

Estimating the Social Value of Higher Education: Willingness to Pay for Community and Technical Colleges

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joint with

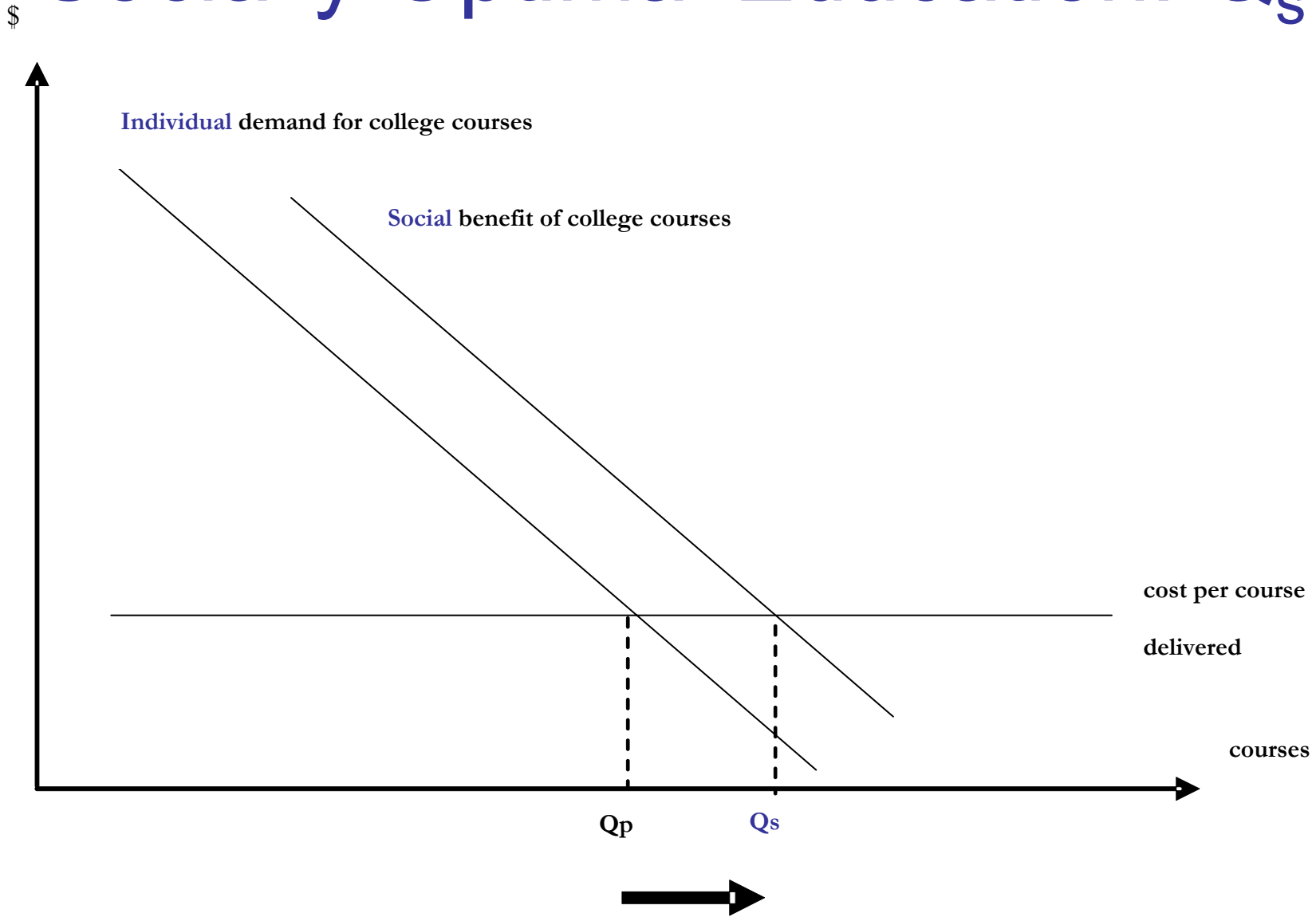
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Socially Optimal Education: Q_s



Private, Individual Returns? YES

Market

- *Card Handbook of Labor Econ* (1999)
OLS 5-10% earnings, IV & twins 10%+
- Heckman, Lochner, & Todd *Handbook of Econ Educ* (2006) general, nonparametric, nonstationarity

Private, Individual Returns? YES

Nonmarket

- Grossman *HEE* (2006) nonmarket, health Marshall's worker/consumer, +5% points
- Cutler & Llera-Muny *NBER* (2006) VSL, +1-5% points
- Becker & Murphy *JHC* (2007) recent increases in nonmarket returns > market returns

External Productivity Benefits? Yes

- Urban agglomeration & endogenous growth
- Moretti *J.Econometrics* (2004) *Handbook U&R* (2004) Area education raises wages & growth
1970,80,90 Census wage eqns., share of college grads, +1% share → +0.6 to 1.2% ave. wage
- Instrumental variables: land grant college, lagged city demographic structure

External Productivity Benefits? No

- Lange & Topel *HEE* (2006) review + new
- Endogeneity of wages & area education, spatial equilibrium, more able sort to better areas
- 1940-2000 Census data, wages & area educ – yes control for labor quality – no, impact fades
Critical of compulsory schooling laws on hs, not college
- “No strong reason to believe in importance of production externalities from education”

External QOL Benefits? Yes

Health

- Wheeler, St. Louis Fed (2008)
- Panel US cities, 1990 & 2000, Census & National Center Health Statistics cause of death data
- Higher area education (college) → lower mortality rates (conditional on age, race, sex, education)
5% point decrease college share → 14-40 % increase death rate
- Instruments: 1980 age distribution and land grant colleges

External QOL Benefits? Yes

Less Crime

- Lochner & Moretti *AER* (2004)
- Census & FBI data, 1960, 1970, 1980 (also NLSY)
- extra year of schooling → 0.10 point reduction prob(incarceration) for whites; 0.37 point for blacks
greatest: murder, assault, motor vehicle theft
- External effect: 14-26% of private return
- Instruments: compulsory school attendance laws from Acemoglu and Angrist *NBER Macro* (2000)

External QOL Benefits? Yes

Better Public Governance: Voting

- Dee *JPubE* (2004)
High School & Beyond 1980, 1984, 1992
Instrument: proximity to community college as teen
College entrance → 17-22 % point increase prob(vote)
- Milligan, Moretti, & Oreopoulos *JPubE* (2004)
1948-2000 National Election Studies US
Instrument: compulsory schooling laws
High school grad → 30 % point increase prob(vote)

External QOL Benefits? Yes

Better Public Governance: Corruption

- Glaeser & Saks *JPubE* (2006)
- Federal convictions for corruption by state in US
1976-2002 U.S. Department of Justice data
- Instruments: Median hh income 1940 &
Congregationalist church membership share 1890
- College share inc 1 SD → convictions dec half SD OLS
Twice as strong if IV

Typical Effect of Productivity Spillovers: Our OLS Earnings Regression (Census)

	Males	Females
Individual education		
Associate's Degree	0.209***	0.414***
	(0.018)	(0.018)
Region Level Education		
Percent Associate's or More	0.739***	0.728***
	(0.036)	(0.042)

Other Schooling, Experience & Sq, Black, Married, Divorced N = 38,583

N = 37,396

Evidence of Spillovers? Mixed

- Correlations *are* strong!

- Productivity: probably no?

Lange & Topel (2006) in Hanushek & Welch's *HEE*

Instruments good enough? Sorting,

Compulsory schooling laws influence high school

- QOL: yes, not as sensitive to IV

- Total Social Value approach, complements IV

Our Estimates of Values of Higher Education

- ***Total Social***: Value directly & indirectly to all residents – contingent valuation survey
- ***Individual***: Value directly to students – Earnings, two estimates from two data sets
- ***External*** = Total Social – Individual

Three Related Analyses

WTP: Willingness to pay for an expansion of KCTCS
(random sample surveys of Kentuckians with
 $n \approx 1,000$)

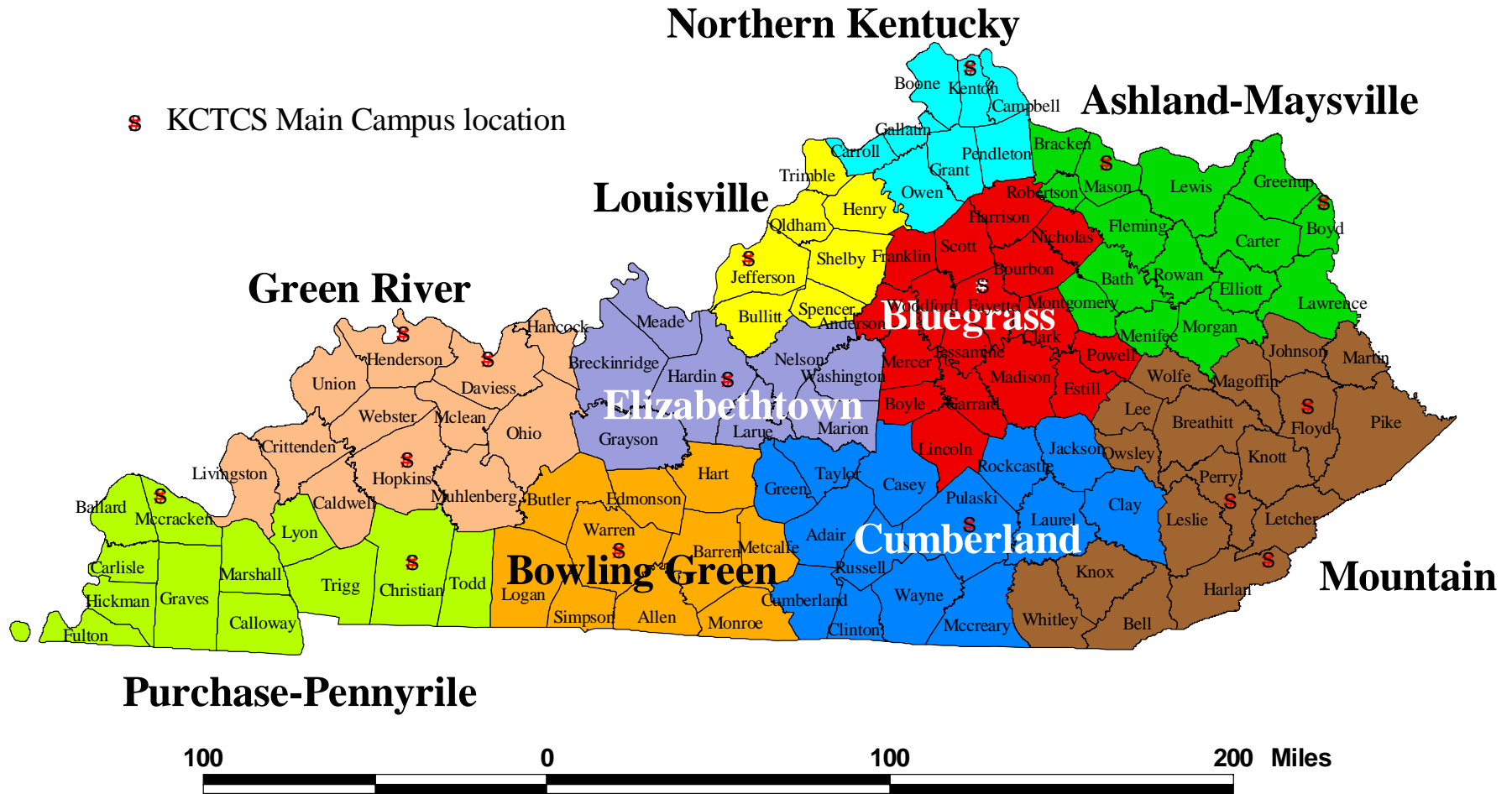
EARNINGS, Long-run: work-life financial returns from
an associate's degree for Kentucky residents
2000 Census data (76,000 individuals)

EARNINGS, Short-run: financial returns from degree,
diploma, or certificate
administrative data from KCTCS & KY ($n=22,000$)

Kentucky Community and Technical College System (KCTCS)

- 16 colleges with 65 campuses
- Open admissions policy
- 2-year curriculum, transfer credits
- Continuing education, work force training, adult education, community development programs
- Associate Degree, Diploma, Certificate

Kentucky Geographic Regions



Based upon U.S. Census Bureau Public Use Microdata Areas (PUMAs) and KCTCS campus enrollment clusters (based on students' counties of residence).

Our Estimates of Values of Higher Education

- *Total Social*: Value directly & indirectly to all residents; contingent valuation survey
- *Individual*: Value directly to students – Earnings, two estimates from two data sets
- *External* = Total Social – Individual

Total Social Value - WTP

- Measure the overall, total, social benefits to Kentucky residents of expanding the KCTCS

including both

- Value to students: increased *earnings*
- Value to nonstudent residents of Kentucky: education *externalities*

Contingent Valuation: WTP

- ❖ CVM: tool to value specific goods/services not typically traded in a market
- ❖ Scenario: WTP specified dollar amount for a 10% expansion in KCTCS programs
- ❖ Information, description, elicitation format, valid
- ❖ Random sample of Kentucky households

Related Contingent Valuation

- Drago et al. *ILRR* (2001) teachers WTP work/family benefits, users & nonusers
- Cawley *NBER* (2006) NY residents WTP to reduce childhood obesity
- Escobar et al. *EdEvalPolAnalysis* (1988) parents of handicapped children in Iowa, preschool
- Stair et al. *EcEducRev* (2006) rural Penn residents WTP quality high schools
- **NONE:** WTP higher education, social value

A Survey about Budget Choices and Community Colleges



Choices for Kentucky's Overall State Budget: Information & Tradeoffs

“Warm up”

“If you were making the choices for the state of Kentucky and an extra \$100 million were available to be added to the existing budgets, how much of the \$100 million would you put in each of the following budget categories?”

Choices for Kentucky *Overall* State Budget

1	\$ _____	AGRICULTURE: Animal health, livestock services, and pest management
2	\$ _____	CULTURAL INSTITUTIONS: State libraries, arts and humanities, museums, and historical societies.
3	\$ _____	ECONOMIC DEVELOPMENT: Industrial development, marketing information, community and regional planning, housing and building construction.
4	\$ _____	ENVIRONMENT: Air and water pollution prevention, waste management, mining and minerals, forestry, conservation, and energy efficiency.
5	\$ _____	FINANCE AND REVENUE: Investment and debt management, computer information systems, property valuation, taxation and collection.
6	\$ _____	HEALTH CARE: Medicare, Medicaid, county health departments, mental health services, and services for the disabled.
7	\$ _____	HUMAN RESOURCES: Social services, food stamps, and aid to families with dependent children.
8	\$ _____	JUSTICE: Jails and correctional systems, state police, and the courts.
9	\$ _____	LABOR AND WORKER'S COMPENSATION: Occupational safety and health payments to workers suffering job-related injuries and diseases
10	\$ _____	NATIONAL GUARD: Military affairs, veterans affairs, and disaster relief.
11	\$ _____	SCHOOLS: Public elementary, middle, and high school construction and maintenance, teacher salaries and retirement system, and Kentucky Educational Television.
12	\$ _____	TOURISM: State parks, fish and wildlife programs, and the state fair.
13	\$ _____	TRANSPORTATION: Highway construction and maintenance, airports, and public transportation.
14	\$ _____	UNIVERSITIES: State university and community college construction and maintenance, faculty/staff salaries, research, and student loans.

Choices for *Public Education Budget*

CHOICES FOR KENTUCKY'S OVERALL PUBLIC EDUCATIONAL BUDGET

Budget choices are made all the time within state agencies. If you were making the choices for the education budget for the state of Kentucky and an extra \$100 million were available to be added to the budget categories shown below, how much of the \$100 million would you put in each category? If you put more money into a given category, the programs in that category would be expanded. If no money is allocated to a given category, programs would be maintained at current levels. The total should add up to 100.

1	\$ _____	LOCAL K-12 PUBLIC SCHOOLS: Expenditures in this category are used to fund teaching and learning programs, tutoring services, nutrition and health services, student assessment programs, construction of new buildings, and purchases of new technology for local K-12 public schools.
2	\$ _____	STATE 4-YEAR COLLEGES: Expenditures in this category are used to fund instruction, research, public service, academic support, scholarships/fellowships, construction of new buildings, and purchases of new technology at the state 4-year colleges such as the University of Kentucky, the University of Louisville, and the regional state universities.
3	\$ _____	KENTUCKY COMMUNITY AND TECHNICAL COLLEGE SYSTEM: Expenditures in this category are used to fund instruction, public service, academic support, scholarships/fellowships, construction of new buildings, and purchases of new technology for the Kentucky Community and Technical College System.
4	\$ _____	VOCATIONAL AND WORK FORCE TRAINING PROGRAMS: Expenditures in this category are used to fund education and technical training to new and existing workers to match the needs of Kentucky businesses and industry.

Choices for *KCTCS* Budget

1	\$ _____	INSTRUCTION: This budget category is used for academic instruction, occupational and technical instruction, community education, preparatory and adult basic education, and departmental research.
2	\$ _____	PUBLIC SERVICE: This budget category is used for services designed to benefit community members, such as seminars, community projects, and hosting organizations that provide service to particular community sectors.
3	\$ _____	ACADEMIC SUPPORT: This budget category is used to provide media and technology, museums and galleries, audio/visual services, computing services, and faculty development courses to the Kentucky Community and Technical College System.
4	\$ _____	CAMPUS LIBRARIES: This budget category is used to provide information services to students, faculty, and staff. Resources and services include books, periodicals, interlibrary load, and on-line access to library services.
5	\$ _____	STUDENT SERVICES: This budget category is used for student social and cultural activities, counseling and career guidance, student admissions and records, student health services, and intercollegiate activities.
6	\$ _____	INSTITUTIONAL SUPPORT: This budget category is used for administrative services, public relations, and employee benefits.
7	\$ _____	OPERATION AND MAINTENANCE OF PLANT: This budget category is used for operation and maintenance of physical plant, campus grounds, facilities, utilities, and property insurance.
8	\$ _____	SCHOLARSHIPS: This budget category is used to provide awards, scholarships, grants and scholastic prizes to students.
9	\$ _____	STUDENT FINANCIAL AID: This budget category includes state, local, and federal funds available to students as low interest loans.

Benefits of Education & Training

1	\$ _____	ECONOMIC DEVELOPMENT: Increased education or training improves the local workforce, thus benefiting local business and attracting new businesses.
2	\$ _____	LOCAL PURCHASES: Postsecondary institutions make purchases of goods and services from surrounding businesses and individuals.
3	\$ _____	CRIME: Education and training operate through various channels to lower the number of violent crimes and property crimes.
4	\$ _____	BETTER PUBLIC DECISION MAKING: Having better educated or well trained residents results in better decision making on civic matters such as voting and more knowledgeable public officials.
5	\$ _____	TECHNOLOGY: Increased education or training promotes technological change or makes it easier to use existing technology.
6	\$ _____	WAGES OF ATTENDEES: Individuals with more education tend to have higher wages. The higher wages are in the form of increased pay at existing jobs or new career opportunities with higher pay.
7	\$ _____	WAGES OF NON-ATTENDEES: Individuals with more education or training tend to raise the productivity and wages of those who work with them, even those who do not directly seek more education.
8	\$ _____	OWN HEALTH: Individuals with more education or training tend to make better decisions about their lifestyles and health and are thus healthier.
9	\$ _____	HEALTH OF NON-ATTENDEES: Individuals with more education or training tend to have better health which can be beneficial to those around them due to lower chances of getting sick.

Dichotomous Choice Elicitation of WTP

“Would you vote for the referendum to expand the Kentucky Community and Technical College System by 10% here and now if you were required to pay a one time $\$T$ out of your own household budget?”

Yes

No

($T = \$25$ to $\$400$, 8 prices, each person gets one price)

WTP in Hypothetical Market

The
Good

The Kentucky Community and Technical College System provides services to over 86,000 attendees in the state of Kentucky. The system currently offers 96 programs of study ranging from auto body repair to nuclear medicine technology. The system, like many state activities, changes over time in response to preferences of individuals like you. For this study, please consider a hypothetical expansion of **10%** in the size of the system. The **10%** expansion would increase the number of programs offered at the Community and Technical College System from **96 to 105**. In addition, the expansion would include an increase in the number of faculty, staff, and structures to accommodate the expansion.

Much of the funding for the Kentucky Community and Technical College System comes from tax dollars. Private citizens have a say in how tax dollars are spent by voting during elections that include public referendums.

Referendum

Please consider one such public referendum. The issue to be decided is whether to expand the Kentucky Community and Technical College System by **10%** (as described above). The expansion would only take place if a majority votes for the expansion in a public referendum. The referendum would require every tax payer to pay an additional, one-time **\$400** increase in their taxes.

Assume that you are being offered the opportunity to vote on the referendum described to you.

Price

Q12 Would you vote for the referendum to expand the Kentucky Community and Technical College System by **10%** here and now if you were required to pay a one time **\$400** out of your own household budget?

Hypothetical Bias

Will individuals who say
“yes” they will pay in
contingent valuation
actually, really pay?

Mitigating Hypothetical Bias

- **Ex ante** – before WTP question (design)
budget reminders, cheap talk, consequentiality
- **Ex post** – after WTP question
follow up certainty, calibration
- **In medius res** - during
don't know/no opinion (NOAA)
payment card with certainty at each price

Follow Up Certainty Question

- Are you “probably sure” or “definitely sure” that you would contribute \$400 for the expansion of the Kentucky Community and Technical College System?
- Probably Sure
- **Definitely Sure**

For “no” also

“Eliciting Willingness to Pay
without Bias:
Evidence from a Field Experiment”

The Economic Journal (2008)

Karen Blumenschein
Glenn C. Blomquist
Magnus Johannesson
Nancy Horn
Patricia Freeman

Study Design – Health Good

Type-2 diabetes management program offered by trained pharmacist

- 3 appointments over 3 months for approximately 2 hours total time
- Measure blood pressure, hemoglobin A1c, weight
- Discuss symptoms, diet, exercise, and personal management
- Not part of insurance plans and not offered on market

Study Design - Sample

- Pharmacy patients who are diabetic
- Scientific study involving 20 minute interview at pharmacy
- Face-to-face, in-person interviews
- Paid \$25
- May 1 – July 23, 2003 in Kentucky, USA
- Approximately 270 consumer/patients – 90 in each of the 3 groups

Study Design – 3 Groups

1. **REAL** – actually offered the program & provided if purchased
 2. **HYPOTHETICAL** – dichotomous choice contingent valuation*
 3. **HYPOTHETICAL** – “Cheap Talk” before contingent valuation*
- ***CERTAINTY FOLLOW UP** questions were asked of hypothetical groups

Study Design – cont.

- Compare real purchases with hypothetical purchases adjusted for certainty
- Prices: One price per individual. Vary among individuals. \$15, \$40, or \$80
- Highly similar individuals in groups – 21 Household, Health, and Socioeconomic characteristics. 2 significant differences

Table 1. Percentage of YES Responses – *Real* Purchases

Price	Real group
	%
\$15	45
\$40	23
\$80	10
All	26

Downward-sloping demand curve

Table 2. Percentage of Yes Responses: Real Purchases vs. All Hypothetical

Price		Real group	Hypothetical group: All yes responses	
		%	%	p-value*
\$15		45	71	0.040
\$40		23	41	0.129
\$80		10	19	0.301
All		26	45	0.006

*Contingency table Pearson Chi-square test

Hypothetical Bias: Real 26% < Hypothetical All 45%

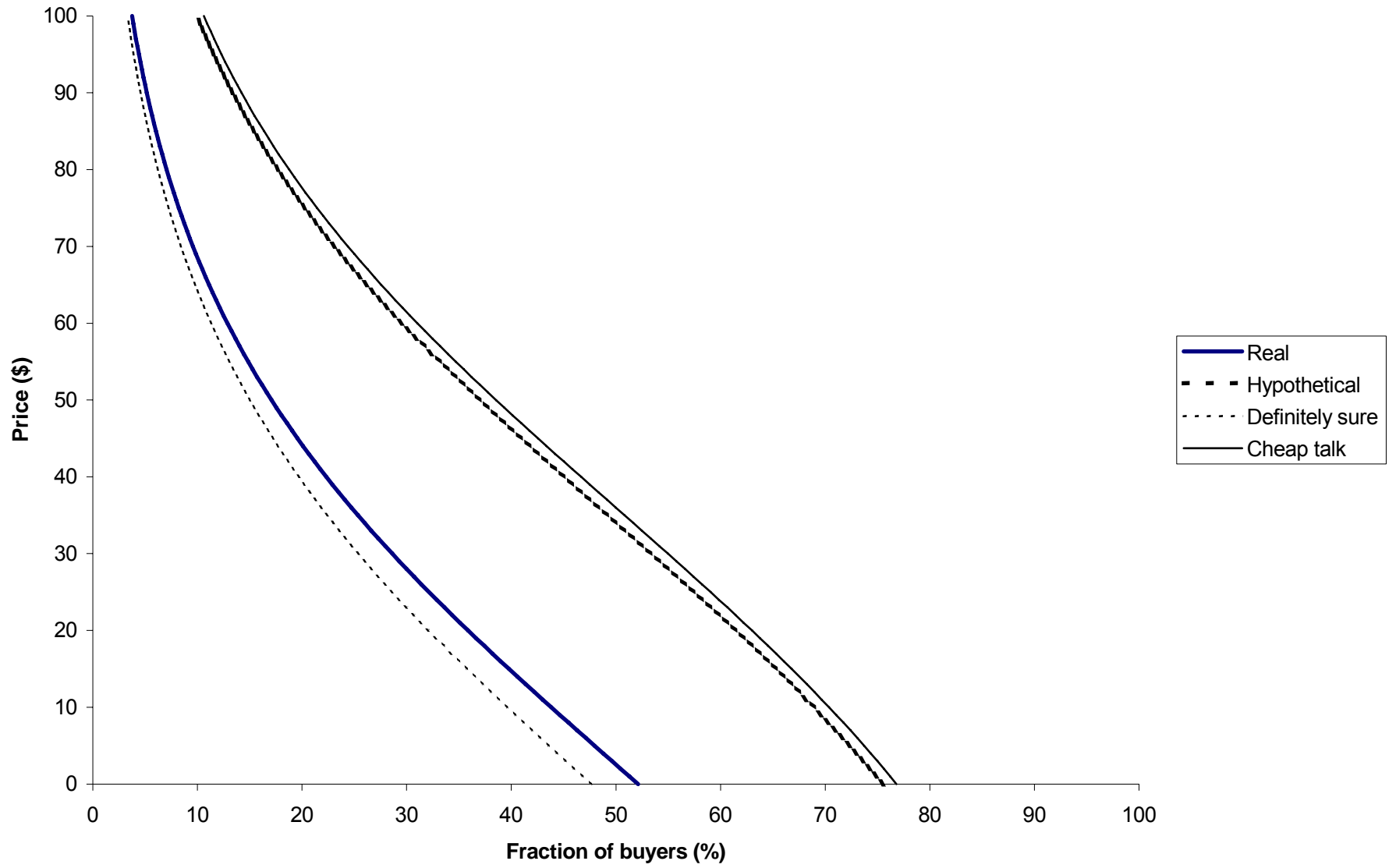
**Table 3. Percentage of Yes Responses:
Real vs. Hypothetical-All vs. Hypothetical-Definitely Sure**

Price		Real group	Hypothetical group: All yes responses		Hypothetical group: <i>Definitely sure</i> yes responses only	
		%	%	p-value*	%	p-value*
\$15		45	71	0.040	35	0.460
\$40		23	41	0.129	32	0.423
\$80		10	19	0.301	0	0.103
All		26	45	0.006	24	0.830

*p-value of the difference compared to the yes responses in the real group.

**No statistically significant difference:
Real 26% and Definitely Sure Yes Hypothetical 24%**

Figure 2. Parametric demand curves



Field Experiment Results

Will individuals who say “yes”
they will pay in contingent
valuation **actually, really** pay?

Yes, if “definitely sure”

End Field Experiment

Back to Education

Total Social Value of Education

- Two focus groups & pretest
- Knowledge Networks (private firm)
- June-July 2007
- Web-based survey of 370 of representative panel
74% response rate, usable n=275
- Mail survey, random, follow ups, 10,000 hh
29% response rate, usable n=1,023
- Web, mail, and Census match well (logit)

Table 1. Demographics of KCTCS Survey vs. American Community Survey 2007 for Kentucky

		Web-based Sample	Mail-based Sample	P-Value: Web vs. Mail	Total Sample	American Community Survey 2007
Gender	Female	52.50%	53.20%	0.899	53.14%	51.93%
Age	18-29	21.54%	19.96%	0.553	20.12%	21.69%
	30-39	10.40%	15.17%	0.15	14.69%	17.24%
	40-49	25.96%	19.43%	0.136	20.08%	19.56%
	50-64	28.49%	28.25%	0.594	28.27%	24.68%
	65 or over	13.61%	17.20%	0.471	16.84%	16.83%
Race	White	90.45%	89.39%	0.791	89.49%	90.37%
Education	Less than High School Diploma	8.67%	17.07%	0.023	16.26%	19.58%
	High School Diploma or Equivalent	45.29%	36.74%	0.132	37.56%	35.19%
	Some College	15.85%	18.65%	0.378	18.38%	20.71%
	Associate Degree	10.45%	8.13%	0.585	8.35%	6.01%
	Bachelor Degree	11.23%	11.21%	0.99	11.21%	11.43%
	Master Degree or Beyond	8.51%	8.20%	0.086	8.23%	7.08%
Household Income	Under \$25,000	36.39%	36.76%	0.622	36.72%	32.31%
	\$25,000 - \$39,999	19.72%	17.77%	0.414	17.97%	17.91%
	\$40,000 - \$59,999	22.09%	18.42%	0.247	18.79%	17.89%
	\$60,000 - \$99,999	16.97%	18.82%	0.952	18.63%	19.96%
	\$100,000 or more	4.82%	8.23%	0.062	7.89%	11.92%

Note: Both the KCTCS Survey statistics and the American Community Survey statistics are for those individuals 18 years old or over. The sample size for each variable in the web-based sample is 275. The total sample size is 2,892 for Gender, 2,827 for Age, 2,877 for Race, 2,867 for Education, and 2,725 for Household Income.

Table 2. Definitions of Variables and Summary Statistics

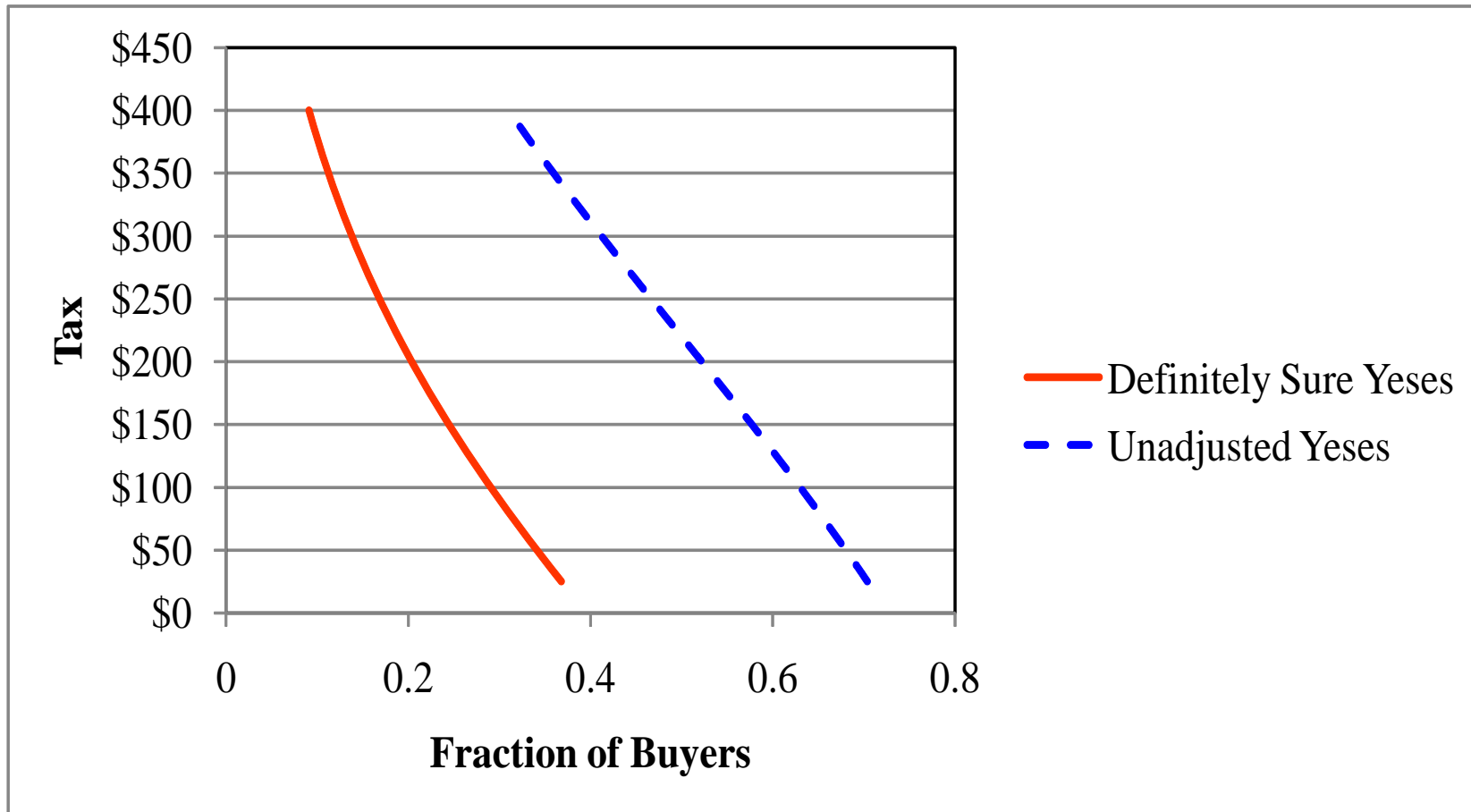
Variables	Mean	Description
Tax	162.2 [166.84]	Dollar amount individual would pay for change in KCTCS in 2007 dollars. Amounts were one of eight amounts: 25 (21%), 75 (21%), 100 (3%), 125 (2%), 150 (21%), 200 (2%), 250 (18%), 400 (14%).
Income \$25-39K	0.22	1 if \$25,000 ≤ household income ≤ \$39,999, 0 otherwise
Income \$40-59K	0.17	1 if \$40,000 ≤ household income ≤ \$59,999, 0 otherwise
Income \$60-99K	0.16	1 if \$60,000 ≤ household income ≤ \$99,999, 0 otherwise
Income > \$100K	0.08	1 if household income ≥ \$100,000, 0 otherwise
Income Missing	0.05	1 if no response to household income question, 0 otherwise
Taken a Class	0.27	1 if respondents has taken a class from KCTCS, 0 otherwise
Family Attended	0.53	1 if a family member has attended KCTCS, 0 otherwise
Know Employee	0.27	1 if respondent knows someone that works for KCTCS, 0 otherwise
Web	0.1	1 if survey was web-based, 0 if mail-based
Cheap Talk Minus 10	0.22	1 if received cheap talk treatment & 10% reduction scenario, 0 otherwise
Cheap Talk Minus 25	0.24	1 if received cheap talk treatment & 25% reduction scenario, 0 otherwise

The number of respondents who said “yes” and were definitely sure is 272. This means that the dependent variable takes on a value of 1

Table 3. Logistic Regression Results with Dependent Variable equal to "Definitely Sure"

	Coefficient	Standard Error	Marginal Effect
Tax Amount	-0.0047***	0.0007	-0.0008***
Income \$25K-39K	-0.0759	0.2938	-0.0131
Income \$40K-59K	0.3645	0.2843	0.0675
Income \$60K-99K	0.6662**	0.2854	0.1278**
Income > \$100K	1.1486***	0.3247	0.2411***
Income Missing	-0.4103	0.453	-0.0648
Age 30-39	0.1975	0.4659	0.036
Age 40-49	0.4313	0.4461	0.0807
Age 50-64	0.8695**	0.4276	0.1602*
Age 65	1.0286**	0.4488	0.2069**
Age Missing	-0.4142	1.1418	-0.0646
Taken a Class	-0.231	0.2054	-0.0393
Family Attended	0.4527***	0.1737	0.0794***
Know Employee	0.3630**	0.1748	0.0662**
Web	0.0091	0.244	0.0016
Cheap Talk Minus 10	0.8032***	0.186	0.1553***
Cheap Talk Minus 25	0.7958***	0.1904	0.1550***
Constant	-2.1981***	0.6469	
Sample Size	1023		
Likelihood Ratio Statistic	157.24		
Pseudo R-squared	0.1327		

Figure 1: Parametric Demand Curves for Ten Percent Expansion of KCTCS (definitely sure “yes” and all “yes”)



WTP from the Logit

$$\text{mean WTP} = -(1 / b_T) \ln(1 + e^z)$$

where

b_T coefficient on T, the tax amount

z constant in the logit regression

effect of all of other covariates evaluated at their means is added to the constant (Johansson 1995)

Total Value of KCTCS Expansion: WTP

❖ Average KY household WTP = **\$56**

(\$42,\$70)

❖ Aggregate 1.65 million households

WTP = **\$92 million** (\$69m,\$115m)

❖ Individual benefits + area wide benefits from enhanced productivity and quality of life

Our Estimates of Values of Higher Education

- *Total Social*: Value directly & indirectly to all residents – contingent valuation survey
- *Individual*: Value directly to students; Earnings, two estimates from two data sets
- *External* = Total Social – Individual

Individual Earnings Returns: Census

- Associate's Degree, 2-year
- Increase labor market earnings
- Long- run, over work life
- Kentucky residents
- 2000 U.S. Census data, PUMS 5%,
all HS grads who worked in 1999 n=84,000

Mincer Wage Equation

- DepVar: natural log of labor earnings
- Education: **Associate Degree dummy** and 5 others
- Experience: age-18 for HS, age-22 for bachelor's
- Marital status, Race
- Separate models for men and women
- No adjustment for ability bias

Table 5. Log Earnings Equations, 2000 U.S. Census Data for Kentucky

	Males	Females
Education		
Less than One Year of College	0.161*** (0.016)	0.178*** (0.018)
Year or More of College, No Degree	0.117*** (0.012)	0.159*** (0.014)
Associate Degree	0.243*** (0.018)	0.438*** (0.018)
Bachelor Degree	0.555*** (0.012)	0.672*** (0.016)
Master Degree	0.570*** (0.019)	0.838*** (0.020)
Professional or Doctoral Degree	0.975*** (0.023)	1.092*** (0.035)
Experience		
Potential Years	0.0715*** (0.002)	0.0626*** (0.002)
Potential Years Squared	-0.00138*** (0.000)	-0.00113*** (0.000)
Socio-demographic		
Black	-0.233*** (0.018)	0.0157 (0.020)
Married	0.419*** (0.012)	-0.0128 (0.015)
Divorced	0.180*** (0.017)	0.114*** (0.018)
Constant	9.029*** (0.014)	8.712*** (0.018)
Observations	38583	37396
R-squared	0.244	0.141

Individual Earnings Returns: KCTCS

Associate's Degree, Diploma, or Certificate

- 2002-2003 student cohort & student demographic & coursework file from KCTCS
- 2000-2006 quarterly earnings data from KY unemployment insurance program

$$\ln Y_{it} = \beta \cdot S_{it} + \gamma \cdot X_{it} + \eta_i + \tau_t + \varepsilon_{it}$$

Table 6. Log Earnings Equations with Individual and Time Fixed Effects, KCTCS Administrative Data.

	Males	Females
Education		
Associate Degree	0.105*** (0.016)	0.319*** (0.013)
Diploma	0.067*** (0.021)	0.300*** (0.013)
Certificate	-0.01 (0.018)	0.072*** (0.013)
Observations	204,108	228,285
Students	10052	12171
R-squared	0.6215	0.5415

Discounted Present Values

- **Probability of surviving to each age**

U.S. Center for Health Statistics (2006)

- **Probability of working at each age**

Calculated from Census data

- **Discount rate, annual 2.8%**

OMB rate for long-term policy

- **2007 dollars, CPI**

Individual Earnings Returns: Census

Increase in work-life earnings from
associate's degree over high school

Men: \$63,822

Women: \$92,148

Individual Earnings Returns: KCTCS Data

Lifetime Returns above HS Degree

	Men	Women
Associate's Degree	\$46,721	\$98,895
Diploma	\$26,702	\$92,297
Certificate	-\$15,297	\$13,909

Our Estimates of Values of Higher Education

- *Total Social*: Value directly & indirectly to all residents – contingent valuation survey
- *Individual*: Value directly to students – Earnings, two estimates from two data sets
- *External* = Total Social – Individual

Calculating Total Individual Benefits

- To calculate statewide estimates of individual returns, we make the following assumptions:
 - 10% expansion results in 10% increase in number of degrees, diplomas, and certificates
 - Gender and age profile of award recipients remains unchanged

First Estimate of Values of Higher Education: +10% KCTCS

- Total Social Value: WTP of all KY hh =
\$92 million [69, 115]
- Individual Private Earnings, Census =
\$61 million
- External = \$92m - \$61m = \$31 million
External \approx 50% of individual earnings
Social \approx 50% greater than private

Second Estimate of Values of Higher Education: +10% KCTCS

- Total Social Value: WTP of all KY hh =
\$92 million [69, 115]
- Individual Private Earnings, KCTCS data =
\$48 million
- External = \$92m - \$48m = \$44 million
- Two estimates: \$31 to \$44 million ($\approx 50\%$)

Table 8. Predicted Lifetime Private Returns for 10% Expansion to KCTCS, Kentucky.

Models	Males	Females	Total
Census – Associate Degree			
With age-adjusted work and survival probabilities (preferred estimate)	\$16,080,919	\$45,129,173	\$61,210,093
with age-adjusted work probabilities and controls for industry, occupation	\$17,555,003	\$31,501,456	\$49,056,459
no adjustment for work probability or survival	\$26,274,228	\$82,994,551	\$109,268,779
KCTCS			
With age-adjusted work probabilities			
Associate Degree	\$7,145,350	\$33,997,917	\$41,143,267
Diploma	\$1,279,582	\$10,859,507	\$12,139,089
Certificate	-\$9,714,560	\$4,813,923	-\$4,900,637
TOTAL (preferred estimate)	-\$1,289,628	\$49,671,347	\$48,381,719
No adjustment for work probability or survival			
Associate Degree	\$11,402,510	\$57,931,606	\$69,334,116
Diploma	\$2,983,085	\$20,262,610	\$23,245,695
Certificate	-\$10,564,745	\$11,724,282	\$1,159,537
TOTAL	\$3,820,850	\$89,918,498	\$93,739,347

Effect of Education Spillovers: Census Data

- We estimate spillover effects using the following model:
- $\ln Y_i = \alpha + \beta S_i + \gamma X_i + \delta AS_i + \varepsilon_i$
 - $\ln Y_i$ natural log of labor earnings
 - S_i person's level of earnings
 - X_i marital status, experience, race/ethnicity
 - AS_i Average schooling level of adults in region

Table 9. Log Earnings Equation with Area-wide Education, 2000 U.S. Census Data for Kentucky

	Males			Females		
	(1)	(2)	(3)	(4)	(5)	(6)
Individual Education						
Less than One Year of College	0.143*** (0.0156)	0.145*** (0.0156)	0.143*** (0.0156)	0.161*** (0.0179)	0.164*** (0.0179)	0.163*** (0.0179)
Year or More of College, No Degree	0.0865*** (0.0117)	0.0866*** (0.0118)	0.0846*** (0.0117)	0.132*** (0.0141)	0.132*** (0.0142)	0.131*** (0.0141)
Associate Degree	0.209*** (0.0184)	0.222*** (0.0184)	0.209*** (0.0184)	0.416*** (0.0183)	0.416*** (0.0183)	0.414*** (0.0183)
Bachelor Degree	0.488*** (0.0127)	0.484*** (0.0128)	0.480*** (0.0128)	0.610*** (0.0159)	0.605*** (0.0161)	0.603*** (0.0161)
Master Degree	0.508*** (0.0192)	0.501*** (0.0193)	0.497*** (0.0193)	0.791*** (0.0197)	0.783*** (0.0199)	0.782*** (0.0198)
Professional or Doctoral Degree	0.898*** (0.0231)	0.887*** (0.0223)	0.884*** (0.0233)	1.029*** (0.0351)	1.015*** (0.0352)	1.014*** (0.0352)
Region Level Education						
Average Years of Schooling	0.0796*** (0.00377)			0.0823*** (0.00447)		
Percent Bachelor or More		0.739*** -0.0383			0.746*** -0.0447	
Percent Associate or More			0.739*** (0.0363)			0.728*** (0.0423)

Effect of Education Spillovers:

Census Data $\approx 8\%$

- Estimates are slightly above Rausch's (1993) estimates of **2.8 to 5.1%**
- Estimates are similar to Acemoglu and Angrist's (2000) OLS estimate of **7.3%**
- Estimates are within the range of Moretti's (2004a) estimates of **0.6 to 1.2%**
- Estimates with Kentucky data are similar to previous estimates.

Effect of Education Spillovers: Census Data

- Coefficient on Associate's Degree in Table 5 without the region education levels
0.24 for Males & 0.44 for Females
larger than in Table 9 with region wide educ.
- Consistent with part of the estimated return being the result of education externalities in an area.

Table 5. Log Earnings Equations, 2000 U.S. Census Data for Kentucky

	Males	Females
Education		
Less than One Year of College	0.161*** (0.016)	0.178*** (0.018)
Year or More of College, No Degree	0.117*** (0.012)	0.159*** (0.014)
Associate Degree	0.243*** (0.018)	0.438*** (0.018)
Bachelor Degree	0.555*** (0.012)	0.672*** (0.016)
Master Degree	0.570*** (0.019)	0.838*** (0.020)
Professional or Doctoral Degree	0.975*** (0.023)	1.092*** (0.035)
Experience		
Potential Years	0.0715*** (0.002)	0.0626*** (0.002)
Potential Years Squared	-0.00138*** (0.000)	-0.00113*** (0.000)
Socio-demographic		
Black	-0.233*** (0.018)	0.0157 (0.020)
Married	0.419*** (0.012)	-0.0128 (0.015)
Divorced	0.180*** (0.017)	0.114*** (0.018)
Constant	9.029*** (0.014)	8.712*** (0.018)
Observations	38583	37396
R-squared	0.244	0.141

Respondents' Beliefs about Benefits of Higher Education

- We also asked respondents to report their perceived benefits from higher education
 - Assigned points to various benefit categories
 - Designed to get respondents thinking about the benefits of higher education

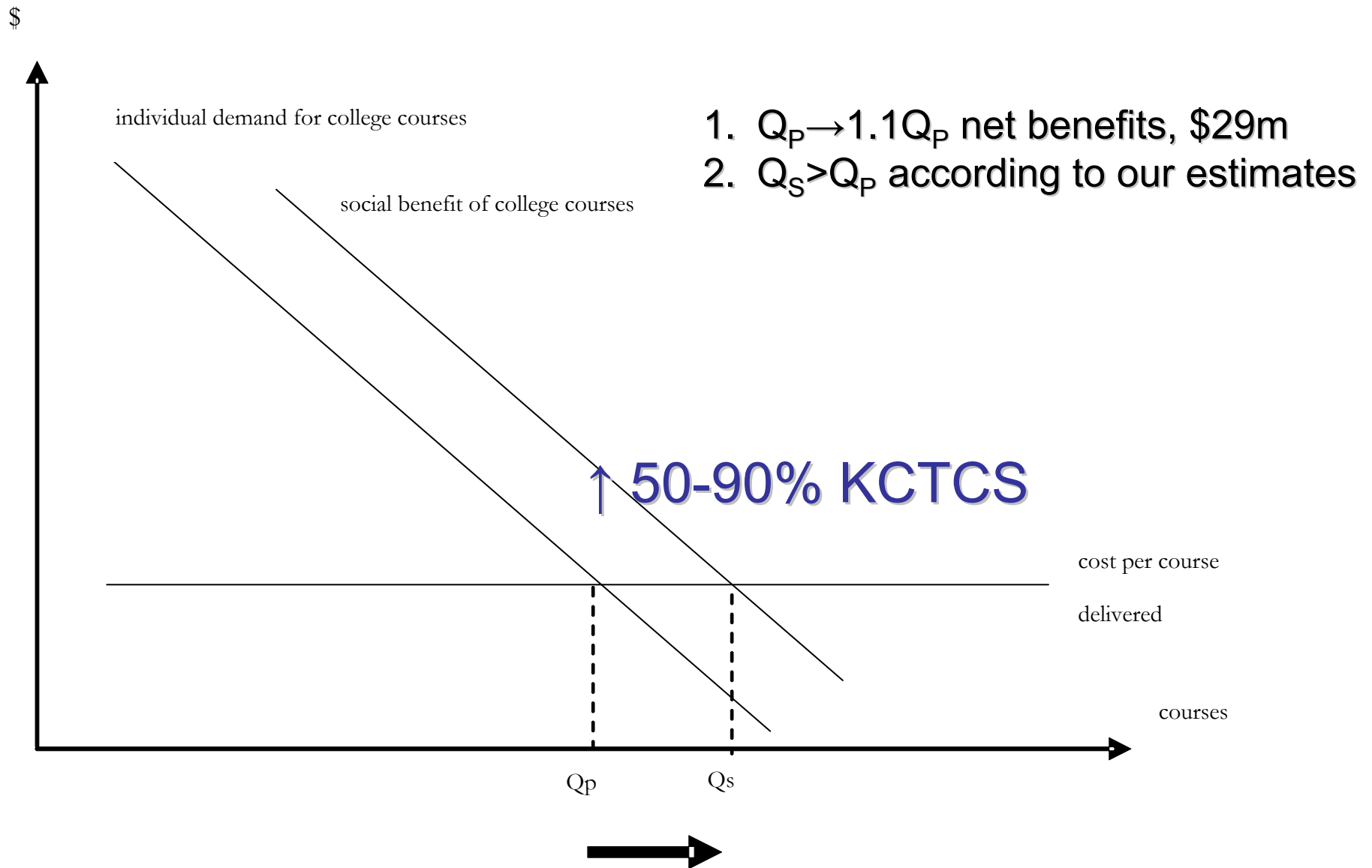
Table 4. Respondents' Beliefs about the Benefits of Education and Training

	Mean	Standard Deviation	Min	Max
Economic Development	18.14	12.31	0	100
Technology	13.54	10.43	0	100
Wages of Attendees	13.23	10.21	0	100
Crime	12.02	11.6	0	100
Better Public Decision Making	11.31	9.19	0	100
Own health	10.33	8.67	0	100
Local Purchases	8.46	7.14	0	50
Wages of Non-Attendees	6.6	6.58	0	60
Health of Non-Attendees	6.39	6.95	0	60

BOTEC: Net Benefits of +10% KCTCS

- **Total WTP = \$92 million**
- Operating expenses 2005 for KCTCS = \$598 million (\$634.7 m in 2007 dollars, +6.1%)
Cost of +10% = \$63 million
- *Net benefit of +10% = **+\$29 million***

Socially Optimal Education - Q_s



Summary Point

- Alternative methodology to estimate the *total social returns* to higher education including any educational externalities
- Advantage: captures all individual (private) & external *productivity* and *quality of life* benefits

Conclusion

- Total social value of higher education exceeds the private value by 50-90%
 - Lochner and Moretti (2004) find that just one type of external effect—crime reduction—is 14-26% of the private return
 - Our estimates include all benefits such as productivity spillovers, better government and in-kind transfers

Caveats

- Estimates of private benefits may be too small because:
 - Census estimates do not include returns to diplomas and certificates
 - KCTCS estimates are based on short-run returns
- Estimates of private benefits may be too large because:
 - Do not adjust for ability
 - Marginal people getting a degree may have a lower return than the average person

Another Caveat

- Our estimate of the education externality may be too large because it includes any private, non-market returns to education
 - We are not aware of any current estimate of the private non-market returns to schooling

Policy Implication

- Our estimates do suggest that there is a role for public subsidy of higher education
 - More work needs to be done measuring the size of any education externality

Estimating the Social Value of Higher Education: Willingness to Pay for Community and Technical Colleges

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