

## Context

In a June 2009 report, Moody's Investors Service claimed that "Most universities demonstrate countercyclical ability to increase student enrolments during recessions ...". The statement appeared in a Special Comment entitled *Global Recession and Universities: Funding Strains to Keep Up with Rising Demand*. The report (pdf) is available at Global Higher Ed at: <http://globalhighered.files.wordpress.com/2009/07/s-globrecess-univ-6-09.pdf>. Global Higher Ed also provides a helpful commentary (<http://globalhighered.wordpress.com/2009/07/07/moodys-special-comment-report-on-the-global-recession/>).

To demonstrate the countercyclical nature of universities, Moody's used OECD data on "percentage change in total enrollment in Canada, France, Italy, Spain, United Kingdom, and [the] United States" between 1985 and 2006. This time period included two recessionary periods.

I've heard this countercyclical assertion made often by administrators in colleges and universities in the United States. It seems plausible. During recessions, people use higher education to acquire new skills or as a safe haven from labor market stress. But conventional wisdom is sometimes wrong or requires nuance. I decided to investigate a little.

For some time now, I've also been playing with XQuery as a web query tool. Examining the countercyclical nature of higher education provided a good opportunity to expand these use cases.

I did two things in this small project: a) explored the ability of XQuery to integrate data from diverse sources into a dataset suitable for analysis; and b) conducted an exploratory analysis of whether higher education is countercyclical.

## Summary

1. XQuery continues to impress me as a web query tool. In this project I used it successfully to access and integrate enrollment data from a U.S. Department of Education web site and economic data from an API at a Federal Reserve Bank. The new use cases included screen scraping enrollments embedded in html and pipelining enrollment and economic data through several transformations to create the final dataset.
2. The evidence that higher education in the United States is countercyclical appears weak based on the exploratory analysis done here. If determined solely by the direction of enrollment change during recessionary periods, some association between enrollment growth and recessions could be inferred. But there is so much chatter in the enrollment data during non-recessionary periods that any countercyclical claim seems tenuous at best.
3. The evidence varies somewhat by control (public vs private) and type (4-year vs 2-year; and 4-year universities vs 4-year other) but mostly the general observation of a weak association holds true. Except for private 2-year institutions, where the enrollment counts are too small to provide stability, annual percentage changes in enrollments at private institutions are more modulated than those at public institutions. And in cases like private 4-year universities there seems scant evidence of countercyclical enrollment growth. I did not examine variation by level (eg, undergraduate vs graduate).
4. The tools used in this project, XQuery and R statistics, are powerful but quite technical and complex. They are wonderful research tools, but are not suitable for more general use without wrappers that would remove the complexity and also avoid sacrificing too much power and flexibility. I know of no such wrappers.
5. The data.gov web site promises to open U.S. Federal government data sources for broader public access. The site is still in the early stages of development, but the amount of education data available is very modest. The screen-scraping technique used in this project makes immediately available vast amounts of education data, although in fairness to the U.S. Department of Education much of the Federal data is already available in alternative ways (eg, Excel or csv downloads). Data easily convertible to XML is the essential requirement for XQuery work.
6. There were several points throughout the process of data access and integration that required human judgment

(see the documentation at [http://garymlewis.com/instchg/public/xquery/dt08\\_189/dt08\\_189\\_doc.xq](http://garymlewis.com/instchg/public/xquery/dt08_189/dt08_189_doc.xq)). For research purposes, this presents no problems. In fact, it is even desirable to ensure that the researcher really understands the data sources. However, for general use as an ad hoc query and discovery technique, it is inadequate. None of the data sources used here included semantic or linked data markup. I think for my next use case I'll explore what, if anything, xquery can do with data marked up with RDFa or microformats.

## Data Sources

1. Fall enrollments in degree-granting institutions came from the U.S. Department of Education, National Center for Education Statistics (NCES). I used Table 189 in the Digest of Education Statistics 2008. The table is available at: [http://nces.ed.gov/programs/digest/d08/tables/dt08\\_189.asp?referrer=list](http://nces.ed.gov/programs/digest/d08/tables/dt08_189.asp?referrer=list).
2. Unemployment rates came from the U.S. Department of Labor, Bureau of Labor Statistics. I accessed this data via the API of the Federal Reserve Economic Data (FRED) at the Federal Reserve Bank of St. Louis. Details are available at: <http://api.stlouisfed.org/docs/fred/>. The FRED series is called UNRATE.
3. Dates of business cycle expansions and contractions came from the National Bureau of Economic Research (<http://www.nber.org/cycles.html>) as provided by the Economic Research department at the Federal Reserve Bank of St. Louis ([http://research.stlouisfed.org/fred2/help-faq/#graph\\_recessions](http://research.stlouisfed.org/fred2/help-faq/#graph_recessions)).

## General Procedures

1. I first saved the html page source for Table 189 and converted this into valid xhtml with the *tidy* utility (see <http://tidy.sourceforge.net/>).
2. I then wrote 3 xquery programs to access, transform, and merge the enrollment, unemployment, and recession data in an XML format suitable for analysis.  
Documentation is available at:  
[http://garymlewis.com/instchg/public/xquery/dt08\\_189/dt08\\_189\\_doc.xq](http://garymlewis.com/instchg/public/xquery/dt08_189/dt08_189_doc.xq).  
The 3 xquery programs are:  
[http://garymlewis.com/instchg/public/xquery/dt08\\_189/dt08\\_189\\_enrl.xq](http://garymlewis.com/instchg/public/xquery/dt08_189/dt08_189_enrl.xq)  
[http://garymlewis.com/instchg/public/xquery/dt08\\_189/dt08\\_189\\_econ.xq](http://garymlewis.com/instchg/public/xquery/dt08_189/dt08_189_econ.xq)  
[http://garymlewis.com/instchg/public/xquery/dt08\\_189/dt08\\_189\\_final.xq](http://garymlewis.com/instchg/public/xquery/dt08_189/dt08_189_final.xq)
3. I used R (see <http://www.r-project.org/>) and its XML package to parse my XML dataset and convert it into an R data frame. I then used the R *xyplot* package to produce the time series graphs. The program is available at: [http://garymlewis.com/instchg/public/xquery/dt08\\_189/dt08\\_189\\_final.Rhistory](http://garymlewis.com/instchg/public/xquery/dt08_189/dt08_189_final.Rhistory)

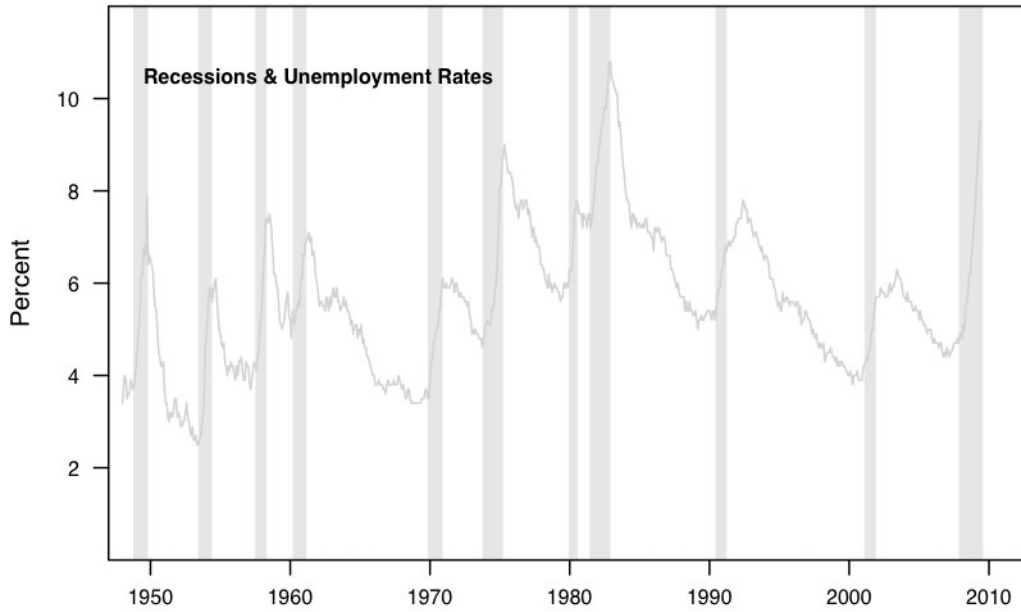
## Hierarchy of Institutional Classifications

When viewing the graphs, the following hierarchy may provide an orientation.

- Total, All Institutions
  - Total, All Public Institutions
    - Total, All Public 4-Year Institutions
      - Public 4-Year Universities
      - Public 4-Year Other
    - Public 2-Year
  - Total, All Private Institutions
    - Total, All Private 4-Year Institutions
      - Private 4-Year Universities
      - Private 4-Year Other
    - Private 2-Year

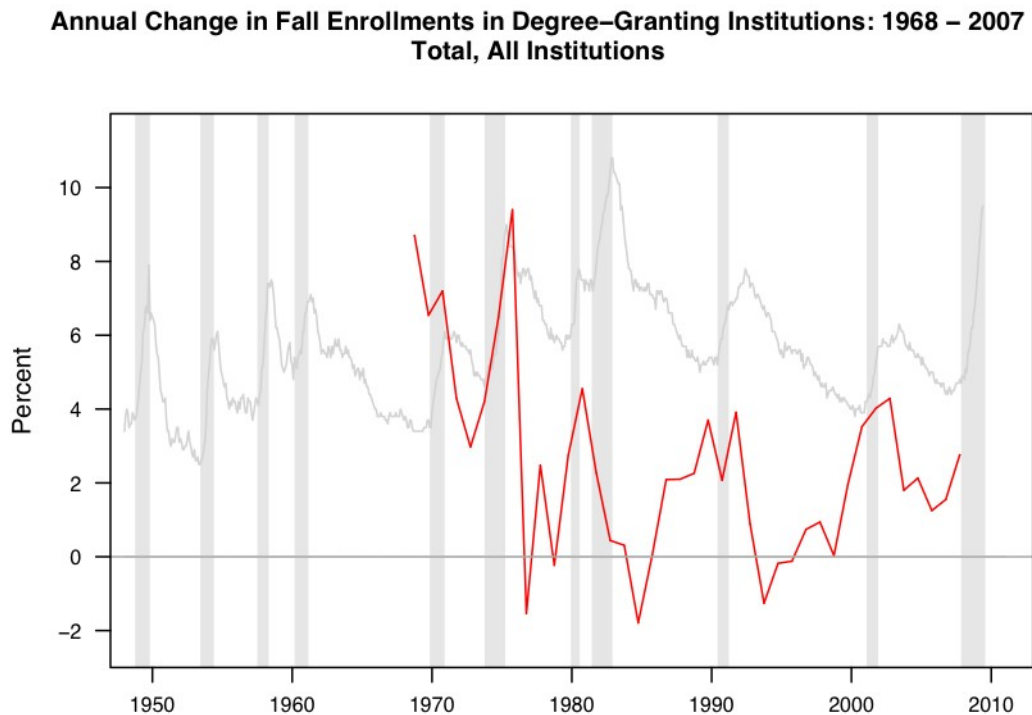
**Figure 1**

Note the close coincidence of recessions and peaks in unemployment rates, although in the recessions of 1990-1991 and 2001 unemployment peaks lagged recessions. This graph is used as background to all the other graphs that feature enrollments.



## Figure 2

Here's a full-flavored graph showing percentage enrollment change in all degree-granting institutions. It's intended for illustration at a convenient scale. All the graphs that follow use a reduced scale to permit better graph-to-graph comparison.



Shaded background indicates civilian unemployment rates and periods of recession.

### Fall Enrollments:

Table 189 at [http://nces.ed.gov/programs/digest/d08/tables/dt08\\_189.asp?referrer=list](http://nces.ed.gov/programs/digest/d08/tables/dt08_189.asp?referrer=list)  
Snyder, T.D., Dillow, S.A., and Hoffman, C.M. (2009). Digest of Education Statistics 2008 (NCES 2009-020).  
National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education. Washington, DC.

### Civilian Unemployment Rates:

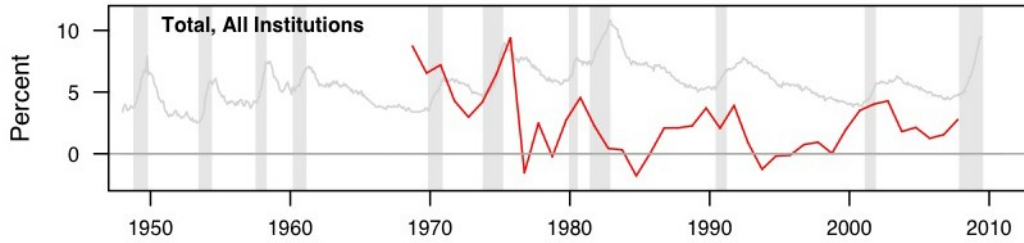
U.S. Department of Labor, Bureau of Labor Statistics.  
Accessed 2009-07-27 via the API of the Federal Reserve Economic Data (FRED) of the Federal Reserve Bank of St. Louis.  
<http://api.stlouisfed.org/docs/fred/>

### Recession Dates:

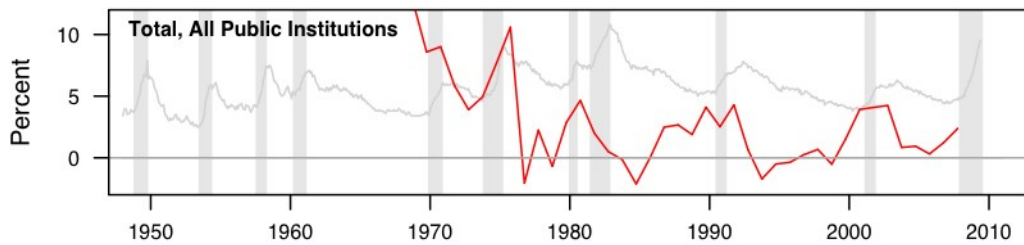
National Bureau of Economic Research.  
Accessed 2009-07-27 via Economic Research at the Federal Reserve Bank of St. Louis.  
[http://research.stlouisfed.org/fred2/help-faq/#graph\\_recessions](http://research.stlouisfed.org/fred2/help-faq/#graph_recessions)

**Figure 3**

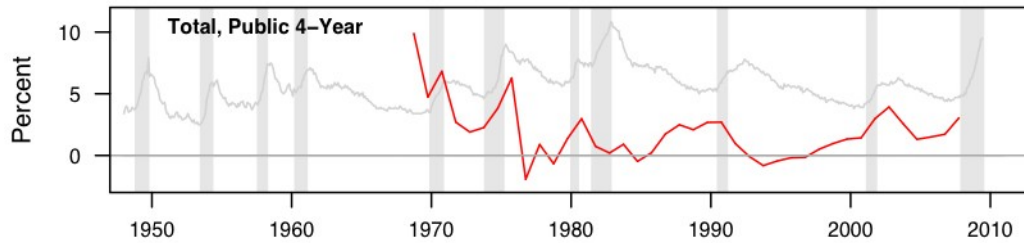
This is the same graph as Figure 2 but at a reduced scale that makes comparison across graphs easier.



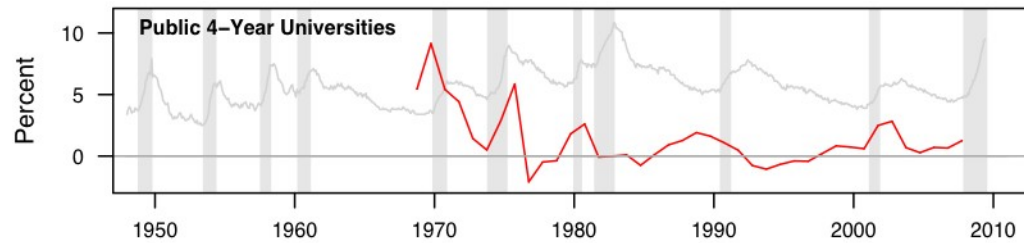
**Figure 4**



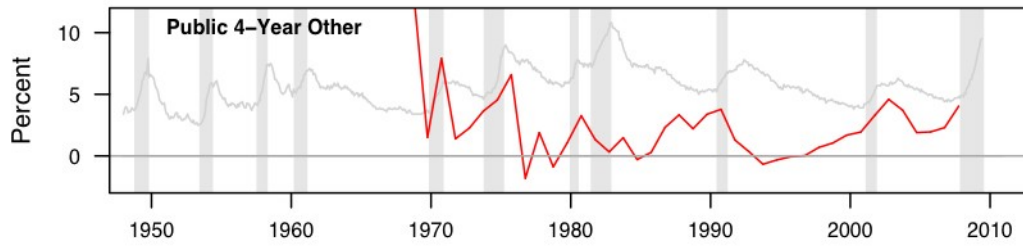
**Figure 5**



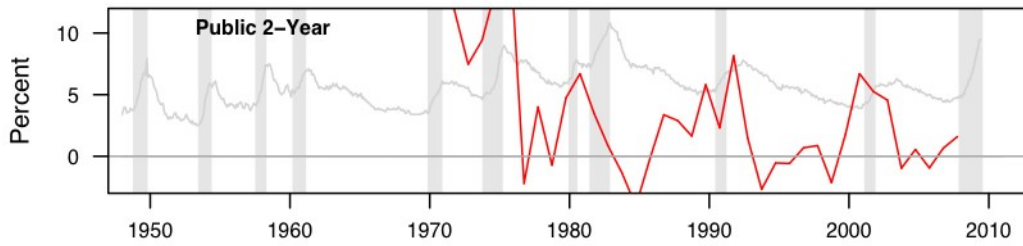
**Figure 6**



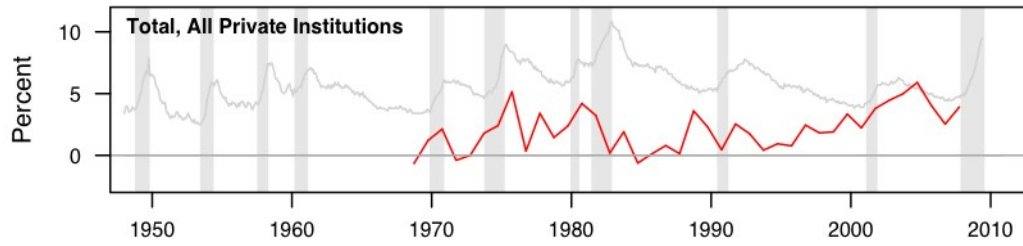
**Figure 7**



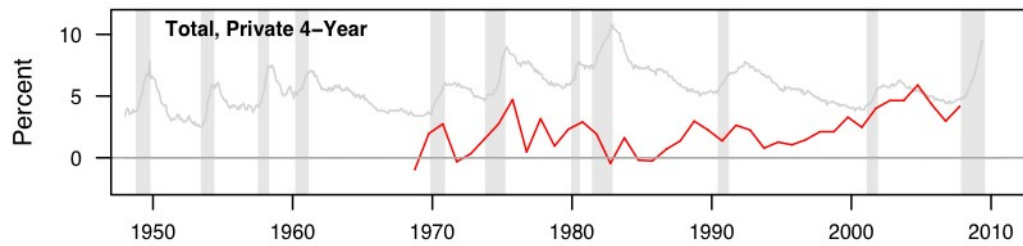
**Figure 8**



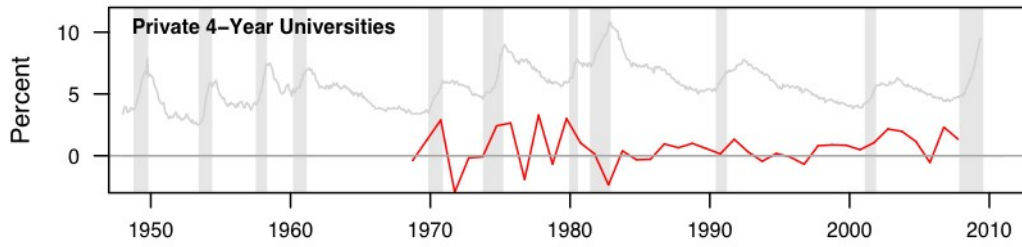
**Figure 9**



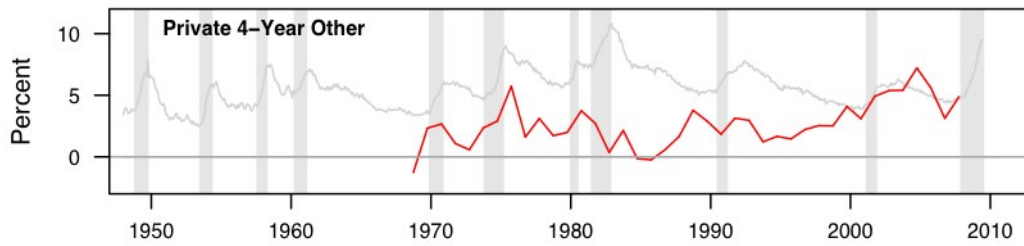
**Figure 10**



**Figure 11**



**Figure 12**



**Figure 13**

