

CALCULATING RETURNS TO
DEGREE
~~USING ADMINISTRATIVE DATA~~

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WORKFORCE DEVELOPMENT

MOTIVATING QUESTIONS

- What are Iowa community colleges role in labor supply?
- Does a college degree provide economic returns to the individual?
- Where do students end up in the economy after leaving a community college?

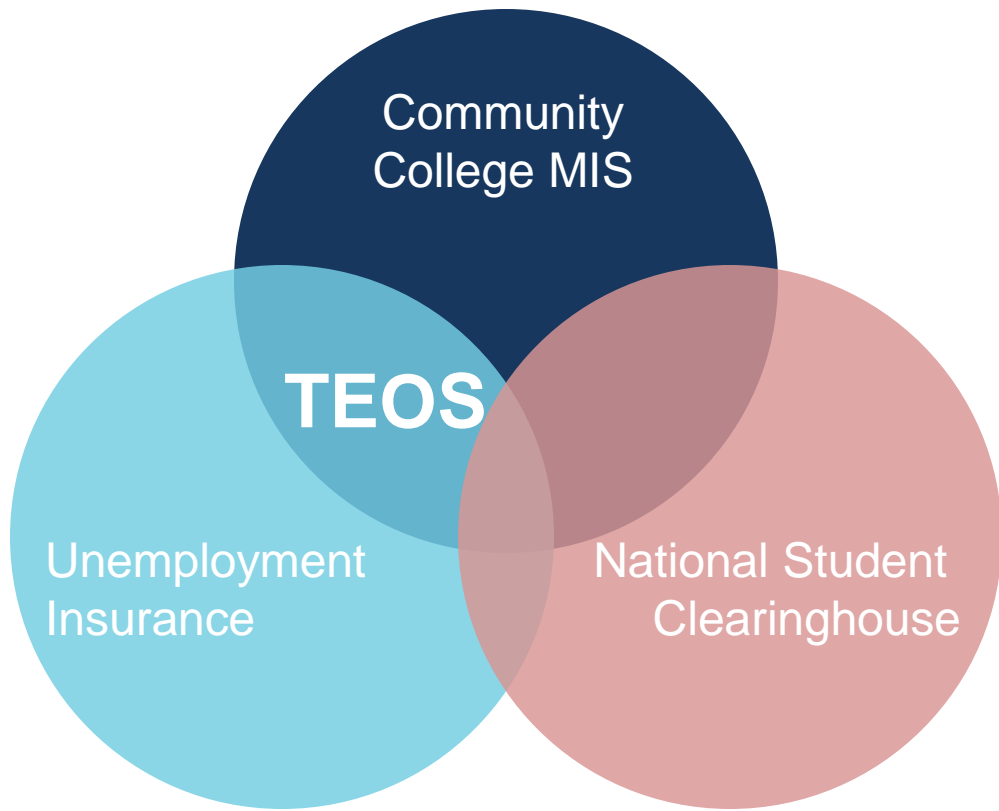
ADMINISTRATIVE RECORDS

- Educational administrative records rose in popularity during the 1990s.
- Actively used to meet state and federal requirements (e.g., Perkins IV Act).
- Unemployment Insurance (UI) records are used to administer unemployment insurance benefits.

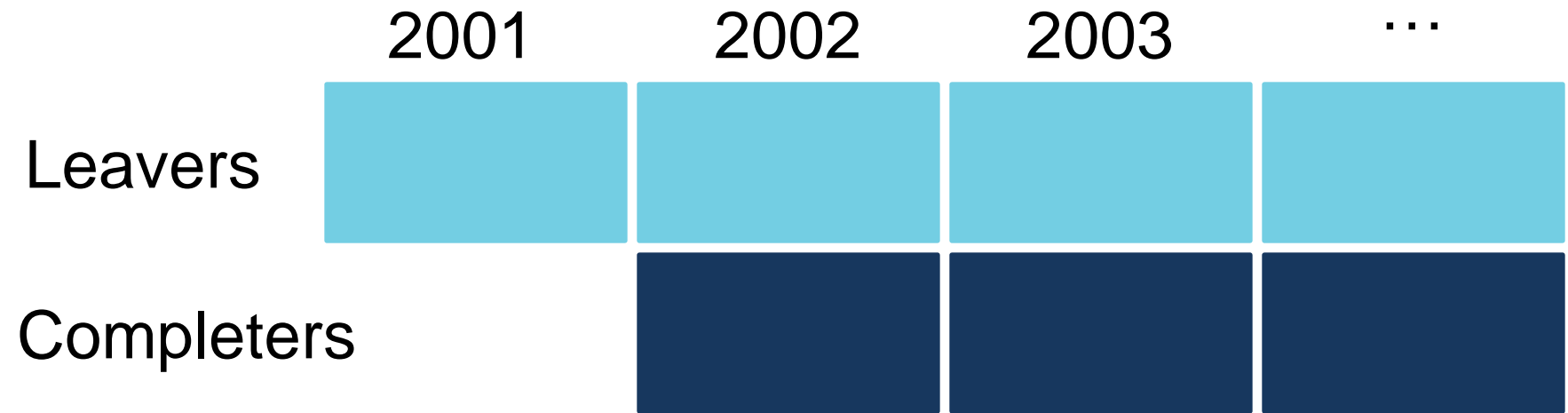
ADMINISTRATIVE RECORDS & WORKFORCE OUTCOMES

- Several studies match educational and workforce records to provide descriptive statistics of wages (Sanchez et al. 1999; Seppanen, 1998; Gracie, 1998).
- However, these studies do not attempt to find whether the wages cover the costs of education.

TRAINING AND EMPLOYMENT OUTCOMES SYSTEM

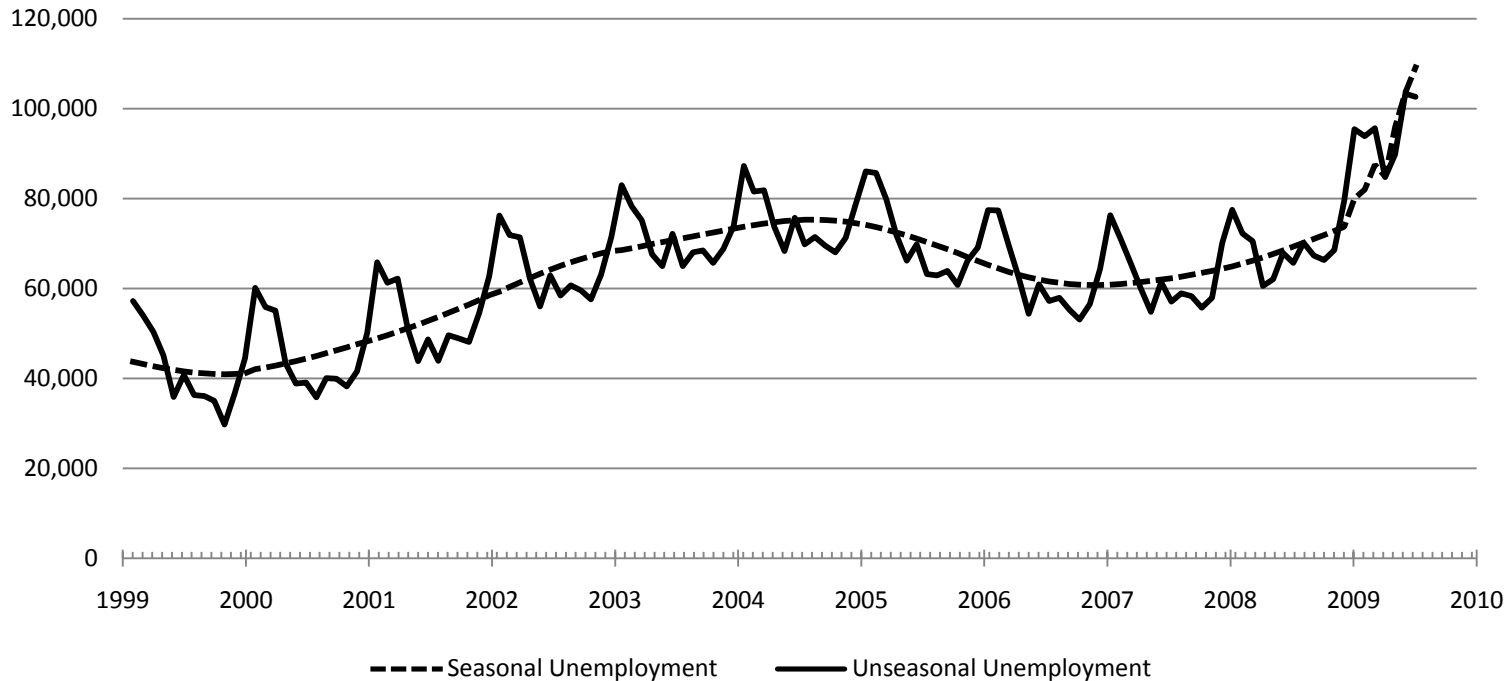


STAGGERING COHORTS



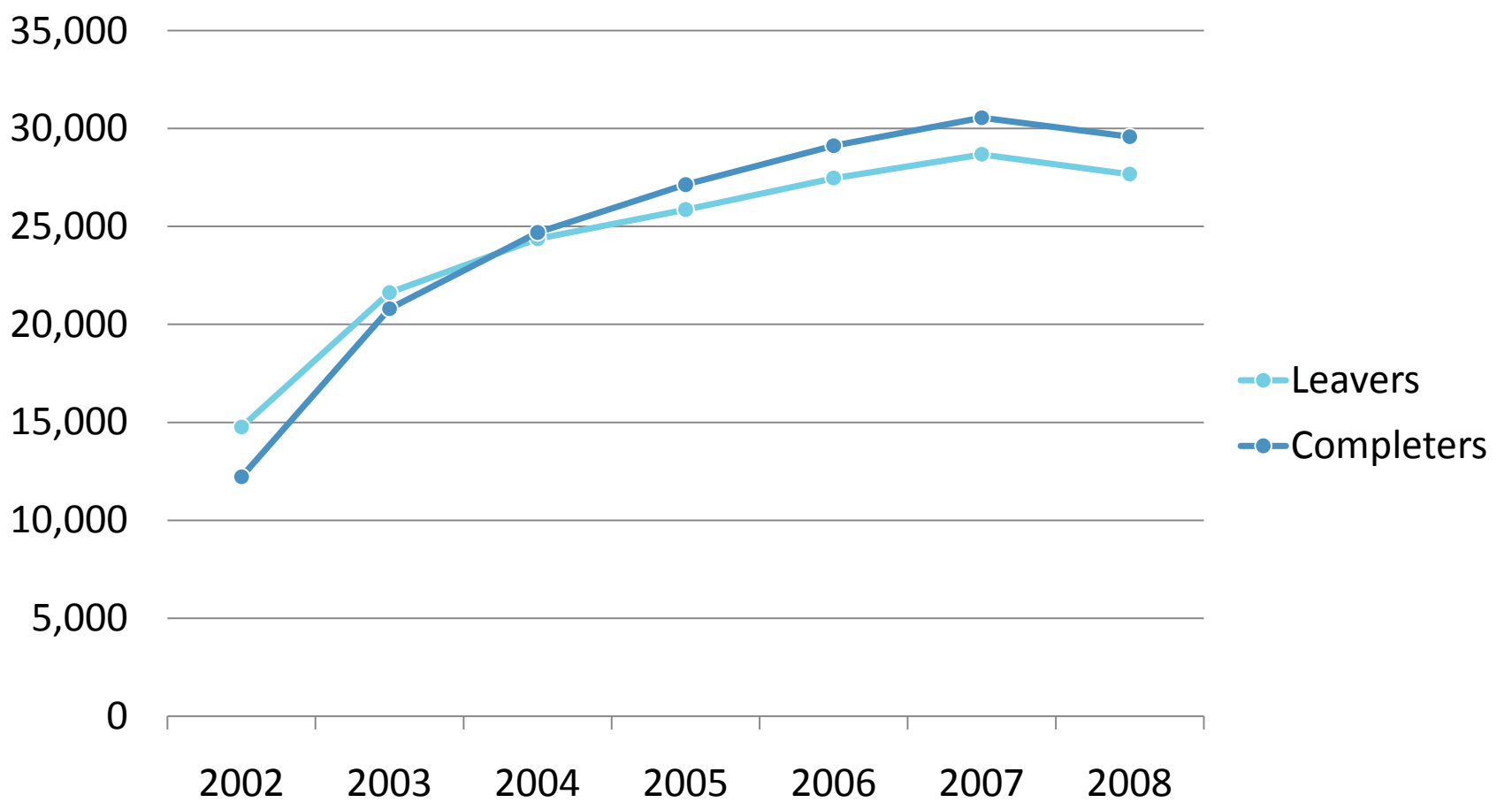
UNEMPLOYMENT INSURANCE

Other studies utilizing UI records only include students who worked all four quarters, which ignores seasonal unemployment.



DESCRIPTIVE WAGES: 2002

COHORT



RETURNS TO DEGREE

- Returns to degree calculations have been around since 1964 (Becker).
- More popular since 1972 (Mincer).
- Literally hundreds of papers today.

COSTS OF HIGHER EDUCATION

- Direct costs (e.g., tuition)
- Opportunity costs (e.g., lost wages)
- Time costs (e.g., higher wages later in life)

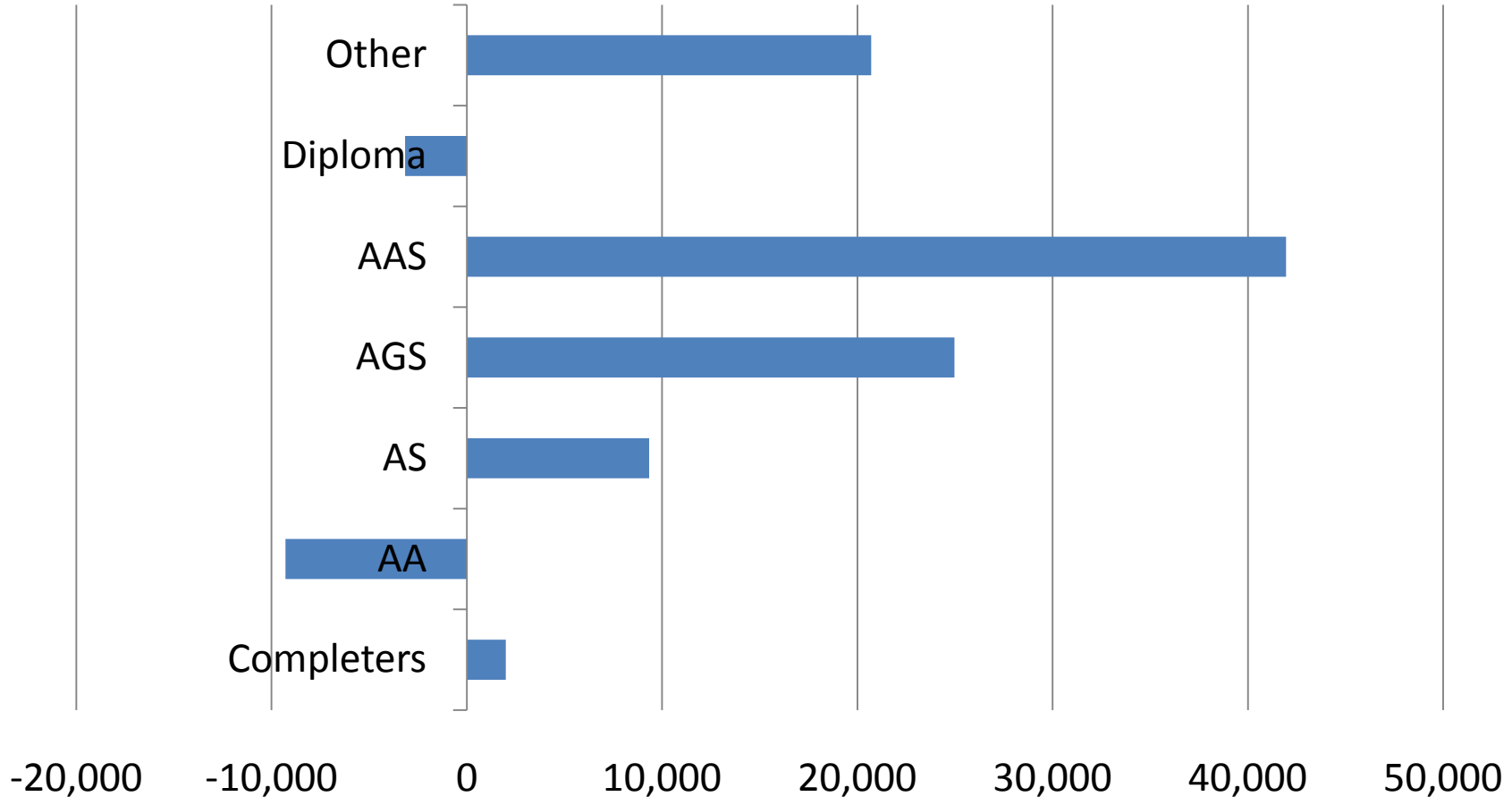
RATE OF RETURN FORMULATION

$$\sum_{t=1}^T \frac{W_{ti} - W_{tj}}{(1 + i)^t} - C$$

STRATEGY

- Assume an interest rate, i , to find the net present value – the dollar value of completing a degree.
 - The dollar value for completing a degree.
- Solve for the interest rate to get the rate of return.
 - How much is returned for every dollar spent?

NET PRESENT VALUE BY COMPLETION STATUS



POLICY INTERPRETATION FOR NET PRESENT VALUE

- NPV for Completers: \$1,934
- How much money will it take to convince students to leave community college and enter the workforce? NPV!
- NPV for AA recipients: \$-9,286.
- How much money will it take to convince students to remain in school? NPV!
- NPV is the *compensation differential*.

SOLVING FOR INTERNAL RATE OF RETURN

$$\sum_{t=1}^T \frac{W_{ti} - W_{tj}}{(1 + i)^t} - C$$

$$i = \text{[scribble]}$$

MATRIX FORMULATIONS

Matrix of wages for *completers*

$$\mathbf{Y} = \begin{pmatrix} y_{1,1} & y_{1,2} & \cdots & y_{1,T} \\ y_{2,1} & y_{2,2} & \cdots & y_{2,T} \\ \vdots & \vdots & \ddots & \vdots \\ y_{n,1} & y_{n,2} & \cdots & y_{n,T} \end{pmatrix}$$

Matrix of wages for *leavers*

$$\mathbf{X} = \begin{pmatrix} x_{1,1} & x_{1,2} & \cdots & x_{1,T} \\ x_{2,1} & x_{2,2} & \cdots & x_{2,T} \\ \vdots & \vdots & \ddots & \vdots \\ x_{m,1} & x_{n,2} & \cdots & x_{n,T} \end{pmatrix}$$

MATRIX FORMULATIONS

Let d be a vector of discount rates .

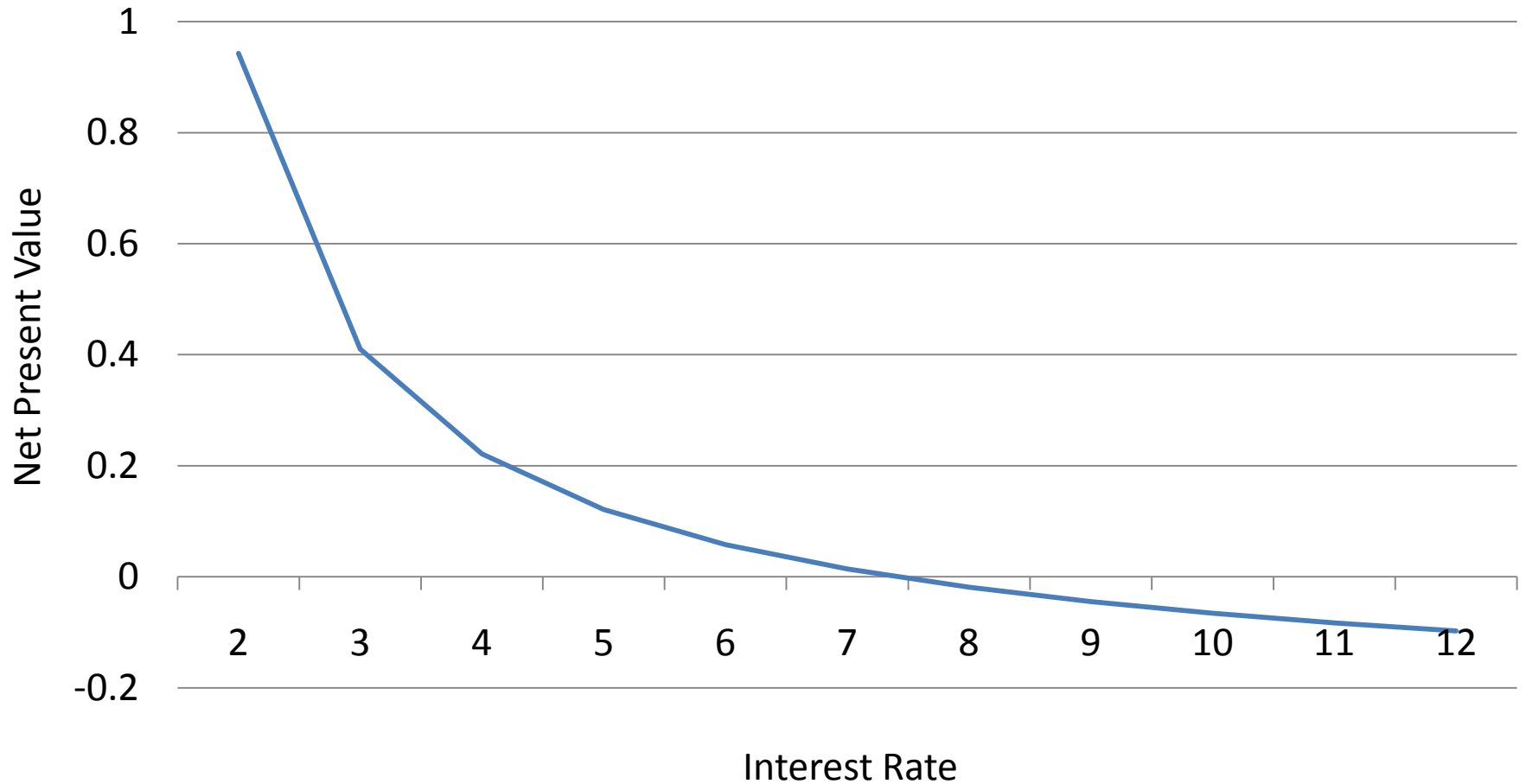
$$\vec{d} = \left[\frac{1}{(1+i)^1} \quad \dots \quad \frac{1}{(1+i)^T} \right]$$

When we assume an interest rate, then the net present value is:

$$\vec{F} = (\mathbf{Y} - \mathbf{X}) \bullet \vec{d} - \vec{c}$$

Where F is an n -element vector of net present values for each student.

RELATIONSHIP BETWEEN NET PRESENT VALUE AND INTEREST



NEWTON-RHAPSON MULTIPLE ITERATION

Let $f(r) = \sum_{t=1}^T \frac{Y_j - X_j}{(1+i)^t} - c = 0$ so the Jacobian is:

$$\vec{J}(r) = \begin{pmatrix} \frac{\partial f_1}{\partial i} \\ \vdots \\ \frac{\partial f_n}{\partial i} \end{pmatrix}$$

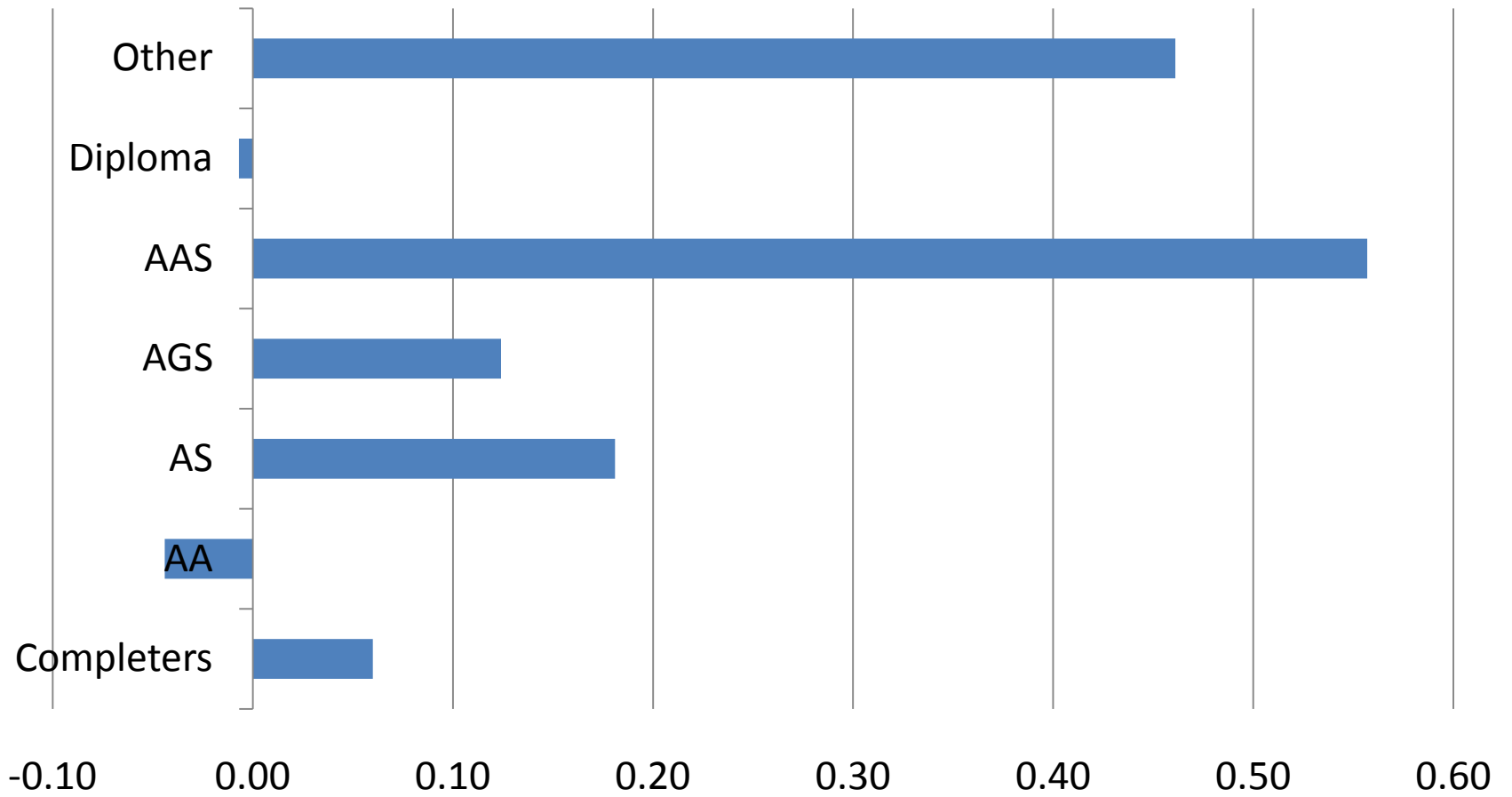
NEWTON-RHAPSON MULTIPLE ITERATION

Find an a_0 so $F(a_0) = 0$. Guess an initial value, a_k and then follow the procedure:

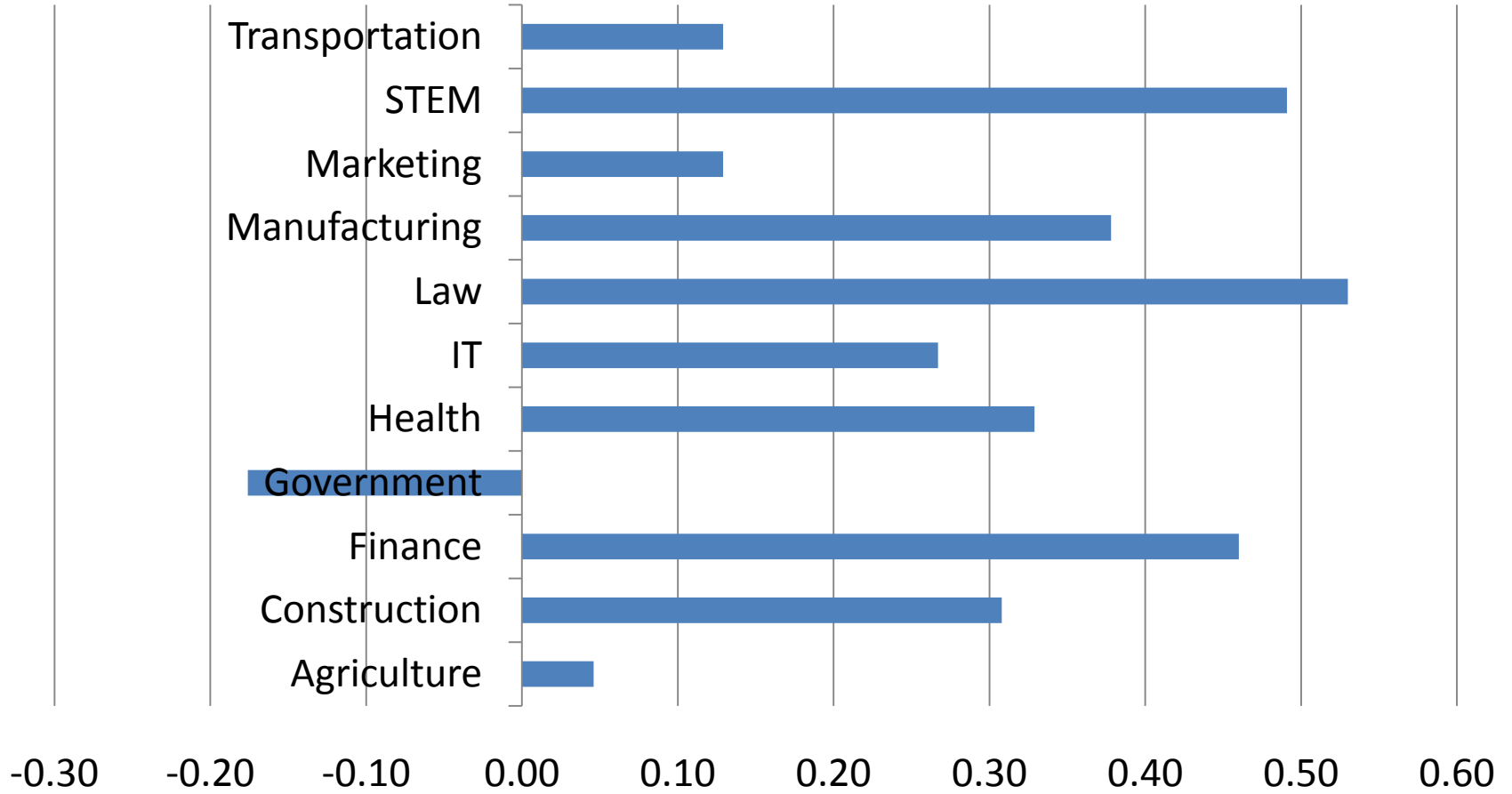
$$a_{k+1} = a_k - [\vec{J}(a_k)]^{-1} \vec{F}(a_k)$$

Until a_{k+1} is sufficiently close to zero. Thus $a_{k+1}-1$ is the rate of return.

RETURNS BY AWARD



RETURN BY CAREER CLUSTER

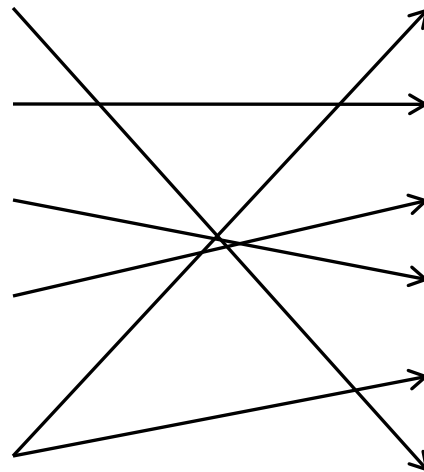


COMPARING METHODOLOGIES

- What matters most about returns by program? → Ranks!

2008 Wage Levels

1. Government
2. STEM
3. Manufacturing
4. Finance
5. Transportation



Rate of Return

1. Law
2. STEM
3. Finance
4. Manufacturing
5. Health

SPEARMAN CORRELATION BETWEEN RANKS

	Wage Levels (2008)	Cumulative Change	Annual Change	Present Value	Net Present Value	Rate of Return
Wage Levels (2008)	1.00*** (0.00)					
Cumulative Change	0.63** (0.01)	1.00*** (0.00)				
Annual Change	-0.63** (0.01)	-1.00*** (0.00)	1.00*** (0.00)			
Present Value	0.76*** (0.00)	0.48 (0.06)	-0.48 (0.06)	1.00*** (0.00)		
Net Present Value	0.76*** (0.00)	0.45 (0.08)	-0.45 (0.08)	1.00*** (0.00)	1.00*** (0.00)	
Rate of Return	0.70*** (0.00)	0.40 (0.12)	-0.40 (0.12)	0.97*** (0.00)	0.97*** (0.00)	1*** (0.00)

Note: P-values are shown in parenthesis. 5 percent significance is denoted by *, 2.5 percent **, 1 percent, ***.

ESTIMATED NATIONAL RETURNS

- Generally, each additional year of education returns 10 percent (Card, 1999; Psacharopoulos, 1994; Psacharopoulos & Patrinos, 2002; etc.)
- Community college to High School returns is between 15 and 27 percent (Leigh & Gill, 1997; Kane & Rouse, 1995, 1999).

ESTIMATED RETURNS & IOWA'S ESTIMATES

- Earning a degree versus leaving early returns is between 6 and 14 percent.
- Iowa's estimates show returns of 6 percent.
- Still early in a student's career, 10 to 15 years later will be better estimates.

SUMMARY

- Net present value provides a single amount which can be used to persuade decisions.
- Rate of return provides a dollar-free, single value that is nationally and internationally comparable.
- These measures lead to distinct differences in the qualitative interpretations.