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# Quantitative Assessment of the Presence of a Bubble in the Higher Education Market

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Quantitative Assessment of the Presence of a Bubble in the Higher Education Market

By

Kyle Steven Birnbaum

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Submitted in partial fulfillment  
of the requirements for  
Honors in the Department of Economics

UNION COLLEGE

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## **ABSTRACT**

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The relationship between the value of a college education and the price of the diploma is explored for exuberance in light of the accelerating growth rate of college tuition. With the Great Recession of 2007 still in on the minds of the American public, bubble formation and the subsequent burst is a concern for future economic stability. Discussion on the presence of a higher education bubble continues to increase however it has yet to be quantitatively assessed. This paper utilizes a modified price-dividend ratio, tailored for higher education, implemented in the econometric model for bubble detection developed by Phillips, Wu and Yu (2011) and Phillips, Shi and Yu (2013). The results from this study suggest the presence of bubble activity during the sample period, although there is inconsistency in the date-stamping process.

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## **Chapter 1: Introduction**

Speculative asset bubbles have the potential to result in great wealth for those who know how to exploit them, however selling too soon can limit one's earnings and selling too late very easily can result in a catastrophic loss in capital. Is the United States economy in the escalating period of a credit-based speculative asset bubble in regards to higher education? With the increase in college tuition potentially outpacing that of the value of a college degree, students are being forced to take out a greater quantity of larger loans, which are getting repaid more and more slowly and organizations such as Sallie Mae may suffer a fate similar to that of Fannie Mae and Freddie Mac.

In the wake of the Great Recession, triggered by the 2008 crash of the real estate bubble in the United States, research on economic bubbles has begun to expand and become more robust. It is easy to state *ex post facto* that a certain market experienced a speculative asset bubble, however it is much more difficult to determine that a bubble is forming or when it will burst. It would be ideal to be able to realize there is a bubble forming in the economy so the Federal Reserve Bank can take a proactive stance in order to mitigate any potential fallout when it bursts, as well as informing consumers that their speculations of the intrinsic value of the asset are exaggerated.

Using the lifespan of the 2008 housing bubble involving subprime mortgages and subsequent bubble analysis as a template, the state of higher education in the United State will be analyzed. College tuitions are constantly increasing, in one decade (2001-02 to 2011-12), tuition at public and private not-for-profit institutions have increased by 40 and

28 percent, respectively according to the Institute of Education Sciences. The question is, how quickly is the value of a college education increasing, if at all, and does it justify the increasing cost? Different methods of evaluating the worth of a college degree will be explored and tests derived from the work of Peter C.B. Phillips, renowned Econometrician who specializes in stochastic characteristics of time series data, and his colleagues will be applied to the market to see if there is a bubble forming, and, if so, any possible consequences that may result from the burst.

The asset price of an institution will be based on the sticker price of tuition for both public and private institutions in the United States. In order to calculate the intrinsic value of a college education, average annual earnings of those who hold a college degree or higher will be compared to the earnings of those finishing their education with a high school diploma.

The results of this study are inconclusive, due to a small sample size of the data set. While the tests do imply the formation of a speculative asset bubble in the higher education market, the date-stamping process of the bubble is inconsistent.

## **Chapter 2: Literature Review**

### 2.1: Speculative Asset Bubbles

In its simplest state, a bubble forms when the value placed on an asset by the public – the speculative future worth of the asset—becomes larger than the intrinsic value. This is most clearly seen in the stock market through the trading of certain commodities. When there is belief that an asset will increase in value, it will rapidly be purchased, driving the price higher and higher. This is considered the manic period of bubble formation.

Charles Kindleberger details five stages of a bubble in his book Manias, Panics and Crashes: A History of Financial Crises. According to Kindleberger, bubbles begin to form due to some sort of displacement; an event or shock that would give reason to reassess the value of an investment. These can range from innovation, such as the case of the technology startups and the internet's growth during in the dot-com bubble, to restructuring of government through deregulation of banks. This displacement leads to the creation of credit. Kindleberger cites Hyman Minsky in stating that credit supply is pro-cyclical. In times of economic prosperity, due to an optimistic outlook of the future, banks tend to become more lenient when granting credit, whereas in times of economic downturn, banks will become more stringent when loaning money. When the economy gets shocked into a boom through some displacement, lenders become eager to dole out credit, expecting a large return. This rapid growth of easy-to-acquire credit easily evolves into euphoria, Kindleberger's next stage.

During euphoria, investors are extremely active in buying assets quickly for short-term capital gains. They will hold on to the asset for as long as they predict the value will increase, then sell it to a greater fool, one who still feels that the asset's value will continue to rise. This is where information asymmetry plays a huge role. Even rational investors will be buying and selling an asset at different times because they have differing information from other investors or they do not believe others have the same information they have, resulting in their extending the life of the bubble by holding onto assets to sell at a later date. This rampant price increase can go on potentially for months, even years until there is a synchronization of investors disinvesting the asset, for whatever reason, causing the bubble to burst and prices to fall dramatically.

The burst of the bubble brings the economy to Kindleberger's bust stage, which is comprised of manic selling at any price in order to get the asset off the books of lenders. While in the bust stage, those who recklessly handed out credit are now struggling to see any return on their investment. When a large number of debtors are unable to pay back their loans, banks start to fail, as seen on a large scale with the collapse of Lehman Brothers in 2008. These closings result in a crash in consumer confidence and a slowdown or potential halt in market activity, causing prices to tumble in the final state of revulsion.

## 2.2: The Housing Bubble

The most recent bubble is the subprime mortgage crisis that predated the Great Recession. Origins of the housing bubble stem back to the stock market boom of the late



90's, where consumption growth greatly outpaced the national income (Foster & Magdoff 2009). Those who increased their wealth during the lifespan of the dot com bubble began purchasing houses based on this recent influx of cash. Because of the sticky nature of housing supply, the increase in demand drove up housing prices in the United States, and they continued to rise (Baker 2008). The expectation was that the growth was perpetual and that borrowing to purchase a house would not be problematic, regardless of the amount, because the house will be worth more in the future. Banks had the same mentality, relaxing their lending standards, making purchasing a home out of an acceptable price range drastically easier (Foster & Magdoff 2009). This started the speculative manic activity of a forming bubble.

Typical predictions would have the housing bubble pop alongside the stock market bubble. Instead, the population turned to real estate, seeing it as a safe investment, after the loss of confidence in the stock market. This, paired with the continuous slashing of interest rates by the Federal Reserve to promote economic growth in the aftermath of the collapse of the dot-com bubble, resulted in continuous growth of house prices (Baker 2008). Construction began to take off as well in order to take advantage of the increased demand.

When the bubble began to burst in 2007 due to the increase of interest rates, the market quickly shifted from a seller's to a buyer's market. The explosion of construction activity caused an excess of houses that could not be supported by the inflated real estate prices, sending prices into a downward tailspin. The use of adjustable rate mortgages was at an

all-time high during this run-up. These “sub-prime” mortgages appealed to those who could not really afford a home with “very low interest rates...charged for a few years before the rates become adjustable” (Foster & Magdoff 2009, 51). When the rate adjusted beyond the amount possible to be paid by households, bankruptcies and foreclosures began to spread.

The extreme trend of foreclosures, although distressing to the homeowners and local commercial banks is not what caused the most distress to the economy. Companies such as Fannie Mae and Freddie Mac, who are controllers of mortgage backed securities, were incentivized to acquire as many mortgages as possible, typically targeting lower income households. When securitization became a common practice in mortgage underwriting, the loans were no longer originated to be held by the bank. Instead, the bank passed the risk to the holder of the mortgage-backed securities (Schwartz 2009). When the bad loans, hidden amongst the strong loans, started to fail, the entire mortgage backed security started to depreciate in value. This caused major players in the economy, such as Bear Sterns and Lehman Brothers, who until recently were deemed “too big to fail,” failed.

### 2.3: Signs of a Higher Education Bubble

There are three facts that support the theory that there is a higher education bubble currently forming in the United States. College is getting more expensive every year, making the cost of a degree, the asset, higher. Student debt is increasing due to those rising prices, as well as the ease of borrowing money. The job market is oversaturated

with college graduates, making it significantly harder to find a job, decreasing the return on the investment. If there is a bubble forming, the nature in which these three trends interact will eventually result in a burst.

### 2.3.1: Improvements to Marketing, not Education

Why have tuition prices skyrocketed at an alarming rate—439% since 1982? Why does the market not hold the price down through simple supply and demand? Normally, when prices are so high, supply will eventually increase, which would bring the price closer to cost. However, higher education institutions are not ruled by the invisible hand of the free market. This is due to the large barriers to entry into the higher education market, driven by school prestige.

### College Tuition vs. Medical Care vs. Home Prices vs. CPI: All Items 1978 to 2011

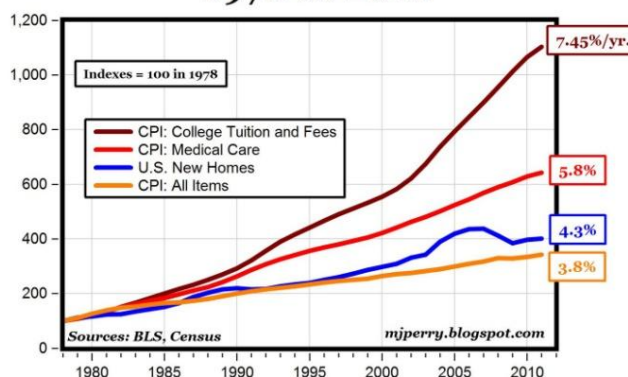


Figure 1: Comparison of College Tuition to the Consumer Price Index over time.

There is not a disparaging gap between the academic standing of peer institutions. The most salient differences between these colleges and universities are location, size, prestige and price. None of these factors can easily be translated into the best return on investment, however they are characteristics that are weighed heavily when most students

make decisions on their choice of a college. Competition is based upon how well the school can display physical amenities – marketing. Why has this become the custom? Why are schools, where the sole purpose for their existence is education, marketing their student life more than the classroom? It is because the success of a school is driven by prestige maximization.

Top-tier colleges on average accept 10 percent of applicants. This is because they are not concerned with profit maximization; colleges and universities are focused on prestige. Colleges are successful when there is high competition to attend the institution, so funds go towards marketing the school for things such as new buildings, state-of-the-art dormitories, and salient athletic programs. No matter how many applications a college receives, they will still accept roughly the same number of students, due to housing and classroom availability. For this reason, the typical market solution of reducing prices to increase demand for a higher profit does not work for a college institution. Also, due to the barriers to entry in the higher education field as well as a delay in the expansion of an institution, a subsidy—easily attainable government aid, for example—that would typically incentivize an expansion of the market, simply allows colleges to augment tuition in response to the public's increased ability to pay.

Prestige is not pointless, however. If someone is spending four (or more) years at a college, these improvements to student life are important and marketing those benefits in and of itself is not problematic. The trend that schools are less focused on academics is worrisome. *Academically Adrift: Limited Learning on College Campuses*, Richard Arum

and Josipa Roska, follows 2,300 college students during their four years at 24 different universities. The initial shock is that more than 33 percent of students displayed no improvement in their critical thinking skills (Arum & Roksa, 2011). Why is this? It could be that students care less (no doubt a cause for concern, but not applicable to the topic at hand) but it also is the result of lax requirements at the institutions. Thirty-five percent of students study five or less hours per week. Half of the students reported that not one of their current courses required 20 pages or more of writing. This is not to say that all colleges are failing at educating their students. These numbers are averages and trends, but they speak to the point that the increasing price tag of colleges is mostly due to what were once considered nice extras to education, and not the education itself.

### *2.3.2: Student Loans*

How and why do people still pay astronomical prices for higher education? The current culture dictates that no matter the cost, having a college diploma will lead to a more successful life. As a result, student loans have allowed students to pay for an education that they cannot afford and will take an increasingly longer time to repay. As of 2013, there is more than \$1.1 trillion outstanding student loan debt in the United States spread across 38 million borrowers.

The majority of the two thirds of college students that are receiving some sort of aid have government provided aid—nearly 70 percent as of 2006. In order to receive these loans, all that is required is to fill out the Free Application for Federal Student Aid (FAFSA) and have financial need approved by the institution. No credit check or risk analysis is

done to decide the probability that the loan will be repaid. There is a large distinction between government backed and private loans. Federal loans are beneficial for the student with lower interest rates, deferred interest payments until after graduation and no need for a cosigner. Being that these easy-to-acquire loans are so prevalent, driving tuition increases, often time students need even more loans to be able to afford higher education. After a slight decrease in private loans during the aftermath of the housing crisis, private loans have been increasing once again.

The change in the bankruptcy code in 2005 which exempts student loans from being forgiven through bankruptcy can be attributed to the lax lending practices. Banks are not nervous about lending because there is a near guarantee that they will eventually get their loan reimbursed. This also makes student loans even more attractive as an investment in asset-backed securities. Securitization of student loans through companies like Sallie Mae and JPMorgan is safe because of the guaranteed return and, unlike a house or a stock which can be traded, a pop of the bubble will only impact the rate of loans, not those outstanding.

Because money is so easy to acquire to attend higher education institutions, the explosion of tuition costs can be sustained and, as long as it is acknowledged that college graduates are better off than those with just a high school diploma, people will continue to borrow to attend.

### 2.3.3: State of the Job Market

An important aspect of a bubble is that it is not formed simply by the price of an asset increasing; the price increase must be disproportionate to the intrinsic value of the asset. There is a multitude of ways to identify the value of a college degree, and the state of the job market has a large impact on that value. Factors taken into account are the average loan payment of graduates versus their average salaries, the demand for graduates—seen through the relative supply, and comparing salaries and job placement to those without a college degree.

The average annual salary for the class of 2013 is \$45,000. This may have been an increase from the class of 2012, but when compared to the rate of student loan payment the outlook does not appear as positive. The average graduate in the class of 2014 has approximately \$33,000 of debt upon graduation, making them the most indebted class ever, a title that was previously held by the class of 2013.

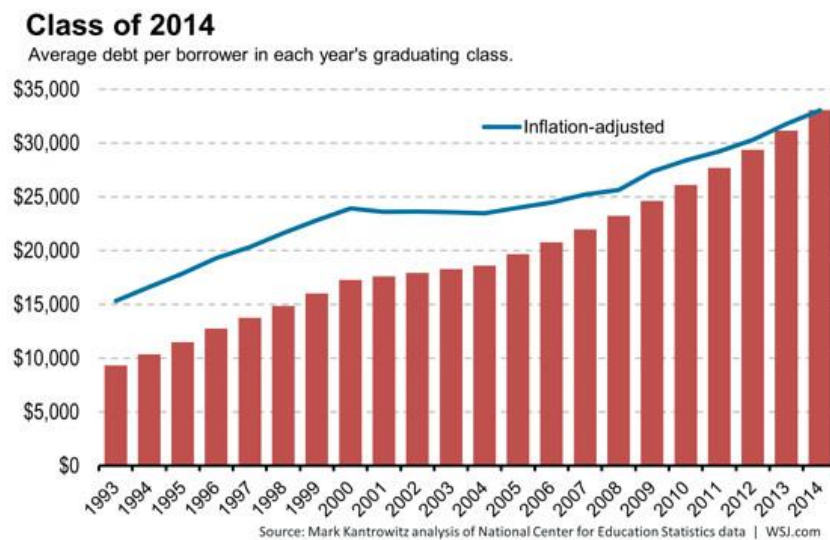


Figure 2: Average debt per student loan borrower over time.

In the years between 2001 and 2014, the number of college graduates has increased from 1.1 million to 1.6 million. The market is getting flooded with college graduates, with numbers still climbing. This increase of supply, while demand stays constant (some argue demand is decreasing due to the maturity of the technology boom) leads to lower salaries, as per simple supply and demand analysis. One can argue that the demand for highly skilled workers is always increasing and that these new graduates are filling the need for specialized jobs. According to the numbers, this does not appear to be happening.

The proportion of students that are underemployed is alarmingly high. Looking simply at the unemployment rate, or even the underemployment rate, of recent college graduates (between the age of 22 and 27) versus all college graduates, there is not an unprecedented difference. However, when looking deeper into the breakdown of unemployment, there is a scary trend forming. Underemployment, a college graduate being employed in an occupation that does not require a college degree, can be categorized by two different pools of jobs—good non-college jobs, those that do not require degrees but are career oriented and require skill such as a dental hygienist or a mechanic, and low-wage jobs such as a bartender or cashier. Since the 1990s, recent college graduates underemployed in good non-college jobs has decreased from 50 percent to around 36 percent and those holding low wage jobs rose from 15 to 20 percent by 2009. So while the number of graduates who are underemployed may not be an issue, the quality of job that they are holding while being underemployed shows that the value of an education is not holding the weight it used to.



## Share of Underemployed Graduates in Good Non-College and Low-Wage Jobs

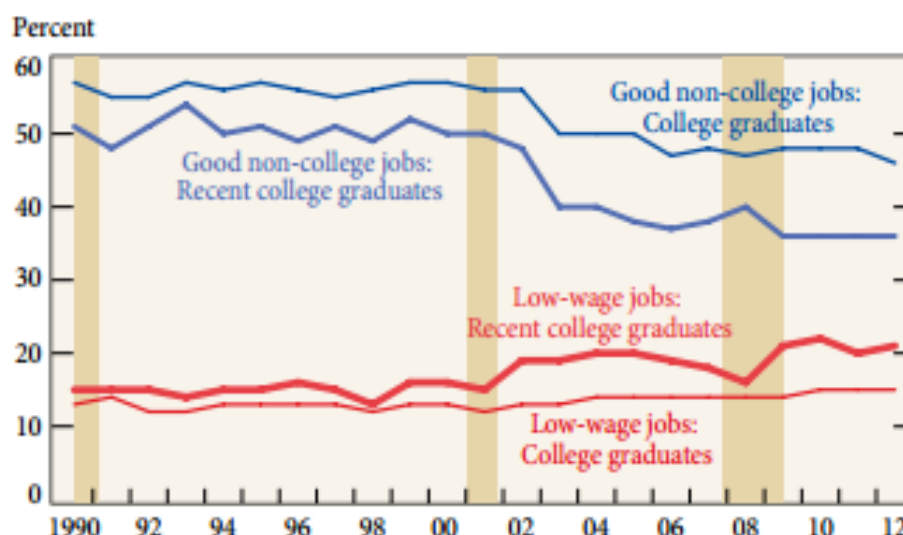


Figure 3: Breakdown of underemployment market over time.

More and more people are starting to realize this disparity between tuition and expected return on a college degree. The Bureau of Labor Statistics “predicts that 7 of the 10 fastest growing jobs of the next decade will be based on on-the-job training rather than higher education” (Reynolds 2013). When people who realize that the value of a college degree is not what it used to be, the more likely it is that the bubble will burst. If people decide it is a better value to bypass higher education and focus on trade-oriented fields, then higher education institutions will not be able to sustain their bloated tuitions, crashing the system. This is not likely to happen in the near future. There are simply too many people holding true to convention that in order to get ahead in life, you need a college degree. People will likely turn to alternative forms of education. As online education becomes more robust, sophisticated, and commonplace it will start to become a proper alternative to traditional four year universities.

#### *2.3.4: Comparing Tuition to the 2008 Housing Crisis*

Looking at the recent burst of the housing bubble, we can recount the events that led up to the Great Recession and compare them to the current state of college tuitions to assess the existence of a higher education bubble. Andrew Gillen ran this comparison in 2008, when fallout from the housing crash was still occurring. He summed up the cause of the housing crises, aside from rapidly increasing sticker prices, being “artificially low interest rates and lax lending standards” (Gillen 6).

The first sign that a bubble may be forming is a rapid increase in the price of an asset, disproportionate to the intrinsic value. The true value of both residential real estate and higher education is very difficult to definitively define. Housing prices are based on many variables such as location and current market health, allowing for the same house to sell for different prices if it were in different locations, or sold at different times. Tuition price tends to be based on inputs, not outputs; based on amenities the school has in place not success of graduates. There is no simple way to place a value on either of these assets, causing the speculative price to run rampant, allowing a bubble to form.

Much like housing, people rely heavily on loans to pay for a college education and a college loan is extremely easy to attain. In regards to the housing bubble, due to programs such as Fannie Mae and Freddie Mac, banks are able to sell off their mortgage loans, relieving themselves of any risk and creating an incentive to make as many loans as possible. This securitization is also applicable to student loans through similar programs such as Sallie Mae and Citi Student Loans. A default fee is built into most student loans

that goes to a guarantor who will reimburse a defaulted loan (although it is very difficult to default on student loans, they remain even through bankruptcy). The securitization and reimbursement guarantee disincentivizes lenders to run thorough credit screenings.

Gillen stressed the effect of the artificially low interest rates of the mortgage loans in the housing crisis. Lenders were granting loans recklessly with low interest rates and the bubble popped when the Federal Reserve increased interest rates and suddenly homeowners who could not afford the new bloated payments simultaneously defaulted. The securitized loans plummeted; banks could not sell their mortgages, forcing them to stop lending recklessly. These deceptively low rates can be seen with student loans as well. Federal grants boast a lower-than-average interest rate, currently at 4.66%. This increases students' ability to pay for an institution. When colleges see that the ability to pay is increasing, they then can raise their tuitions, forcing students to take out more, private loans that do not have the same benefits as federal loans.

One difference between the housing bubble and the tuition bubble is in how the bubble will be popped. In the housing market, payments could no longer be paid and loans were defaulted on, leading to house foreclosures. You cannot foreclose on a degree. Once obtained, a college degree is retained whether you can pay for your loans or not. Student loan debt is not forgiven even through bankruptcy, so something else must pop the bubble. A mass cultural divergence from the norm, a rising belief that college is no longer worth the price tag, will burst this bubble.

### **Chapter 3: Quantitative Measures of Bubbles**

The higher education market appears to mimic activity of the housing market of 2008, but it does not necessarily mean there is a bubble in the market. There have been many ways to quantitatively analyze the existence of a bubble. Due to the recent prevalence of bubbles in the United States economy, there has been a surge of advancements of this field. There has not been a published analysis that quantitatively assesses the possibility of a bubble in the higher education market in the United States. The steps of what is necessary to pinpoint start and end dates of a bubble as well as the model for such a test are articulated in Phillips, Shi and Yu (2013).

The humble beginnings of bubble analysis were based predominantly on intuition and graphical analysis. One would plot a time-series of asset prices alongside respective fundamental values (intrinsic values) and mark where there would be a significant deviation in the graphs. There is clear cause for concern with this method, as there are a multitude of reasons as to why a deviation would occur, including natural tendencies in the market independent of bubble formation. The next logical step is to test both the asset price and fundamental value for unit roots. A unit root is indicative of a constant trend in the data.

The Augmented Dickey Fuller Test (ADF test) is used in order to classify the two values as either stationary or non-stationary. The distribution of time series data that is stationary does not vary over time (Stock & Watson 2003). Chou explains that out of the four potential outcomes of this test – asset price and fundamental value are both stationary;

asset price is stationary while the fundamental value is non-stationary; asset price is non-stationary while the fundamental value is stationary; and both the asset price and fundamental value are non-stationary – a bubble may be present in the second and fourth instances. If the asset price is not stationary when the fundamental value is, that by definition is a bubble. If both values are non-stationary, a co-integration test must be performed in order to discern if they move with one another. If the asset price and the fundamental value are not co-integrated, according to the Augmented Dickey Fuller test, there is a bubble. Multiple data sets are considered co-integrated when they have the same stochastic, or long-term, trend.

The Augmented Dickey Fuller test has been the standard bubble identification tool for a long time, despite several limitations to its power, or its ability for the test to correctly reject the null hypothesis. One criticism of the Augmented Dickey Fuller test is that it is inherently flawed by using a linear model in order to test for non-linear growth. Because by nature the market fluctuates, causing the Augmented Dickey Fuller test to seriously understate the growth of a bubble. If there is a bubble that is periodically growing and bursting, an ADF test using lengthy time series data can make the results appear less severe. The ADF test is based on the difference between the asset price and its fundamental value. If the bubble periodically bursts and brings the asset price back in line with fundamental value, the presence of the bubble can be blurred in the big picture.

Phillips, Wu and Yu attempt to account for the limitations of the ADF test by using right-tailed ADF tests as opposed to the popular left-tailed tests. The difference between the

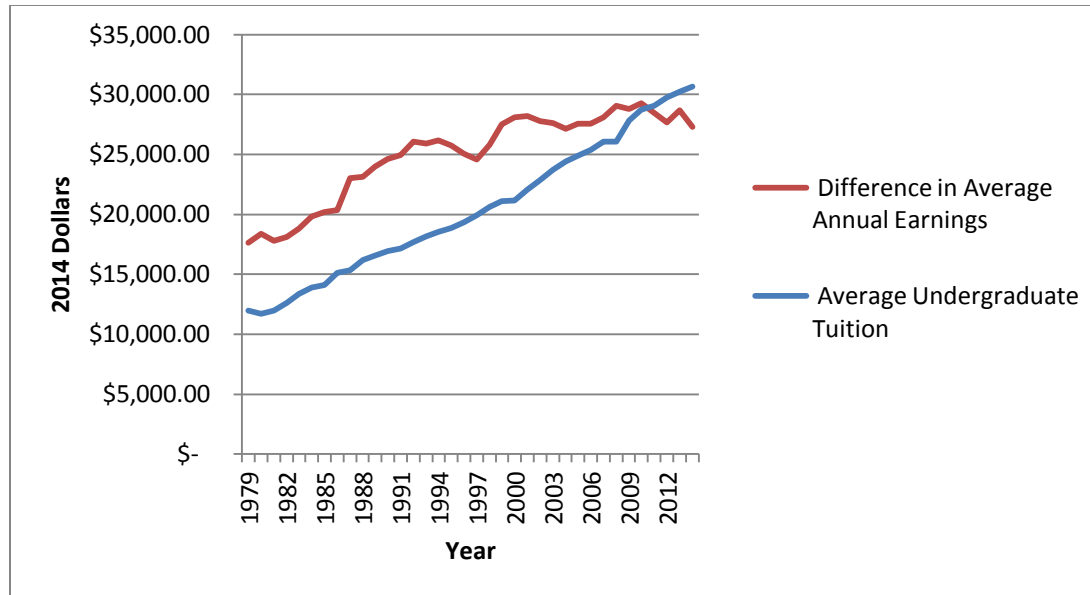
two tests is the operator used in the alternative hypothesis. A right-tailed test calculates the p-values greater than the t-statistic, placing it in the right-tail. A left-tailed does the opposite, calculating the p-statistic less than the t-statistic, thus in the left-tail (Stock & Watson, 2003). They also recursively regress over expanding windows of time, sequentially adding one more time unit of data in order to accurately date-stamp the existence of a bubble. The right-tailed ADF test is more powerful in testing for non-linear explosive behavior.

Phillips, Shi and Yu take the previous test one step further to make the detection more robust. Instead of rolling the end point of the window of time, the start point rolls as well. This results in testing near every possible combination of observations, accounting for any periodically collapsing bubble that may be present. This resolves the overarching issue of bubble detection; using a linear approach to test for nonlinear growth.

## **Chapter 4: Data**

The data for this regression has been collected from two sources. The price of higher education manifests itself as the average tuition and fees, including room and board for undergraduate institutions in 2014 dollars. This includes both private nonprofit four-year institutions and public four-year institutions. The data represents in-state charges for the public institutions from the 1979-1980 school year to the 2014-2015 school year and the posted tuition for private institutions for the same timeframe. The arithmetic mean of tuition for the same year was taken to yield the average undergraduate college tuition in the United States. The raw data was collected by College Board from the Annual Survey of Colleges, the College Board, Integrated Postsecondary Education Data System, U.S. Department of Education, and the National Center for Education Statistics. The College Board compiled the raw data into the published report in October of 2014.

The intrinsic value of a college education is represented in one's average salary post-graduation. The median usual weekly earnings for those 25 years of age and older, who are employed full time was collected from the Bureau of Labor Statistics. From this, the earnings for those who graduated from high school and did not pursue higher education were collected as well as those who have attained a bachelor's degree or higher between the years of 1979 and 2014. The data was given in nominal dollars, so the CPI for 1999 was used to convert all years to 1999 dollars, and then the entire batch was converted to 2014 dollars. Each data point was multiplied by 52 to get the average annual earnings. The average earnings for those holding only a high school degree was then subtracted from those who hold a bachelor's degree or higher.



**Figure 4: Time series visualization of data.**

Figure 4 displays the relationship between the independent data sets. The advantage of attaining a college degree has clearly been increasing constantly until approximately the 2000's, where the disparity, although varying, appears to somewhat plateau. Tuition has undisputedly been constantly increasing throughout the entirety of the data set. In 2010, average tuition surpasses the advantage higher education graduates gain through their education.

The data collected do raise some concerns in regards to power, robustness and over-simplicity. These concerns and the implications of not accounting for them will be discussed at length in the results section of this paper.



## Chapter 5: Model

There are two models that will be used to assess the presence of a bubble in the housing market, one that builds off of the other. The forward expanding recursive sup ADF test (SADF) used by Phillips, Wu, and Yu (2011) will be used, as well as the rolling window generalized sup ADF test (GSADF) used by Phillips, Shi, and Yu (2013) (further referred to as PWY and PSY, respectively). Both tests utilize right-tailed unit Augmented Dickey Fuller tests (ADF), in order to detect for mild explosiveness, as opposed to the traditional left-tailed ADF tests, which concerns itself with unit root detection. The right tailed application is specifically applicable being that “explosive or mildly explosive ... behavior in asset prices is a primary indicator of market exuberance during the inflationary phase of a bubble and it is the time series manifestation that may be subjected to econometric testing using recursive testing procedures like the right sided unit root tests in PWY” (PSY 2013, 7).

Traditionally, when the SADF or GSADF tests are conducted, or bubble analysis in general is attempted, the asset pricing equation is used in order to account for discounting factors and dividend growth. Being that we are assessing the explosiveness in the college market, not in stocks or assets, that equation cannot be applied. However, as was referenced in PSY, “tests for a unit root in the price-dividend ratio do not preclude the presence of a (stationary or nonstationary) time-varying discount factor influencing the ratio” (PSY 2013, 33). The fact that the price-dividend ratio is an acceptable function to run the SADF and GSADF regressions on is extremely helpful in the unconventional task of testing for a bubble being caused by a non-tradable asset, in this case a college degree.

This is because a college degree has a price – tuition, and it has a dividend – return on schooling, or the premium seen in average earnings when a degree is attained. Thus, the price-dividend ratio for higher education would be:

$$\frac{\text{college tuition}}{\text{difference in earnings with and without bachelor's degree}}$$

I will also be taking the log-linear approximation of the ratio, by taking its natural logarithm, in order to make the numbers more manageable, as suggested in PSY.

The first test, in alignment with rudimentary bubble testing techniques, will simply look for explosive behavior in the price of a college education as well as, according to the belief that there is a bubble in the market, a lack of explosive behavior in the premium in earnings. A simple right-tailed ADF test run on both the variables individually will yield these results. This is an important first step because if neither variable displays explosive behavior, there clearly is no evidence of a bubble.

After the elementary level test for an indication of bubble behavior, the SADF test will be conducted, as explained in PWY. This uses a forward expanding window when applying the right-tailed ADF test. This process, as opposed to traditional unit root tests that cannot distinguish from data that is indicative of a bubble that is periodically collapsing and a unit root function, can differentiate between these two alternatives. It does this by looking at the data recursively, adding an additional data point each application. The nature of the window is depicted in figure 5 and is explained in PWY (2013, 9).

The window size  $r_w$  expands from  $r_0$  to 1; so that  $r_0$  is the smallest sample window width fraction (initializing computation) and 1 is the largest window

fraction (the total sample size) in the recursion. The starting point  $r_1$  of the sample sequence is fixed at 0; so the end point of each sample ( $r_2$ ) equals  $r_w$ , and changes from  $r_0$  to 1. The ADF statistic for a sample that runs from 0 to  $r_2$  is denoted by  $ADF_0^{r_2}$ . The SADF statistic is defined as

$$SADF(r_0) = \sup_{r_2 \in [r_0, 1]} ADF_0^{r_2}.$$

Although this process is more powerful in detecting periodically collapsing bubbles, it has still been proven to fail to detect all bubbles present. When applied to S&P 500 data in PSY, there are different indications of bubble activity when the data set is truncated, so it can be concluded that “the SADF test fails to find bubbles when the full sample is utilized whereas when the sample is truncated to exclude some of the collapse episodes the test succeeds in finding supportive evidence of bubbles” (PSY 2013, 26).

PSY has accounted for this weakness by implementing the GSADF with a rolling window, which will be the next step in assessing the presence of a bubble in the higher education market. This technique results in vastly more subsamples, which has the ability to detect even minute instances of explosiveness in data sets. As opposed to only adjusting the end point of the window, the starting point is also incremented by a pre-defined fraction of the whole data set. The GSADF statistic is denoted in PWY (2013, 11) as

$$GSADF(r_0) = \sup_{\substack{r_2 \in [r_0, 1] \\ r_1 \in [0, r_2 - r_0]}} \{ADF_{r_1}^{r_2}\}.$$

“Suppose the rolling window regression sample starts from the  $r_1^{th}$  fraction of the total sample (T) and ends at the  $r_2^{th}$  fraction of the sample, where  $r_2 = r_1 + r_w$  and  $r_w$  is the (fractional) window size of the regression. The empirical regression model can then be written as

$$\Delta y_t = \alpha_{r_1, r_2} + \beta_{r_1, r_2} y_{t-1} + \sum_{i=1}^k \varphi_{r_1, r_2}^i \Delta y_{t-i} + \varepsilon_t$$

*iid*

Where k is the lag order and  $\varepsilon_t \sim (0, \sigma_{r_1, r_2}^2)$ . The number of observations in the

regression is  $T_w = \lfloor T r_w \rfloor$ , where  $\lfloor \cdot \rfloor$  is the floor function (giving the integer part of the argument). The ADF statistic (t-ratio) based on this regression is denoted

by  $ADF_{r_1}^{r_2}$  (PWY 2013, 8).

The differences between the forward expanding window used in the SADF test and the rolling window of the GSADF test are visually displayed in Figure 5.

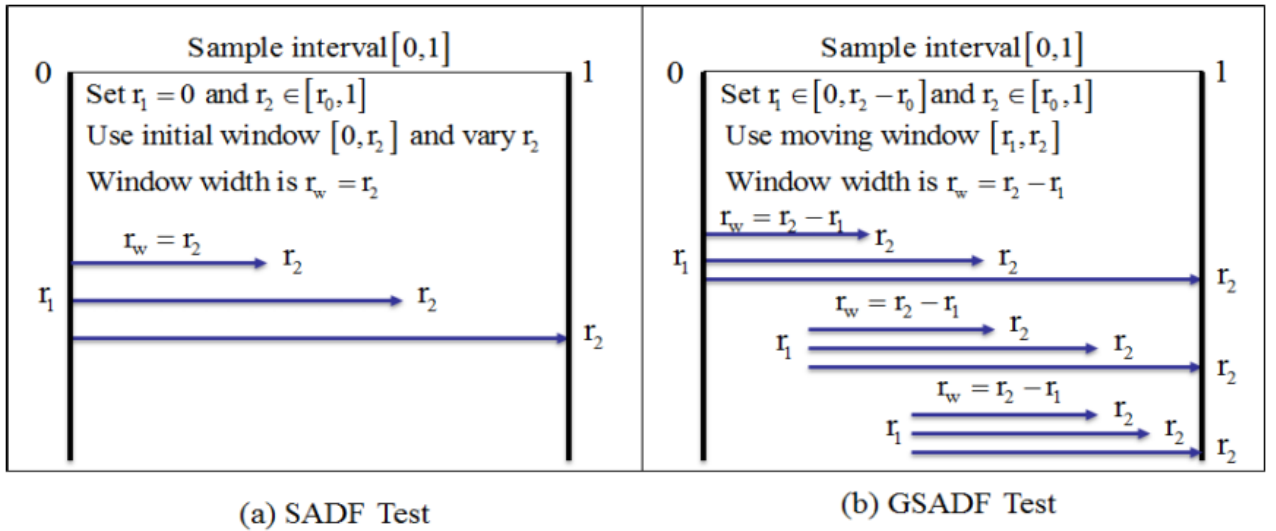


Figure 5: Visual representation of the differences between forward expanding and rolling windows.

The final task is to date-stamp the higher education bubble if it is present, pinpointing the time that the bubble began and, if applicable, ceased. This is done by performing a backward, recursive sup ADF test. This is more powerful when date stamping than the ADF test suggested by PWY because it does not have the danger of reporting stationary activity in the case of periodically collapsing bubbles. PWY's SADF test performed an ADF test at  $r_2$  for each recursion of the test, where the GSADF test of PSY performs a sup ADF test at each  $r_2$ . A visual representation of the two processes is displayed in Figure 6.

The results from the backward SADF test are then compared to the critical values of the test. “[T]he origination date of a bubble [is defined] as the first observation whose backward sup ADF statistic exceeds the critical value of the backward sup ADF statistic. The termination date of a bubble is calculated as the first observation after [the origination date] whose backward sup ADF statistic falls below the critical value of the backward sup ADF statistic” (PWY 2013, 15). Because this test is powerful enough to pick up small blips of explosive behavior, a minimum duration of  $L_T = \log(T)$  must be present in order to characterize the observation a bubble, T being the sample size.

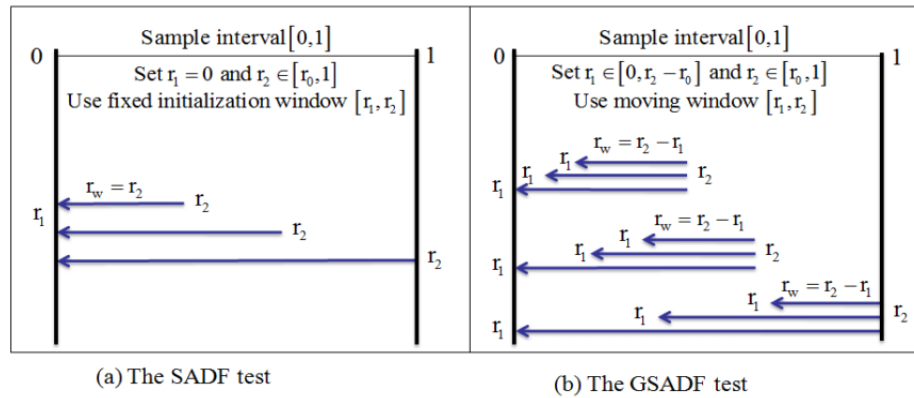


Figure 6: Comparison of date-stamping strategies of the two tests.

## **Chapter 6: Empirical Application**

The models of bubble detection outlined above were run on the relevant higher education data via EViews 8. Itamar Caspi of the Bank of Israel developed an add-in for EViews called Rtaadf which performs all relevant tests. The add-in is capable of executing a standard right-tailed ADF test, a rolling window ADF test, SADF test, and GSADF test. The add-in also calculates relevant critical values and the backward ADF and SADF tests required in order to date stamp possible bubbles. The add-in has been tested by replicating the empirical work published by PSY (2013). Caspi published this replication to ensure confidence in the robustness of his application.

A standard right-tailed ADF test on the earnings premium and on the average tuition was conducted to observe the explosive nature of the variables. To minimize size distortion, a fixed lag length was used. The results of these tests are displayed in Table 1 and Table 2, respectively. The ADF statistic for the increase in a college graduate's earnings is -2.17, failing to reject the null hypothesis of a unit root even at a 10% confidence interval, suggesting a lack in explosive behavior. However, the ADF statistic for college tuition is 1.41, easily surpassing the critical value of 0.62 at the 1% confidence interval, implying explosive behavior of the variable. These results allow for us to move onto the more robust bubble detection tests.

<b>Earnings Premium of Bachelor's Degree +</b>		t-Statistic	Prob.*
ADF		-2.169297	0.7760
Test critical values:	99% level	0.615827	
	95% level	-0.082050	
	90% level	-0.425177	
*Right-tailed test			

**Table 1: Output for right-tailed ADF test on the earnings premium of a bachelor's degree or higher.**

<b>College Tuition</b>		t-Statistic	Prob.*
ADF		1.411092	0.0030
Test critical values:	99% level	0.615827	
	95% level	-0.082050	
	90% level	-0.425177	
*Right-tailed test			

**Table 2: Output for right-tailed ADF test on college tuition.**

The SADF test is then applied to the natural log of the price-dividend ratio as defined in the model section above. Because of the limited observations in the sample size, the initial window size was set to 7% of the sample. The output is displayed in Table 3. The SADF statistic is 0.70, which is indicative of explosive behavior at only the 10% confidence level which has a critical value of 0.56.

		t-Statistic	Prob.*
SADF		0.693635	0.0570
Test critical values:	99% level	1.339359	
	95% level	0.841079	
	90% level	0.559163	
*Right-tailed test			

**Table 3: Output for the sup ADF test on the price-dividend ratio.**

We then compare this output to that of the GSADF test, shown on Table 4. The window size was set to the same value as for the SADF test. The GSADF allows us to easily reject the null hypothesis of a unit root at a 5% confidence interval with the GSADF statistic of 4.70 being greater than the 5% critical value of 1.94.

	t-Statistic	Prob.*
GSADF	4.698835	0.0130
Test critical values:	99% level	4.962406
	95% level	1.942738
	90% level	1.349208
*Right-tailed test		

**Table 4: Output for the GSADF test on the price-dividend ratio.**

When it comes to date stamping for the SADF and GSADF tests, we look at the graphical representation of the backwards ADF and SADF values, respectively, and compare them to the 95% critical values, generated by Monte Carlo simulations with 1,000 replications. These graphs, generated by the add-in, are displayed as Figures 7 and 8, respectively.



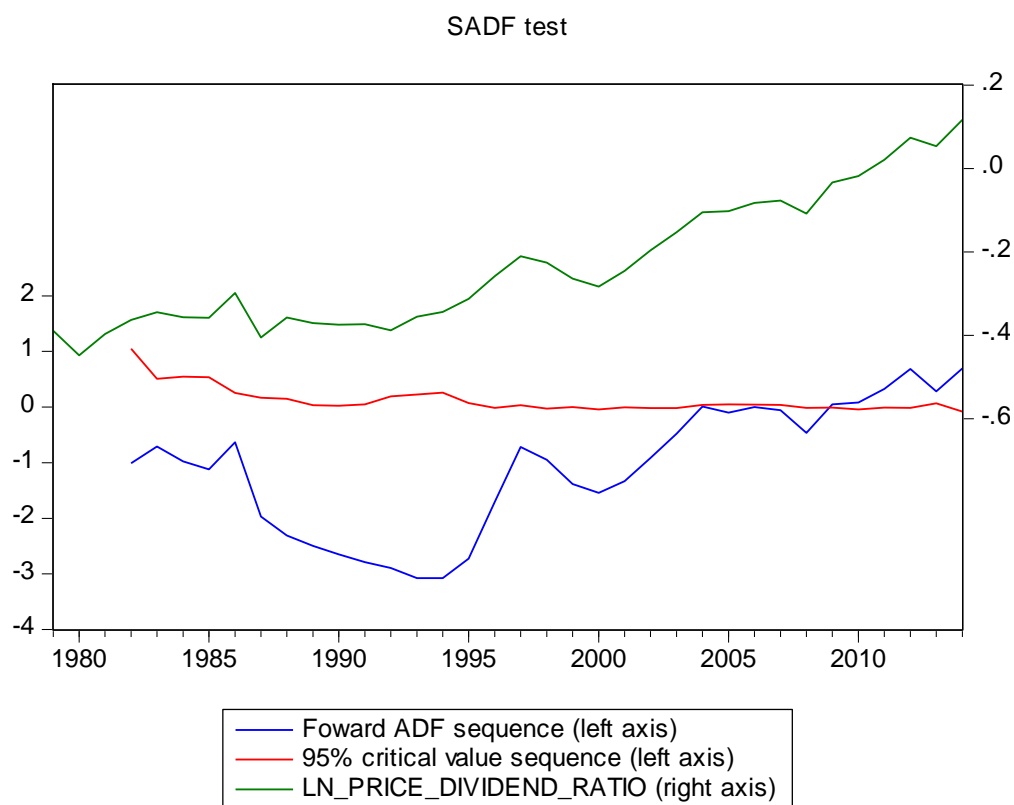


Figure 7: Date-stamping output for SADF Test

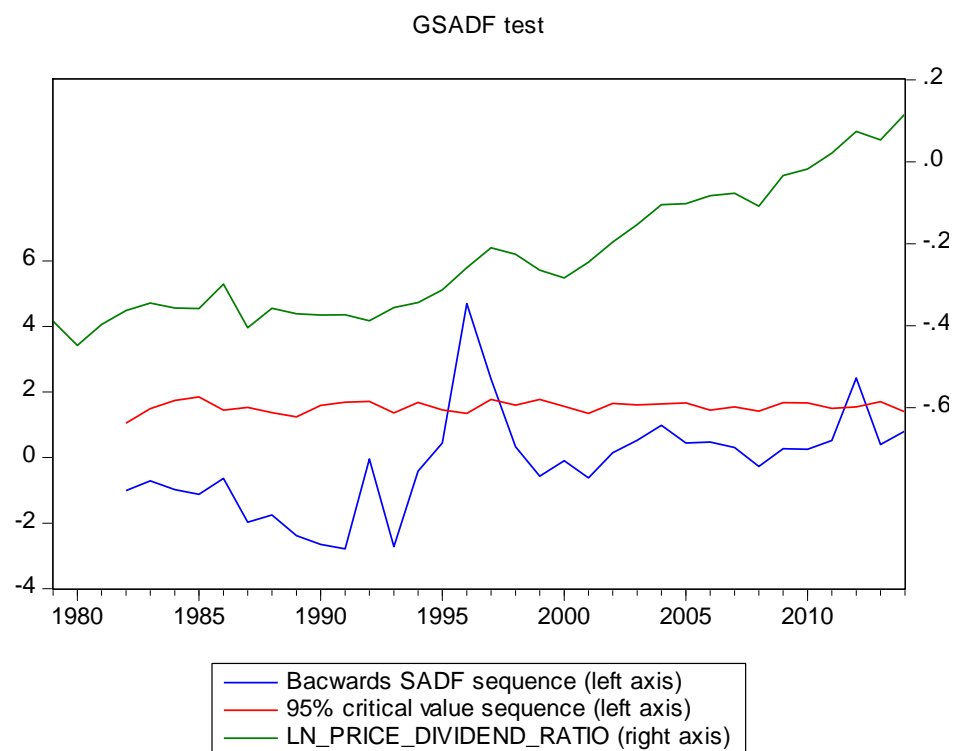


Figure 8: Date-stamping output for GSADF Test

## **Chapter 7: Results**

The first test of exuberance in the individual variables suggests that a bubble can be present in the higher education market. Bubbles are present when the price of an asset grows at a disproportionate rate to the return on that investment. The evidence of explosive behavior in the trend of college tuition and the lack of explosive behavior in the trend of the earnings premium achieved when holding a bachelors degree or higher suggests that the market behavior is indicative of a bubble. This is the most rudimentary level of bubble testing, but a necessary first step. If no exuberance was detected then the analysis could cease. Because the data set passes this first test easily, it is appropriate to continue the assessment of the presence of a bubble in the market.

The SADF test does not offer extremely conclusive results of a bubble in the market. The SADF statistic of approximately 0.70 allows for the null hypothesis to be rejected at the 10% confidence level, but not at the 5% or 1% levels. Depending on the confidence threshold used, the test could potentially insist on a bubble being present during the sample period. When looking at the date-stamping graph for the SADF test, the market is currently in the time of market exuberance suggested by the SADF statistic. The bubble started in 2009 and the forward ADF sequence is trending upwards, suggesting the bubble is continuing to grow. This is also the only instance of bubble activity in the sample period, according to this test.

The GSADF test tells a much different story. Similar to the SADF statistic, the GSADF statistic cannot reject the null hypothesis of unit root behavior at the 1% confidence

interval. However, it can reject the null hypothesis at the 5% confidence interval, providing stronger evidence for the presence of a bubble. Where the discrepancy between the two tests comes into play is when date-stamping is attempted. According to the GSADF output, there were two periods of bubble-like exuberance. The first one started in 1995 and lasted only two years, until 1997. The second period of exuberance lasted only one year, between 2011 and 2012. The latter period, according to parameters set by PWY did not have long enough duration to be considered a bubble. The required length is denoted by  $\log(T)$  and with a sample size of 36, a period of exuberance must last 1.56 years in order to be deemed a bubble.

## **Chapter 8: Conclusion**

As expected, the SADF and GSADF yielded different outcomes, and neither of them produced results that could be accepted at the 1% confidence interval. However, the outcomes of the tests, and even the discrepancies, speak to the current nature of the higher education market.

Both tests acknowledge the presence of a bubble at some point during the sample period, although they differ on when the bubble occurred. Looking at the second period of exuberance displayed from the GSADF test, although it was not sustained long enough to be denoted as a bubble, it points to the writing on the wall for college tuitions. Both tests suggest a bubble during this post-2008 time frame as well as showing a trend leading up to a bubble.

### *8.1: Limitations*

There are some clear limitations to the results that were derived in this paper. The first and foremost concern lies with the sample size of the data set used. When the SADF and GSADF tests are used, there are typically thousands of observations, making the results more significant. Market exuberance tests are traditionally run on S&P data, where observations can be collected daily. However, being that by nature the variables used in this paper are reported annually, there is a severe limitation on the quantity of observations available.

Similarly, the results may be skewed because the two variables may not be directly comparable. For price of higher education, the average undergraduate tuition in the United States was used. The intrinsic value of college education was evaluated by using the annual earnings of those who have their bachelor's degrees or higher. Data representing those who have only a bachelor's degree would be more representative of a bubble in the undergraduate market, however such a data set only dates back to 2000. As opposed to limiting the power of test further by limiting the data set to only fourteen observations, the data representing those who have a bachelor's degree or higher was used. If the ideal data set was used, the findings would be more conclusive and, one could assume, point more towards the creation of a bubble. Including the earnings of exceptionally lucrative professions such as medical doctors and attorneys, that require significantly more schooling, increases the premium in earnings due to education. This inflation is not accounted for in the average undergraduate tuition, skewing the results to make it appear that an undergraduate degree is intrinsically worth more than in reality.

## *8.2: Future Application*

Although there were no conclusive findings in this report, it sets the stage for future quantitative research on the higher education bubble. Most importantly, when more historical data is collected on college tuitions and earnings of those who hold only a bachelor's degree, the GSADF test will certainly have more definitive results for the presence of a bubble.

Although the results imply the trend of a bubble forming, there will not be a devastating pop of this bubble unless there is a shock, like any asset bubble. The shock to pop the higher education bubble has to be a viable alternative to traditional college. This is not going to happen in the near future. Online education is the closest alternative that could compete with traditional undergraduate institutions, and that is not nearly prestigious enough, yet, to cause the pop. The culture of the job market in the United States is that a college education is required, and the traditional route is typically held in higher regard. The bubble will not pop until there is a change in that culture.

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## Appendix A: Data

Median Usual Weekly Earnings (Bachelor's Degree and Higher)				
Year	Earnings	1999 CPIs	1999 Dollars	2013 Dollars-weekly
1979	\$ 344.00	2.555	\$ 878.92	\$ 1,229.61
1980	\$ 376.00	2.295	\$ 862.92	\$ 1,207.23
1981	\$ 407.00	2.022	\$ 822.95	\$ 1,151.31
1982	\$ 438.00	1.833	\$ 802.85	\$ 1,123.19
1983	\$ 461.00	1.726	\$ 795.69	\$ 1,113.16
1984	\$ 486.00	1.673	\$ 813.08	\$ 1,137.50
1985	\$ 506.00	1.603	\$ 811.12	\$ 1,134.75
1986	\$ 525.00	1.548	\$ 812.70	\$ 1,136.97
1987	\$ 564.00	1.52	\$ 857.28	\$ 1,199.33
1988	\$ 585.00	1.467	\$ 858.20	\$ 1,200.61
1989	\$ 609.00	1.408	\$ 857.47	\$ 1,199.60
1990	\$ 638.00	1.344	\$ 857.47	\$ 1,199.60
1991	\$ 666.00	1.275	\$ 849.15	\$ 1,187.96
1992	\$ 696.00	1.223	\$ 851.21	\$ 1,190.84
1993	\$ 715.00	1.187	\$ 848.71	\$ 1,187.34
1994	\$ 733.00	1.153	\$ 845.15	\$ 1,182.36
1995	\$ 747.00	1.124	\$ 839.63	\$ 1,174.64
1996	\$ 758.00	1.093	\$ 828.49	\$ 1,159.06
1997	\$ 779.00	1.062	\$ 827.30	\$ 1,157.39
1998	\$ 821.00	1.038	\$ 852.20	\$ 1,192.23
1999	\$ 860.00	1.022	\$ 878.92	\$ 1,229.61
2000	\$ 891.00	1.000	\$ 891.00	\$ 1,246.51
2001	\$ 921.00	0.967	\$ 890.61	\$ 1,245.96
2002	\$ 941.00	0.941	\$ 885.48	\$ 1,238.79
2003	\$ 964.00	0.926	\$ 892.66	\$ 1,248.84
2004	\$ 986.00	0.905	\$ 892.33	\$ 1,248.37
2005	\$1,013.00	0.882	\$ 893.47	\$ 1,249.96
2006	\$1,039.00	0.853	\$ 886.27	\$ 1,239.89
2007	\$1,072.00	0.826	\$ 885.47	\$ 1,238.78
2008	\$1,115.00	0.804	\$ 896.46	\$ 1,254.15
2009	\$1,137.00	0.774	\$ 880.04	\$ 1,231.17
2010	\$1,144.00	0.777	\$ 888.89	\$ 1,243.55
2011	\$1,150.00	0.764	\$ 878.60	\$ 1,229.16
2012	\$1,165.00	0.741	\$ 863.27	\$ 1,207.71
2013	\$1,194.00	0.726	\$ 866.84	\$ 1,212.71
2014	\$1,193.00	0.715	\$ 853.00	\$ 1,193.34

Median Usual Weekly Earnings (High School Diploma)				
Year	Earnings	1999 CPIs	1999 Dollars	2013 Dollars
1979	\$ 249.00	2.555	\$ 636.20	\$ 890.04
1980	\$ 266.00	2.295	\$ 610.47	\$ 854.05
1981	\$ 286.00	2.022	\$ 578.29	\$ 809.03
1982	\$ 302.00	1.833	\$ 553.57	\$ 774.44
1983	\$ 311.00	1.726	\$ 536.79	\$ 750.96
1984	\$ 323.00	1.673	\$ 540.38	\$ 755.99
1985	\$ 333.00	1.603	\$ 533.80	\$ 746.78
1986	\$ 344.00	1.548	\$ 532.51	\$ 744.98
1987	\$ 356.00	1.52	\$ 541.12	\$ 757.03
1988	\$ 368.00	1.467	\$ 539.86	\$ 755.26
1989	\$ 375.00	1.408	\$ 528.00	\$ 738.67
1990	\$ 386.00	1.344	\$ 518.78	\$ 725.78
1991	\$ 397.00	1.275	\$ 506.18	\$ 708.14
1992	\$ 403.00	1.223	\$ 492.87	\$ 689.52
1993	\$ 415.00	1.187	\$ 492.61	\$ 689.15
1994	\$ 421.00	1.153	\$ 485.41	\$ 679.09
1995	\$ 432.00	1.124	\$ 485.57	\$ 679.31
1996	\$ 443.00	1.093	\$ 484.20	\$ 677.39
1997	\$ 461.00	1.062	\$ 489.58	\$ 684.93
1998	\$ 479.00	1.038	\$ 497.20	\$ 695.59
1999	\$ 490.00	1.022	\$ 500.78	\$ 700.59
2000	\$ 505.00	1.000	\$ 505.00	\$ 706.50
2001	\$ 520.00	0.967	\$ 502.84	\$ 703.47
2002	\$ 535.00	0.941	\$ 503.44	\$ 704.31
2003	\$ 554.00	0.926	\$ 513.00	\$ 717.69
2004	\$ 574.00	0.905	\$ 519.47	\$ 726.74
2005	\$ 583.00	0.882	\$ 514.21	\$ 719.37
2006	\$ 595.00	0.853	\$ 507.54	\$ 710.04
2007	\$ 604.00	0.826	\$ 498.90	\$ 697.97
2008	\$ 618.00	0.804	\$ 496.87	\$ 695.12
2009	\$ 626.00	0.774	\$ 484.52	\$ 677.85
2010	\$ 626.00	0.777	\$ 486.40	\$ 680.48
2011	\$ 638.00	0.764	\$ 487.43	\$ 681.92
2012	\$ 652.00	0.741	\$ 483.13	\$ 675.90
2013	\$ 651.00	0.726	\$ 472.63	\$ 661.20
2014	\$ 668.00	0.715	\$ 477.62	\$ 668.19

<u>Average Tuition</u>			
<b>Academic Year</b>	<b>Private Nonprofit Four-Year</b>	<b>Public Four-Year</b>	<b>Average Undergrad Tuition and Fees and Room and Board in 2014 Dollars</b>
<b>79-80</b>	\$16,339	\$7,587	\$ 11,963.00
<b>80-81</b>	\$16,116	\$7,349	\$ 11,732.50
<b>81-82</b>	\$16,464	\$7,465	\$ 11,964.50
<b>82-83</b>	\$17,413	\$7,810	\$ 12,611.50
<b>83-84</b>	\$18,504	\$8,187	\$ 13,345.50
<b>84-85</b>	\$19,342	\$8,427	\$ 13,884.50
<b>85-86</b>	\$19,674	\$8,529	\$ 14,101.50
<b>86-87</b>	\$21,436	\$8,812	\$ 15,124.00
<b>87-88</b>	\$21,888	\$8,791	\$ 15,339.50
<b>88-89</b>	\$23,443	\$8,957	\$ 16,200.00
<b>89-90</b>	\$24,049	\$9,030	\$ 16,539.50
<b>90-91</b>	\$24,622	\$9,271	\$ 16,946.50
<b>91-92</b>	\$24,819	\$9,537	\$ 17,178.00
<b>92-93</b>	\$25,482	\$9,893	\$ 17,687.50
<b>93-94</b>	\$26,061	\$10,249	\$ 18,155.00
<b>94-95</b>	\$26,487	\$10,628	\$ 18,557.50
<b>95-96</b>	\$27,156	\$10,535	\$ 18,845.50
<b>96-97</b>	\$27,857	\$10,838	\$ 19,347.50
<b>97-98</b>	\$28,738	\$11,087	\$ 19,912.50
<b>98-99</b>	\$29,873	\$11,342	\$ 20,607.50
<b>99-00</b>	\$30,692	\$11,548	\$ 21,120.00
<b>00-01</b>	\$30,664	\$11,635	\$ 21,149.50
<b>01-02</b>	\$32,021	\$12,123	\$ 22,072.00
<b>02-03</b>	\$32,896	\$12,795	\$ 22,845.50
<b>03-04</b>	\$33,758	\$13,642	\$ 23,700.00
<b>04-05</b>	\$34,549	\$14,310	\$ 24,429.50
<b>05-06</b>	\$35,046	\$14,772	\$ 24,909.00
<b>06-07</b>	\$35,705	\$15,029	\$ 25,367.00
<b>07-08</b>	\$36,593	\$15,507	\$ 26,050.00
<b>08-09</b>	\$36,610	\$15,567	\$ 26,088.50
<b>09-10</b>	\$38,799	\$16,855	\$ 27,827.00
<b>10-11</b>	\$39,850	\$17,680	\$ 28,765.00
<b>11-12</b>	\$40,043	\$18,092	\$ 29,067.50
<b>12-13</b>	\$41,022	\$18,528	\$ 29,775.00
<b>13-14</b>	\$41,771	\$18,749	\$ 30,260.00
<b>14-15</b>	\$42,419	\$18,943	\$ 30,681.00

<b>Year</b>	<b>Difference in Average Annual Earnings</b>	<b>Average Undergraduate Tuition</b>	<b>Price-Dividend Ratio</b>	<b>ln price/dividend ratio</b>
1979	\$ 17,657.76	\$ 11,963.00	0.677492567	<b>-0.389356697</b>
1980	\$ 18,365.23	\$ 11,732.50	0.638842984	<b>-0.448096576</b>
1981	\$ 17,798.67	\$ 11,964.50	0.672213104	<b>-0.39717987</b>
1982	\$ 18,135.20	\$ 12,611.50	0.695415414	<b>-0.363245894</b>
1983	\$ 18,834.46	\$ 13,345.50	0.708568336	<b>-0.344508773</b>
1984	\$ 19,838.31	\$ 13,884.50	0.699883317	<b>-0.356841648</b>
1985	\$ 20,174.40	\$ 14,101.50	0.698979805	<b>-0.358133429</b>
1986	\$ 20,383.12	\$ 15,124.00	0.741986629	<b>-0.298424056</b>
1987	\$ 23,000.01	\$ 15,339.50	0.66693456	<b>-0.405063349</b>
1988	\$ 23,158.53	\$ 16,200.00	0.699526399	<b>-0.357351746</b>
1989	\$ 23,968.43	\$ 16,539.50	0.690053568	<b>-0.370986049</b>
1990	\$ 24,638.87	\$ 16,946.50	0.687795212	<b>-0.374264142</b>
1991	\$ 24,950.75	\$ 17,178.00	0.688476428	<b>-0.373274198</b>
1992	\$ 26,068.45	\$ 17,687.50	0.678502289	<b>-0.387867426</b>
1993	\$ 25,905.56	\$ 18,155.00	0.70081473	<b>-0.355511721</b>
1994	\$ 26,170.07	\$ 18,557.50	0.709111469	<b>-0.343742544</b>
1995	\$ 25,757.16	\$ 18,845.50	0.731660722	<b>-0.312438367</b>
1996	\$ 25,046.77	\$ 19,347.50	0.772454809	<b>-0.258181771</b>
1997	\$ 24,568.16	\$ 19,912.50	0.81050014	<b>-0.210103766</b>
1998	\$ 25,825.25	\$ 20,607.50	0.797959392	<b>-0.22569757</b>
1999	\$ 27,508.93	\$ 21,120.00	0.767750726	<b>-0.264290174</b>
2000	\$ 28,080.73	\$ 21,149.50	0.753167795	<b>-0.28346724</b>
2001	\$ 28,209.27	\$ 22,072.00	0.782437727	<b>-0.245340942</b>
2002	\$ 27,793.08	\$ 22,845.50	0.821985114	<b>-0.196032994</b>
2003	\$ 27,619.51	\$ 23,700.00	0.858089217	<b>-0.153047203</b>
2004	\$ 27,124.82	\$ 24,429.50	0.900632729	<b>-0.104657731</b>
2005	\$ 27,590.41	\$ 24,909.00	0.90281381	<b>-0.102238937</b>
2006	\$ 27,552.00	\$ 25,367.00	0.920695561	<b>-0.08262585</b>
2007	\$ 28,122.05	\$ 26,050.00	0.92631942	<b>-0.076536158</b>
2008	\$ 29,069.23	\$ 26,088.50	0.897461059	<b>-0.108185547</b>
2009	\$ 28,772.85	\$ 27,827.00	0.967126913	<b>-0.033425548</b>
2010	\$ 29,280.05	\$ 28,765.00	0.982409473	<b>-0.017747079</b>
2011	\$ 28,456.69	\$ 29,067.50	1.02146456	<b>0.021237441</b>
2012	\$ 27,653.92	\$ 29,775.00	1.076701056	<b>0.073901788</b>
2013	\$ 28,678.57	\$ 30,260.00	1.055143226	<b>0.053676517</b>
2014	\$ 27,307.78	\$ 30,681.00	1.123525949	<b>0.116471909</b>