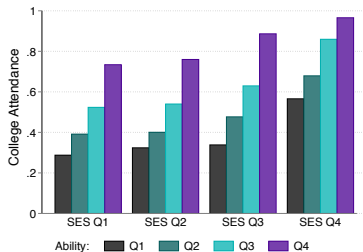
Calibrated Parameters

	Description	Value
Endowments		
a_0	Ability scale factor	1.6
p_0	Transfer scale factor	1.43
ρ	Endowment correlation	0.464
δ	Dispersion of college endowments	0.0211
Colleges		
α	Weight on post college payoffs	2.42
E	College capacity	1.18
Preferences		
$V_c(t)$	Relative value of college	(-2.46, -1.61)
$\xi(t)$	Search cost	(1.91, 1.45)
$\bar{\xi}$	Scale of taste shocks at college entry	0.673
$\bar{\eta}$	Scale of taste shocks when searching	0.37

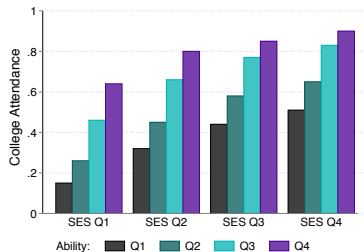
Model Fit



1933 Data



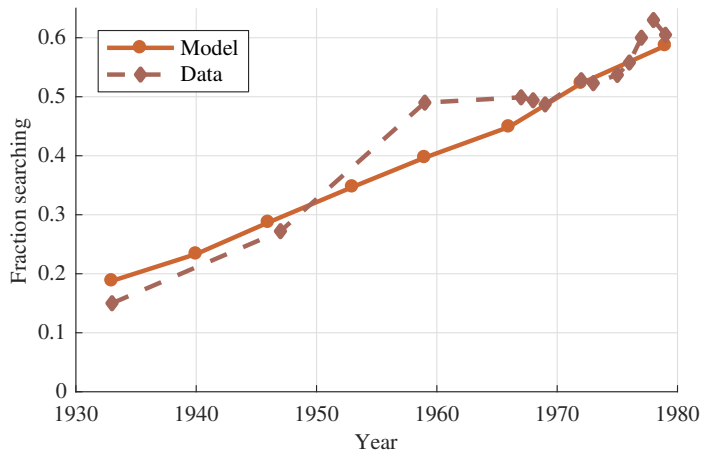
1933 Model



1979 Data

1979 Model

Fraction of Students Searching



Model Mechanics

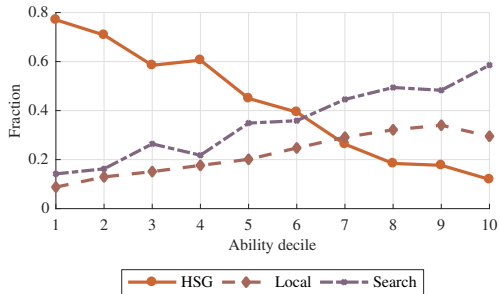
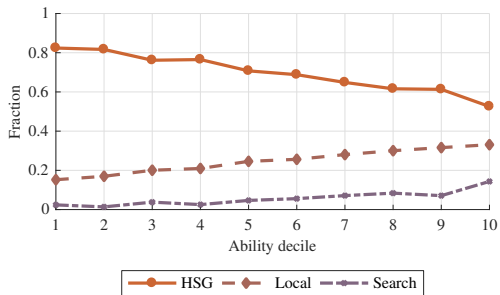
1933:

- ▶ high search cost \Rightarrow most students stay local
- ▶ very little quality variation across colleges
- ▶ little incentive to search

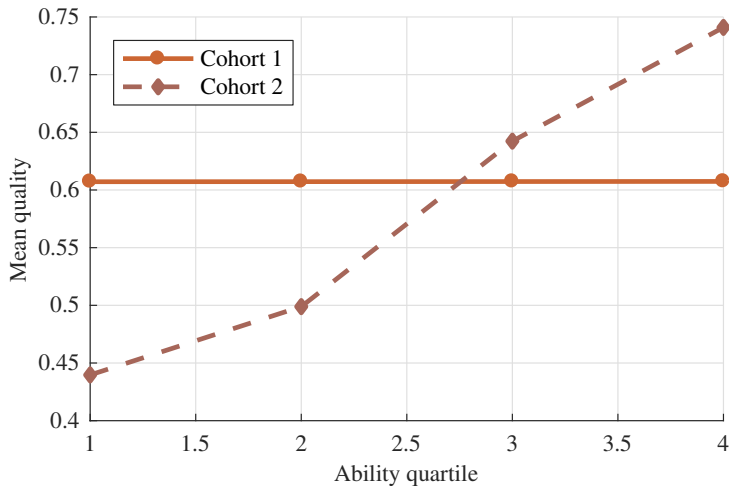
1979:

- ▶ more students search
- ▶ college quality matters most for high ability students
- ▶ high ability most likely to search and attend high quality colleges

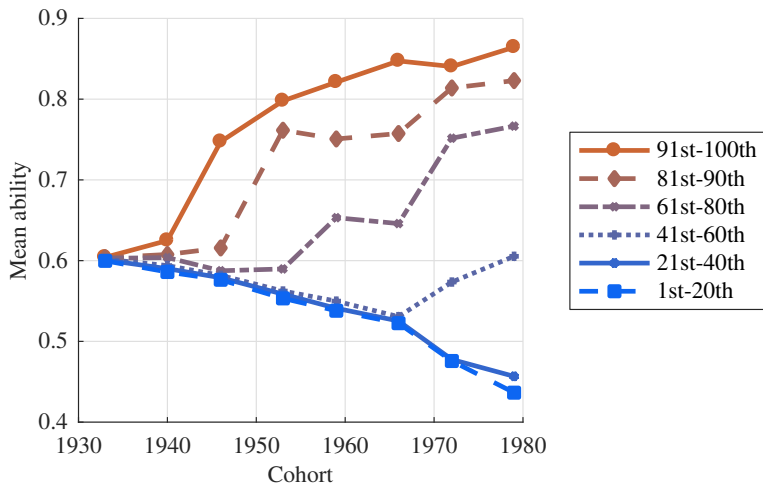
Ability Sorting: 1933 vs 1979



Ability Sorting: 1933 vs 1979



College Selectivity



Consistent with Hoxby (2009)

Results Summary

Model generates change in sorting patterns with two driving forces

- ▶ Quantitatively significant reversal

Key mechanism: search → sorting → available college options

- ▶ Increase in search consistent with the data
- ▶ “Fanning out” of colleges by student ability from Hoxby (2009)
 - ▶ Hoxby: Spread increases from 40 to 70pp, 1962–today
 - ▶ Our model: spread increases from 0 to 40pp, 1933–1979

Conclusion

Empirical: **Reversal** in college attendance patterns around 1950s

Model: decline in **search costs** can account for

- ▶ “national integration” of the market for colleges (more search)
- ▶ increasing stratification of college qualities
- ▶ the reversal