A review of the recent literature on tuition’s effect on higher education enrollments
Primary question: How responsive is enrollment to tuition increases at EWU?

Related question: How might total tuition revenue change if tuition were to be increased by a certain percentage?

Will provide a summary of the state of knowledge across all universities to respond to the first question

Will not answer the second
A review of the literature

• Venerable – dating to the late ‘60’s

• Somewhat old, with fewer published studies in the past decade than in 1980s & 1990’s
  – Will largely focus on most current studies

• Generally, a heterogeneous body of knowledge

• Issue – very few studies cover institutions like EWU
Many different subjects considered in the literature

- All higher education, including community colleges
- All public higher ed, including community colleges
- All 4 year public higher ed, including various Carnegie types
- Private colleges specifically
Many different approaches to variable of interest

- Total enrollment – headcount usually
- Total enrollment \textit{rate}
- Total enrollment by in-state or out-of-state residents only
- Enrollment by first-time, full-time freshman
- Enrollment by race & ethnicity
- Enrollment by disciplines
Data – nearly all based on secondary information, not surveys

• In many earlier studies, analysis was a cross sectional look across many universities at one point in time

• Many early ones also used time series instead
  – Unit of measure often averages (by state)
  – A few looked at responses by individual institutions over time

• Later ones take advantage of both dimensions and analyze “panels” of same units (universities) over a few years
Technique – usually multivariate regression analysis

• Essence – to assign the partial effect of each of several (many) different forces on enrollment, so that the total variation in enrollment can be explained

• Of interest:
  – To fully explain the variance in enrollment among the units studied
  – To demonstrate that “signs” (negative/positive) on the estimated coefficients conform to theory or intuition
  – To examine especially the size of the effect of tuition on enrollment
Typical explanatory variables of demand - seldom used together, however

- **Tuition** -- either “list,” or net of financial aid
- **Financial aid** -- grants usually, if net tuition not used
- **Competitors’ effects** -- for public 4 year institutions, usually tuition of in-state community colleges and/or private schools
- **Academic attributes of students** -- GPA, SAT scores
- **Personal attributes of students** -- race/ethnicity, gender
- **Economic variables** -- per capital personal income, unemployment, &/or “wage premium” for a college degree
Tuition elasticity

- Generally, elasticity is a response by one factor to a change in another

- Or, the \( \% \Delta \) in Y, due to a \( \% \Delta \) in X

- In tuition/enrollment context: \( e = \frac{\% \Delta \text{ in Enrollment}}{\% \Delta \text{ in Tuition}} \)

- Expect that \( \% \Delta \) in enrollment < 0 to a \% increase in tuition, if economic theory (intuition) is correct

- Key question: by how much?
Implications for tuition revenue – a very simple example

• Assume a school has 1,000 students, each paying $1,000 in tuition

• To determine: Revenue consequences of a $100 increase in tuition (10%)

• Case A: inelastic response, where e = -0.6%
  – Lost revenue: 60 students leave => revenue loss 60*$1,000 = $60,000
  – New revenue: $100*940 remaining students = $94,000

• Case B: elastic response, where e = -1.5%
  – Lost revenue: 150 students leave => revenue loss 150*$1,000 = $150,000
  – “New” revenue: $100*850 remaining students = $85,000
Conundrum: Enrollment at WA 4-year public institutions has increased despite increasing tuition.

Cumulative growth index of inflation-adjusted tuition/fees & of annual average undergrad FTEs

(2002-03 = 1.00)
Expressed as a rate, enrollment at WA 4-year public institutions, has been flat, despite increasing tuition.

Cumulative growth index of inflation-adjusted tuition/fees & annual average undergrad FTEs as a share of the 18-24 population

(2002-03 = 1.00)
EWU’s experience - no different

Cumulative growth index of inflation-adjusted tuition/fees & annual average undergrad FTEs

(2002-03 = 1.00)
What do studies say? Starting point is a review article of nine studies from the 1990’s

- Donald Heller (now dean of School of Ed at Michigan State)


- 3 questions
  - Do tuition effects generally match those of an earlier review (Leslie & Brinkman, 1987)?
  - How does financial aid impact higher ed enrollment?
  - Do tuition and financial aid impacts differ by income, race or college sector?
Heller’s summary of articles’ responses: Tuition response is clear

“All the studies described here are consistent in one respect: each found an inverse relationship between tuition and enrollment rates. The exact size may differ depending on methodology used, data set analyzed and the type of students or institutions examined. But the magnitude of the effect is remarkably similar across most of the studies. The evidence indicates that a tuition increase of $100 is consistent with a drop in enrollment of somewhere in the range of 0.5 – 1.0 percentage points, a range consistent with Leslie & Brinkman’s (1987) estimates.”
Heller’s summary: Financial aid response is ambiguous

“Though difficult to generalize, those researchers who conducted cross-sectional (my emphasis) analyses of the major longitudinal data sets...found that students were sensitive to aid awards....The level of that sensitivity varied from study to study, depending on the type of aid...and the dollar value of the aid. The effect that aid has on enrollments is difficult to compare with that of tuition; whereas some studies found similar effects between the two..., others found students to be less sensitive to aid than they were to tuition.

The evidence from time series (my emphasis) studies is more mixed, however.”
Heller’s summary: Income & race/ethnicity matter, generally

• “These researchers concluded that there is a relationship between income and sensitivity to tuition and financial aid. Although the sizes of the effects differ across studies, they find that poorer students are more sensitive to net cost, whether those increases take the effect of tuition increases or financial aid decreases.”

• “The evidence from the studies described...is that black students are more sensitive to college costs than white students, even controlling for income, socioeconomic status and ability. For Hispanic students, the evidence is more mixed.”
Heller’s own research supported some of these findings


• Examined, at the state level, the effect of these two factors on public undergraduate enrollment, overall & by race

• Data: even years, 1976-1994, with states as unit of measure

• A panel set (estimated via linear, “fixed effects” approach)

• Enrollment defined as a rate of all undergraduates to the 18-24 age population
Heller’s results for all public 4-year institutions

Estimates of strengths of the determinants of enrollment rates

<table>
<thead>
<tr>
<th>Explanatory Variable</th>
<th>All Races</th>
<th>Asian Americans</th>
<th>Blacks</th>
<th>Hispanics/Latinos</th>
<th>Whites</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 year institutions' tuition</td>
<td>-0.525**</td>
<td>1.096</td>
<td>0.077</td>
<td>-0.417</td>
<td>-0.639**</td>
</tr>
<tr>
<td>Community college tuition</td>
<td>0.045</td>
<td>1.056</td>
<td>0.501</td>
<td>0.171</td>
<td>0.41</td>
</tr>
<tr>
<td>State grants/18-24 age population</td>
<td>0.935**</td>
<td>1.043</td>
<td>0.669~</td>
<td>0.432</td>
<td>0.566**</td>
</tr>
<tr>
<td>Unemployment rate</td>
<td>0.018</td>
<td>0.266</td>
<td>0.031</td>
<td>-0.012</td>
<td>-0.025</td>
</tr>
</tbody>
</table>

| Observations | 489 | 489 | 489 | 489 | 489 |
| Pseudo R² (goodness of fit) | 0.000 | 0.064 | 0.037 | 0.000 | 0.005 |

~: P ≤ .10; *: P ≤ .05; **: P ≤ .01
Heller’s conclusions about his own estimates

• “The results... confirm the existence of a **downward sloping demand curve** for public higher education.”

• But...”students’ tuition sensitivities appear to have decreased from what Leslie & Brinkman found...”

• His results show an **inelastic** enrollment response to tuition
  – My calculations for Leslie & Brinkman: \( e = -0.62\% \)
  – My calculations for Heller: \( e = -0.54\% \)

• Offered explanations why a decreasing sensitivity to tuition occurred
  – An increase in the college earnings premium over time
  – A greater change in the private college prices than in public 4 year tuitions
Heller’s conclusions, continued

- State, need-based **grants** produce a much greater (positive) response than tuition, & the variables were statistically significant.

- But…. very little explanatory power of the estimating equations.

- And… none of the estimated effects tuition on enrollment of the three **race/ethnic groups** was statistically significant.
A recent effort to account for greater number of factors


- 3 hypotheses about enrollment growth in these institutions:
  - Tuition change has no effect
  - Competitors’ tuition has a positive effect
  - Wage premium of a college education has a positive effect

- Their measure of enrollment: in-state students enrolling for first time as full-time students (FTFT)
Shin & Milton’s approach

- **Data:**
  - All public universities, excluding some branch campuses, w/ total 436
  - Panel defined by 3 years: 1998, 2000, 2002

- **Factors posited to explain enrollment growth in FTFTs**
  - Institutions’ own tuition (& fees)
  - Competitors’ tuition
  - Share of students receiving some form of financial aid
  - Wage premium (percentage difference between college & HS grads)
  - Whether or not institution is a research university
  - State unemployment rate

- **Technique:** hierarchical linear model
Shin & Milton’s findings

• “Tuition change has no effect on change in enrollment...Our estimate is that when colleges increase tuition $100/year, they will show a 1.13 student decrease....However, the effect is not statistically significant at the p<.10 level.”

• Their explanations why:
  – “Students were more responsive to tuition in the 1960s, 1970s and 1980s, but became less responsive in the late 1990’s. Differences in job opportunities, in expected income and between time periods (of the prior studies)....”
  – “There may be a range of tuition levels to which students are more or less sensitive than others.”
  – “Instructional quality might offset any negative effect caused by tuition increase.” (signaling)
Shin & Milton’s findings, cont’d

- “The **wage premium** ... has a positive effect on the growth in enrollment. For example, colleges in states with 1% point higher wage premium than the national average had 4.25% more enrollment growth than in states with the average wage premiums.”

  *(coefficient statistically significant at the 90% confidence level)*

- “High **financial aid**...showed no increase in enrollment growth.”

  *(sign on coefficient positive but very small & not statistically significant)*
  - Possible explanation # 1): Data captured loans as well as grants; prior research has shown a much lower response from loans than grants.
  - Possible explanation #2): Students more interested in financial aid are more likely to attend private colleges
  - Note: grants & loans found to be statistically significant in authors’ follow-up study (2008)
Most recent national look at relationship between tuition & enrollment


- 3 goals
  - To update estimates on the price elasticity of enrollment in public, 4-year educational institutions
  - To assess the differences in these estimates among types of public institutions (Research I, Research 2, comprehensives, liberal arts)
  - To examine the impacts of large tuition increases
Hemelt & Marcotte’s approach

- 3 variants of enrollment: Total headcount, total number of credit hours, number of FTFTs

- Data panel – 600 institutions with annual observations 1991 – 2007

- Posited explanatory variables
  - Tuition & fees at the institution
  - Total value of Pell grants given to students at the institution
  - Value of scholarships given to students at the institution
  - Number of high school graduates that year in each state
  - Competitors’ tuition & fees within the state
  - Per capita personal income in the state
  - State unemployment rate
Hemelt & Marcotte’s estimates of effects of determinants of enrollments for *comprehensive* universities

<table>
<thead>
<tr>
<th>Explanatory Variable</th>
<th>Headcount</th>
<th>Hours</th>
<th>FTFT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log of in-state tuition &amp; fees</td>
<td>-0.0612</td>
<td>-0.007</td>
<td>-0.080</td>
</tr>
<tr>
<td>Log of average community college tuition/fees</td>
<td>0.025</td>
<td>0.075</td>
<td>0.181</td>
</tr>
<tr>
<td>Log of average private 4-years' tuition/fees</td>
<td>0.036</td>
<td>-0.021</td>
<td>-0.070</td>
</tr>
<tr>
<td>Log of state per capita income</td>
<td>.034</td>
<td>-0.020</td>
<td>-0.326</td>
</tr>
<tr>
<td>State population</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>Number of state high school graduates</td>
<td>0.006</td>
<td>0.042***</td>
<td>0.025</td>
</tr>
<tr>
<td>Unemployment rate in state</td>
<td>0.006</td>
<td>0.005</td>
<td>0.002</td>
</tr>
<tr>
<td>Log of total scholarships &amp; fellowships</td>
<td>0.035</td>
<td>0.053**</td>
<td>0.073*</td>
</tr>
<tr>
<td>Log of total Pell grants at the institution</td>
<td>0.225***</td>
<td>0.242***</td>
<td>0.255**</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.969</td>
<td>0.939</td>
<td>0.980</td>
</tr>
<tr>
<td>Observations</td>
<td>3,532</td>
<td>3,532</td>
<td>3,532</td>
</tr>
</tbody>
</table>

* significant at 10%; ** at 5%; *** at 1%
Hemelt & Marcotte’s estimates of same factors, plus a 10% tuition hike, over all 4 year public institutions

<table>
<thead>
<tr>
<th>Explanatory Variable</th>
<th>Headcount</th>
<th>Credit Hrs</th>
<th>FTFT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log of in-state tuition &amp; fees</td>
<td>-0.102***</td>
<td>-0.077</td>
<td>-0.122*</td>
</tr>
<tr>
<td>Log of average community college tuition/fees</td>
<td>0.018</td>
<td>0.060</td>
<td>0.274**</td>
</tr>
<tr>
<td>Log of average private 4-years' tuition/fees</td>
<td>-0.011</td>
<td>-0.020</td>
<td>-0.036</td>
</tr>
<tr>
<td>Log of state per capita income</td>
<td>0.286*</td>
<td>0.233</td>
<td>0.129</td>
</tr>
<tr>
<td>State population</td>
<td>0.000**</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>Number of state high school graduates</td>
<td>0.004</td>
<td>0.034***</td>
<td>0.024***</td>
</tr>
<tr>
<td>Unemployment rate in state</td>
<td>0.010*</td>
<td>0.009</td>
<td>0.001</td>
</tr>
<tr>
<td>Log of total scholarships &amp; fellowships</td>
<td>0.042***</td>
<td>0.058**</td>
<td>0.073***</td>
</tr>
<tr>
<td>Log of total Pell grants</td>
<td>0.205***</td>
<td>0.213***</td>
<td>0.269**</td>
</tr>
<tr>
<td>Large tuition hike dummy variable</td>
<td>.009</td>
<td>.020</td>
<td>.000</td>
</tr>
</tbody>
</table>

R²  | 0.983 | 0.966 | 0.987 |
Observations | 6,399 | 6,509 | 2,897 |

* significant at 10%; ** at 5%; *** at 1%
Helmet & Marcotte’s conclusions

- Enrollment response to tuition increases was very inelastic
  - Over all types of institutions, $e = -0.10\%$ approximately
  - Estimates for public comprehensives not significantly different than 0
  - For Research I’s, tuition’s effect on enrollment is statistically significant but still very small

- Student aid factors, especially Pell grants, are statistically significant & have stronger effects on enrollment than tuition

- Large tuition hikes had no statistical effect on enrollment
A study of a single university – Virginia Commonwealth


• Goal: to understand the response of VCU enrollment to tuition changes, especially the enrollment response of minority students (blacks)

• Variable to explain: “enrollment yield”:  
  
  # new students enrolled at VCU  
  # students accepted at VCU
Wetzel et al’s approach

• Data
  – Created averages of 8 groups along 3 dimensions: 1) whether freshman or transfer, 2) Gender & 3) White or minority (mostly black)
  – Panel: 1988-1993

• Posited explanatory variables
  – Net tuition ( = tuition – grants)
  – Student loans
  – Academic potential (SAT scores)
  – Size of applicant pool/year

• Technique: “random effects” panel regression
Wetzel et al’s findings

- Overall enrollment yields at VCU were not sensitive to tuition increases ($1,000 increase in tuition led to 6% decrease in yield)

- General result conforms to prior results from analyses of undergraduate response at individual institutions
  - Rutgers
  - University of Michigan
  - University of Minnesota

- However, enrollment yields of blacks at VCU were 50% more sensitive to tuition
EWU enrollment forecasting models do not use tuition as a variable

• 4 variables used to explain year-to-year variations in EWU entering freshmen:
  – Washington state high school graduates in same year
  – Average annual wage in Washington two years prior
  – Average annual unemployment rate in Washington two years prior
  – Entering freshman at WSU

• Results
  – All variables are statistically significant at 95% confidence level
  – Model has fit the data well (R2 = 0.78), with misses equal to: -11% to +8%
Actual and forecasted in-state entering freshman to EWU: Fall quarters 1995 - 2011
EWU model’s forecast of all state-funded enrollment even better, using same approach

- 1.1%
- 1.7%
+0.5%
Summary

• All studies, whether presented or reviewed but not presented, show that the response of enrollment -- however defined -- to changes in tuition, “list” or net, is very slight.

• Only one study of an individual institution like EWU could be found, but another looked at all public comprehensives.

• A cursory look at EWU’s own data on changes in enrollments & tuition does not show a negative relationship.

• Most recent studies show the effects of grants to be positive & statistically significant, with magnitudes that are larger than tuition.
Thank you

D. Patrick Jones, Ph.D.

*Executive Director*

Institute for Public Policy & Economic Analysis
dpjones@ewu.edu