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How to Think About Changes in Higher Education Affordability

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Abstract

Many have argued that because the cost of attending college has increased more rapidly than family income, college has become less affordable. In this paper, we argue that this is not the correct way to think about affordability. Goods and services are more or less affordable if the consumer can or cannot afford to purchase the market basket of goods and services in the second time period he or she could afford in the first period. The measure of whether an increase in tuition and fees has increased or decreased affordability should focus on a comparison of the amount of goods and services families have left over after they have paid tuition and fees before and after the tuition increase. This paper explains why this type of measure should be preferred and investigates the recent history of affordability using this measure.

JEL Codes: I22, I23, I28

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1. Introduction

Affordability is a big issue in higher education, but the term is ill-defined and means different things to different groups. Typically the affordability problem is illustrated by the fact that the percentage of income spent on higher education has increased over time. If spending on higher education is going up at a faster pace than median family income analysts often conclude that higher education has become less affordable. Congress also gets in on the act. In "The College Cost Crisis," reps. John A. Boehner (R. OH) and Howard P. "Buck" McKeon (R. CA) write that tuition increases that outpace growth in family income push students out of the market and/or force them to trade down to worse post-secondary choices because options that once were 'affordable' have been priced out of reach. The National Commission on the Cost of Higher Education produced a major report titled "Straight Talk About College Costs and Prices." Once again the notion of affordability figures prominently. In this report, affordability is defined even more simply as the amount the student actually has to pay, net of aid, and the commission argues that affordability is linked to access. If higher education becomes more expensive, people will have less access to the education needed for success in the modern economy.

This usage of the word affordable deserves a close look. If the income of an individual is fixed, then the definition of affordability based on percentages of income seems appropriate. If a price increase causes higher education expenditures to increase as a percentage of a fixed income, a person will have to do without something else in order to continue purchasing the same higher education service as before. If a person cannot afford to buy the same bundle of goods and services he or she did prior to the price

change then this is indeed an affordability problem. The price increase necessarily squeezes either higher education or something else out of the budget. On the other hand, suppose the individual's income is expanding. Now it is distinctly possible that he or she could spend a higher fraction of his or her income on higher education ***and*** still afford to buy everything he or she had purchased previously. If total income is growing rapidly enough, there is no straightforward logic in calling an expansion of the budget share spent on higher education an affordability problem. Nor is there any reason to say that an increase in the net cost of a college education 'forces' a change in behavior.

The title of this paper is a deliberate play on a well-cited article by William Baumol and Sue Ann Batey Blackman (1995). Their work challenged the notion that increases in college cost that push up the share of income spent on higher education necessarily reduce access. They point out that you need to know ***why*** cost is rising, because cost increases in higher education that result from economic growth itself do not reduce affordability. In this paper we offer both theory and evidence that increases in higher education cost are generated by the same process that produces higher real income. As a result, for the median family, higher education is more affordable today than it was in the past.

Changes in the income distribution over the last thirty years have favored the well educated. The reasons for these changes are complex, but the three likely stories are skill-biased technical change, increased trade with developing nations whose economies have a great abundance of low-skill workers, and direct immigration into the U.S. of relatively unskilled workers. All three of these stories are largely exogenous to higher education, i.e. they are independent of the structure of the higher education industry or of

the policies that affect it. Given that the real income gains of the recent past have accrued disproportionately to the well off, the affordability question is still pertinent for the left half of the income distribution. But the causes of affordability problems are to be found more in these broader economic trends that affect the distribution of income than in any pathologies or growing inefficiencies in the provision of higher education itself.

The paper follows in six additional sections. First, we present a simple numerical example that illustrates a situation in which it is difficult to determine whether a good has become more or less affordable. Second, we present a theoretical argument that suggests that our numerical example might well represent the situation for higher education. Third, we present evidence showing that the relationship between higher education costs and income suggested by both the example and the theory holds for U.S. data. Fourth, we shift the discussion from higher education costs to higher education prices and from income per worker to median family income. In the fifth section we investigate how affordability has changed for different measures of income: income for families in the age range to have college students and incomes for a several points on the income distribution. The final section presents our conclusions.

2. A Simple Example

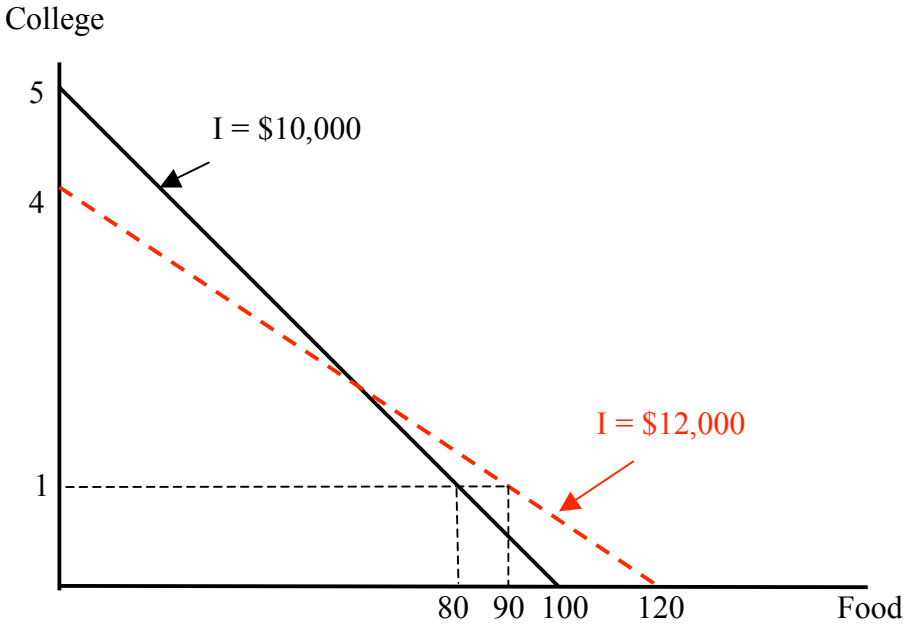
A simple numerical example will help express what is going on. Suppose that a family purchases two things: higher education and food. In the first year the family has an income of $10,000 and they spend $2,000 on higher education and $8,000 on food. In the following year the price of the college education goes up to $3,000, the price of food remains unchanged, and the family's income goes up to $12,000. The price of higher education has soared by fifty percent. Nonetheless, in this second period the family can

afford to spend $3,000 on higher education and $9,000 on food. In the initial year higher education spending consumed 20% of the family's budget. After the price change it consumes 25% of the family's budget. By the typical definition, higher education has become less affordable because its budget share has increased. But is this sensible? The family previously could afford both the higher education and $8,000 in food expenditures. Now they can afford the higher education and $9,000 in food expenditures. This family can afford to buy more ***of everything*** than they could before, so the language is being tortured to suggest that in this case higher education has become less affordable.

Figure 1 is a graphical representation of what is going on. This family has an income of $10,000 that it can allocate to the two products, food and higher education. We have assumed that the family is initially spending $2,000 on higher education. Without loss of generality, suppose the price of the type of higher education the family is currently buying is $2,000, so it is purchasing one unit of higher education. Since higher education comes in various perceived quality levels, purchasing more than one unit is the same as purchasing a more expensive type of higher education. Suppose also that the initial price of a unit of food is $100, so the family is initially purchasing 80 units. The solid black budget line in figure 1 gives the set of all possible combinations of food and education that the family could consume with its $10,000 income. The slope of the budget line (.05) is the relative price of food. One unit of food costs 1/20 of a unit of higher education. The dashed budget line shows the various combinations of what the family can purchase with a $12,000 income and a higher price of education ($3,000 per unit). In this case one unit of food now costs 1/30 of a unit of higher education. Food is relatively cheaper than it was, and higher education is correspondingly more expensive.

The initial consumption point (80, 1) is below and to the left of the dashed budget line, which means the family is unambiguously better off in the new situation. If they actually choose to purchase the same amount of higher education (one unit) they can purchase more food. Alternatively, they could purchase more of both things.

Figure 1. A Graphical Representation of the Example



In our example, the family's standard of living was not harmed despite the fact that the percentage of income spent on higher education went from 20% to 25%. In fact, their consumption of the two items could have remained unchanged if the price increase had been large enough to increase spending on higher education to 33.3% of their budget ($4,000 for higher education and $8,000 for food leaves their food expenditures unchanged). The real question about higher education affordability is whether or not the income left to spend on other things is reduced by the expansion of the budget share devoted to higher education. As our numerical example shows, if income is expanding there may be room for the budget share devoted to higher education to expand ***and*** for the

family to afford more of the other goods and services that make up the full standard of living.

3. A Theory

In the numerical example we simply assumed a particular increase in the cost of higher education together with the rise in family income. There is actually a good theory that links the two. Productivity growth is not uniformly distributed across all industries within the economy. Productivity-enhancing technical change tends to be more rapid in industries that produce goods rather than services, and productivity growth is slowest in the personal services. In basic manufacturing, labor is one of many inputs used to produce a largely homogeneous output. Technical progress that allows firms to get more output per labor hour results in lower unit costs. In most service industries it is harder to reduce the amount of labor needed to provide the service, and for personal services the labor itself often is the output. An hour-long university lecture, for instance, is irreducible. Technology may bring this lecture to more listeners, but even that process is limited by consumer preferences for interactivity. The basic quality of personal services often is a function of the amount of time spent with individuals.[1]

The steel industry provides a good example of the importance of productivity growth in manufacturing. In 1964 the industry employed over 515,000 workers whose workweek averaged 41.2 hours. By 2002 the industry only employed 144,000 workers whose average workweek had increased slightly to 45.6 hours. Adjusting for these changes in hours worked per week, productivity per labor hour in steel production rose by a factor of three. Steel output today is nearly the same as it was a generation ago,

[1] See Robert B. Archibald and David H. Feldman (2008) for evidence supporting the importance of productivity differences as a driver of costs in higher education.

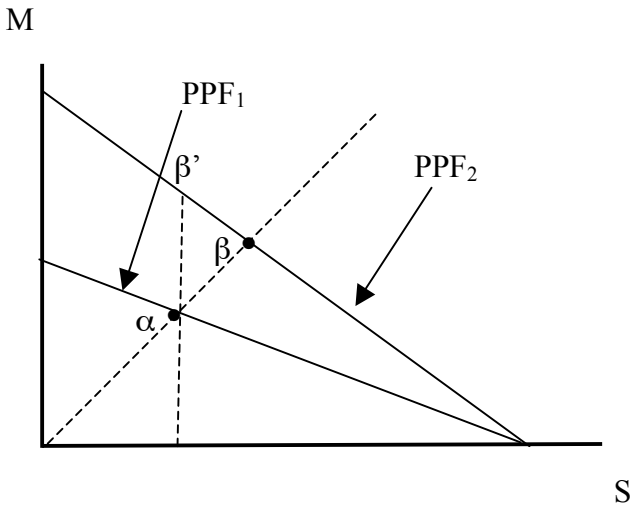
despite a seventy-two percent decline in the number of employees. This kind of labor productivity gain is unheard of in most service industries.

By now, most readers likely will recognize the process we are describing as cost disease, which is the force at work in the article by Baumol and Blackman (1995). Let us take a very simple example of this process as a working model of the economy and use it to explore the consequences of rapid labor productivity growth in one sector (manufactured goods) but not in another (services). We begin the analysis by making the starkest assumption about labor productivity growth in services. Suppose our economy produces two things people want to buy, a manufactured good (M) and a personal service (S). These two outputs are produced using a homogeneous labor input that can be used to produce either the service or the manufactured good. Assuming homogeneous labor obviously abstracts from clear differences in human capital among workers, but it allows us to focus on the average or representative worker. What happens to this average worker is what happens to the nation as a whole. Suppose also that the representative worker's productivity at making goods or services is a function of current technology. For example, let's assume that an hours worth of work by a representative worker yields either five units of the manufactured good or two units of the service. These two numbers (five and two) are the representative worker's labor productivities in the two industries. This simple model is the textbook Ricardian economy that we have used to teach generations of students about the principle of comparative advantage and the gains from specialization and trade.

Visually, this economy is depicted in Figure 2. Given the simple assumptions we have made, the black line labeled PPF_1 represents all the combinations of the two outputs

that society could have produced, given its technology and its pool of labor. Given the labor productivities that we assumed, the slope of this production possibility frontier is 5/2. The economy gives up 2.5 units of the manufactured good to make one unit of the service. That is the cost of the service. The point labeled α represents some initial combination of the two products chosen by this society.

Figure 2. Productivity increase in a simple economy



Suppose now that someone discovers a new way to make the manufactured good with half as much labor as before. The set of outputs this society can produce now shifts outward to PPF_2. For any given level of production of the service we can have twice as much of the manufactured good as before. The first thing to notice is that the relative cost of making the service just went up. In this example it has doubled from 5/2 to 5.

Most people don't think in terms of ***relative*** cost. They think in dollars. The conclusion is the same. Suppose for simplicity that the price of the manufactured good is set in the larger world market, so the main effect of the productivity growth is that it raises wages in the manufacturing sector rather than lowering prices. In a more

complicated economy – one that had capital in addition to labor, for instance – profit likely would rise in the short run, but competition ultimately shifts most of the productivity gain to workers in the form of higher wages or in the form of lower prices. Since the two sectors in the economy must compete to hang on to labor, as wages rise in the manufacturing sector this pulls up wages in the service sector as well. Unlike internationally tradable manufactured goods, prices of personal services are set in a local market so the effect of higher wages is to drive up their price. Recall that there is no offsetting productivity growth in services that keeps production costs (and hence prices) from going up. The net effect of higher labor productivity in manufacturing is higher dollar prices for services.

Has the service thus become less affordable? No, by our criterion, the service has become ***more*** affordable. This technology-induced rise in manufacturing sector labor productivity cannot but improve the standard of living for the representative worker. If every worker continued to do just what he or she was doing before the technology shock then society would have twice as much manufactured output and no less of the service. More generally, the productivity increase allows this society to have more of everything. Point β on PPF_2 represents an equiproportionate increase in consumption of the two goods so it clearly dominates point α on PPF_1.

Lastly, the share of income spent on the service could rise or fall, depending on the preferences of consumers. In figure 2 we show consumption of M and of S rising by the same percentage (along a ray from the origin). Perhaps surprisingly, this is a case in which the percentage of income spent on the service actually rises. Physical consumption of each output rises by an equal percentage, but because the service is increasingly costly

relative to the manufactured good the percentage spent on S must rise while the percentage spent on M must fall. If consumption of the service remained constant (if we moved to β' instead of β) then the percentage spent on S would decline. Since the percentage spent on services clearly is endogenous in this example, one should be very wary of associating changes in that percentage with changes in well-being.

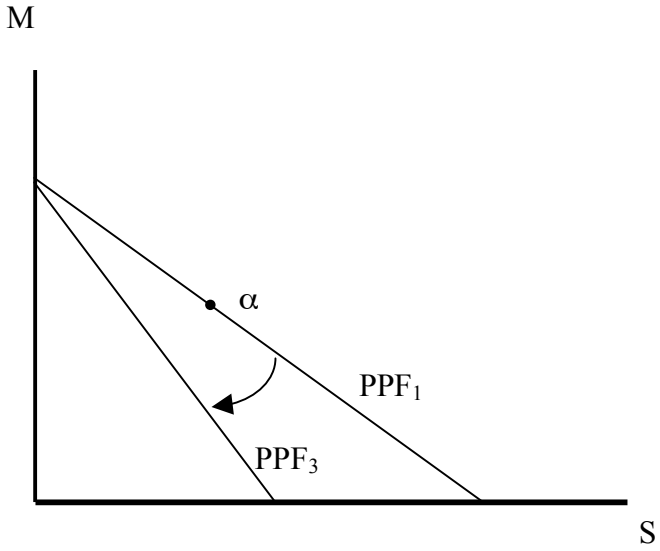
4. Cost and Income

To summarize what we have said thus far, if cost disease is the driving force behind rising higher education costs we would not expect to see reduced affordability for the representative citizen. On the other hand, if the primary forces behind higher education cost increases are exogenous changes within higher education we could well see affordability issues even as we have defined them. For instance, some of the positional arms race stories for why colleges engage in socially wasteful spending could yield affordability problems.[2] Likewise, changes within the academy itself, such as the administrative lattice and the academic ratchet described by Massey, Zemsky and Wilger (2006) also would create affordability problems. These forces result in cost increases in higher education that are independent of any productivity gains in manufacturing. If the scope for inefficiency rises in higher education, so that it takes increasing amounts of labor to produce output (graduates), then labor productivity in higher education would be falling. The effect of this is shown in Figure 3. Increased inefficiency would rotate the PPF in figure 3 inward to something like PPF_3. In this case, to maintain the same consumption of higher education in the face of increased higher education cost, families

[2] Gordon Winston (2000) discusses positional arms races. Some of these, such as amenity competitions, may increase price and hence reduce affordability. Others, such as subsidy competitions, may be socially wasteful without adding to affordability problems.

would have to cut their consumption of the other good. Higher education would indeed have become less affordable.

Figure 3. Increased inefficiency in a simple economy

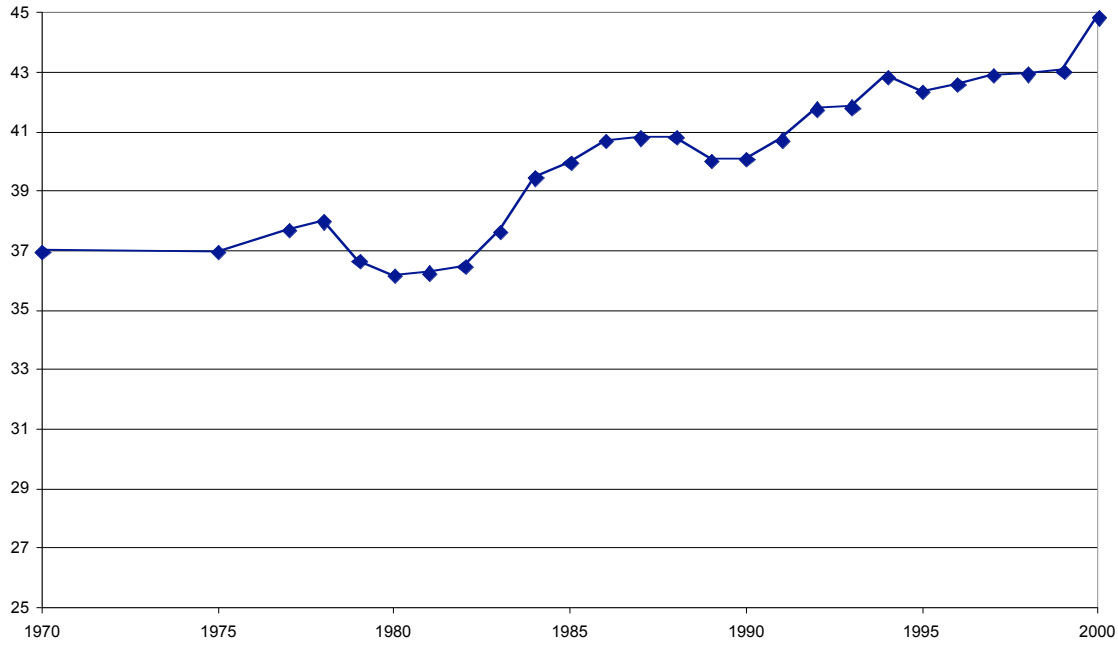


The affordability question always has been an empirical issue. The real question is whether or not the difference between the family's income and the expenditure required to attend college has grown or contracted when measured in inflation adjusted terms. Affordability should not be defined in terms of the share of a family's income that must be paid for a year of schooling and it certainly should not be framed simply as a matter of whether or not the cost of that year of schooling has gone up faster than inflation. So, what are the facts?

Figures 4 and 5 show a thirty-year history (1970-2000) of the two alternate measures of affordability. To compute our measures we combined data from three sources; Current Fund Expenditures of Public Four-Year Institutions from Table 346 of the 2007 Digest of Educational Statistics, Net Domestic income from Table 1.76 on the

Bureau of Economic Analysis website, and Civilian Employment from the Bureau of Labor Statistics website. Unfortunately the data for higher education costs are not available in a comparable fashion after 2000. Figure 4 shows that as a percentage of net real income per worker in the U.S. current fund expenditures at public four-year institutions indeed rose. College cost as a fraction of mean worker income increased from thirty-seven percent of income to forty-five percent. This type of evidence often is cited to make the case for an affordability crisis in American higher education. These data do not take into account the subsidy that the students receive in the form of tuition-reduction for in-state students or explicit grants from government programs, or from the schools themselves in the form of tuition reduction. The cost disease explanation is silent

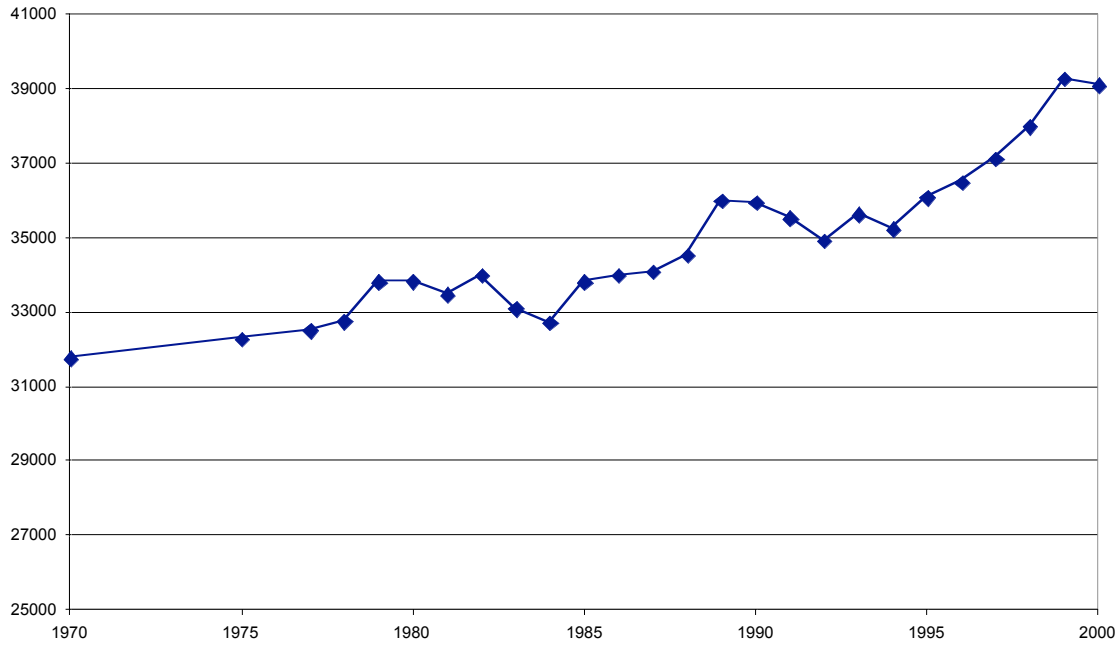
Figure 4 Current Fund Expenditure at Public Four-Year Institutions as a Percentage of Net Domestic Income Per Worker



on the issue of who actually pays the bill. But if cost disease is a significant share of the explanation for rising college cost then the rising income share allocated to college cost need not crowd out other spending.

Figure 5 presents the difference between net real domestic income per worker and current fund expenditures using the same data. The difference rose from roughly $31,400 in 1970 to $39,000 in 2000 (in 2005 dollars). The mean income per worker available for other things other than college costs rose by twenty-four percent over that time span. There are indeed short periods in which affordability declined, and these are usually associated with downturns in overall economic activity. But over long stretches of time overall productivity growth dominates the increase in higher education cost, leaving more resources on the family table.

Figure 5 Difference Between Net Domestic Income Per Worker and Current Fund Expenditures at Public Four-Year Institutions, 2005 Dollars



5. Family Income and Affordability

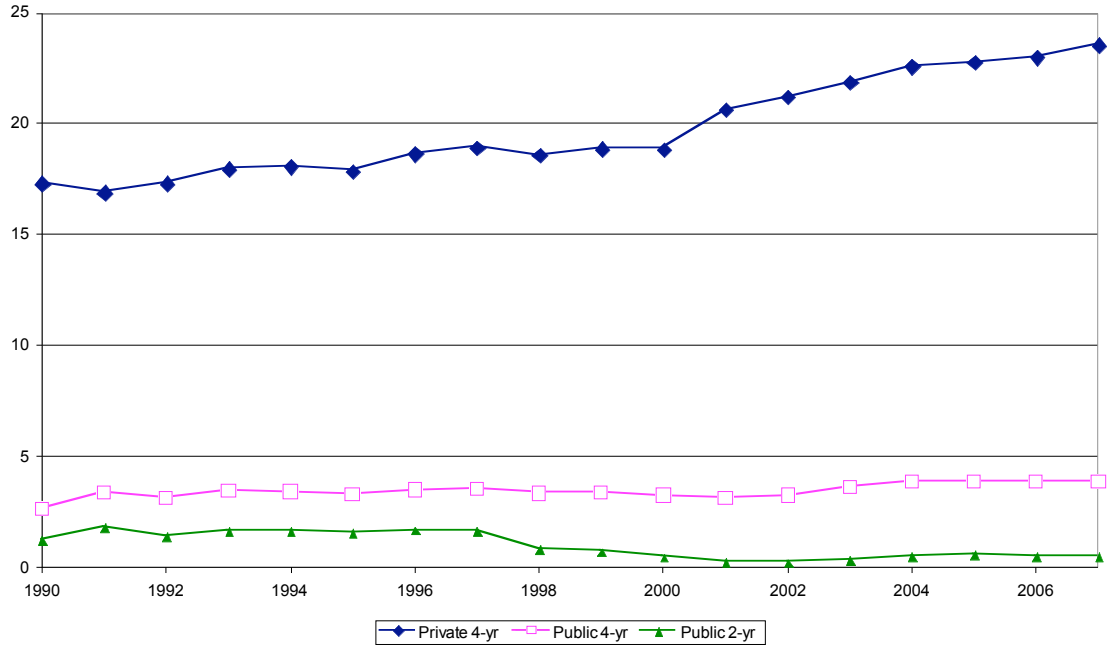
In this section we shift our focus from a discussion of the relationship between income per worker and costs to a discussion of the relationship between family income and student charges. We are making two changes. First, in our discussion of cost disease, the individual worker was the primary unit of analysis. Technical progress that raises factor productivity increases real income per worker. But families finance college expenses, not workers. Clearly families include workers, often more than one worker, so the change to a focus on families is not a radical change. Second, the discussion of cost disease focused on the cost of providing a college education. Families do not face the full cost of higher education. A portion of costs are covered by general subsidies from state governments, private giving, and endowment earnings. Also, individual students receive subsidies in the form of grants and scholarships. As we shift from workers to families and from costs to student charges we move the discussion of affordability to its more traditional footing.

The first, and probably most natural, place to start is with the relationship between median family income and net tuition and fees. The Census Bureau provides data on median family income.[3] Our data on net tuition and fees come from the College Board's ***Trends in College Pricing***.[4] The data cover 1990, which is the first year the net tuition and fees data are available, to 2007. Figure 6 shows net tuition and fees as a percentage of median family income for three types of institutions: private 4-year, public 4-year, and public 2-year.

[3] www.census.gov/hhes/www/income/histinc/h10AR.html (Access August 29, 2008).
[4] See Figure 8a. and Figure 8b. The actual data we used were extracted from the data from ***Trends*** that the College Board makes available.

Figure 6 tells a somewhat different story than figure 4. The overlapping data are for public 4-year institutions from 1990 to 2000. Figure 4 shows that current fund expenditures (costs) take up an increasing fraction of net national product per worker from 1990 to 2000. Over the same time period, for public 4-year schools Figure 6 tells us that net tuition and fees take up a roughly constant percentage of income of the median family.

Figure 6 - Net Tuition and Fees as a Percentage of Median Income, All Families, 1990-2007



The data in Figure 6 also allow us to tell the story for private 4-year institutions and public two-year schools. Over the broader time period, the increase in the share of income devoted to higher education is concentrated at four-year private colleges and universities. The data tell us very different stories for these institutions. Net tuition and fees at private 4-year institutions take up an increasing percentage of median family

income over 1990-2007. The results for public institutions, and especially for public 2-year institutions are quite different. Net tuition and fees at public 2-year schools actually are a declining percentage of median family income over the time period.

There are several things that make the measures reported in Figures 4 and 6 different. First, median family income is quite different from net national product per worker in part because families often have more than one worker. Second, net national product per workers is an average income concept not a median income concept. Third, current fund expenditures are much higher than net tuition and fees because of general subsidies from state governments and specific subsidies to students in the form of grants and scholarships.

Figure 7 The Difference Between Median Income and Net Tuition and Fees, All Families, 1990-2007

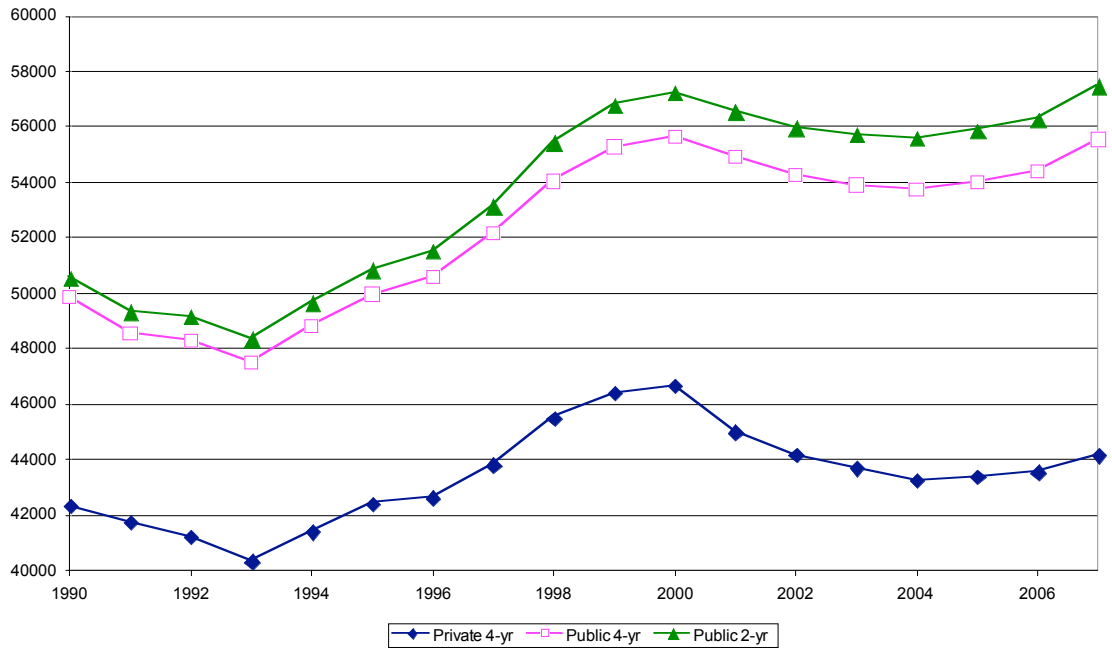


Figure 7 presents the difference between median family income and net tuition and fees for the same three institution types. This figure tells an interesting story. The income left over after paying net tuition and fees is higher for every institution type in 2007 than it was in 1990. The gains are much greater for public institutions than at private institutions. The median family with a student attending a public 4-year institution has roughly $5,500 (2005 dollars) more to spend on other goods in 2007 than it did in 2007. Comparable numbers are $5,750 (2005 dollars) for families with a student attending a public 2-year institutions, and $1,800 for families with a student attending a private 4-year institutions. The overall increases are not uniform across the time period. The decade of the 1990s started with a decline, which was also evident in Figure 5, followed by increases. The first decade in the 21st century saw an overall flattening for public institutions, and declines for private 4-year institutions.

The evidence thus far permits us to draw a few tentative conclusions. First, the pattern we observed in Figures 4 and 5 is repeated in a rough way when we shift the discussion from relationships between higher education costs and income per worker to relationships between higher education prices and median family income. Over the longer run, for 4-year schools we see that a measure based on percentages would suggest that higher education has become less affordable but a measure based on the amount of income left over would suggest that higher education has become more affordable. Certainly, not all of the year-to-year movements are consistent with this summary, but the broad long-term movements are. The pattern for 2-year institutions is different. The percentage of income required to pay net tuition and fees at 2-year institutions actually

declines from 1990 to 2007. Community colleges have become more affordable by either measure.

Over a shorter time horizon, we can see the outlines of an affordability issue for the median family using our "income left over" measures. The years since 2000 have seen increases in net tuition and fees eating up any income gains for the median family at public 4-year universities and actual declines in income left over for the median family when evaluating tuition and fees at private 4-year schools. Yet the longer run evidence is broadly consistent with a cost-disease argument.[5] Average income per worker has tended to rise by enough to leave more left over for other things once the cost of producing a year of schooling is subtracted. Technological progress itself may raise both average living standards and the cost of low-productivity-growth personal services.

While median income often is used in discussions of higher education affordability the all-family median income may not be the best measure to use. There are two difficulties with simply focusing on the median income. First, the median income is measured for all families, only some of which are very likely to have a college student. Very young families do not have college students, and very old families are quite unlikely to have a college student. Better measures should focus on families in the appropriate age range. Second, while the information for the median income household is interesting, very different things may be occurring at other points on the income distribution.[6]

[5] For a more direct evaluation of the cost disease argument about service prices see Archibald and Feldman (2008).

[6] The median also is less useful in evaluating the cost disease argument because the distribution of income may not be symmetric. Cost disease is consistent with a positive correlation between increases in *average* income and higher service prices, but it is silent about how the median level of income is related to service prices.

6. Affordability for Other Income Measures

Age of the Household Head - Our first adjustment will be to replace the median income for all families with the household income for families with a household head aged 45 to 54. This age range is not an exact match to the age range of parents of college students, but it is the best option given the data regularly provided by Census Bureau. Ideally, we would like the median income of families with children aged 18-22. Unfortunately, the census collects data by domicile, and when a student leaves for college he or she is presumed to be domiciled outside the home (often in a college dormitory). Therefore, the statistics for families with children aged 18-22 would capture those with children not attending college or children attending college and living at home. It would not be a representative group.

Figure 8 The Difference Between Median Family Income and Net Tuition and Fees, Household Head Aged 45-54, 1990-2007

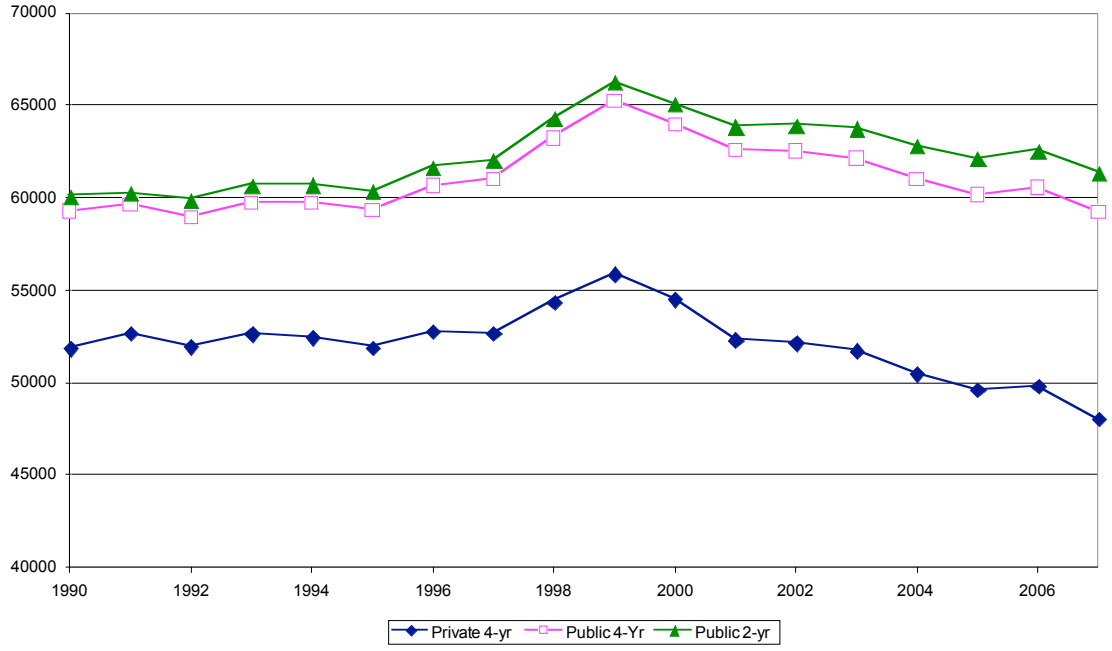


Figure 8 gives the difference between the median income of families whose household head is in the 45-54 age range and net tuition and fees. It tells quite a different story than Figure 7, which uses the overall median family income. Focusing on families in which the household head is 45-54, we find that the difference between median income and net tuition and fees increased until 1999 but declined thereafter. Over the entire time period the difference has increased slightly for families with a student attending a public 2-year institution, stayed roughly constant for families with a student attending a public 4-year institution, and declined considerably for families with a student attending a private 4-year institution. Net tuition is the same for the two figures, so the differences in the time paths reflect differences in median income. Apparently households headed by 45-54 year olds did not do as well as other households in the first years of the 21st century. There are many potential reasons for this, none of which have anything to do with what is going on at colleges and universities.

In fact, the experience of households headed by someone in the 45-54 age range is unusual. From 1999 to 2007 real median family income for all families decreased 0.89%. In the same time period, median family income for household with a household head aged 45-54 decreased by a considerably larger 7.53%. Median family income for the two adjacent age groups behaved quite differently. For households headed by a 35-44 year old the decline was 1.74%, and for households headed by a 55-64 year old median family income actually increased by 3.36%.

Clearly there are unusual things going on in these data. The bottom line we take away from this is that a picture painted by the all-family median income is probably the more accurate picture. There are two reasons for this conclusion. First, the 45-54 age

range probably includes a majority of the parents of college students, but it does not include all of them. A considerable number of parents of college students are in the 55-64 age group, and some are in the 35-55 age group. Real median family income did not decline as much for the 35-44 age group, and it actually increased for the 55-64 age group. Second, parents are not the only ones who support college students. Grandparents contribute quite often. This means that broader age groups are probably more representative of the group actually contributing to the support of college students. Nevertheless, Figure 8 clearly shows that there are large groups of families facing a different situation than the one shown in Figure 7.

Different Parts of the Income Distribution - The median worker or median family is not representative of people at different points in the national income distribution. And the average financial aid package is not what each family receives. This section of the paper thus retells the story of affordability using the net cost of attendance and family income figures for families at the 20th, 40th, 60th and 80th percentiles of the income distribution. We argue that this section offers the clearest picture of affordability.

To do this we need data on family income at a variety of points on the income distribution. We also need information about the average cost of attendance, and about how financial aid affects the net cost of attendance for families at different points on the income distribution. As before, our data for family income comes from the Census Bureau. These data provide us with income figures for the upper limit of each fifth of the income distribution for all families in the United States from 1947 to 2005. The next source of data comes from the 2007 version of ***Trends in College Pricing*** published by

the College Board. ***Trends*** contains estimates of average tuition and fees, average net tuition and fees, average tuition, fees, room and board and average net tuition, fees, room, and board.[7] Average tuition and fees is the average of the published list prices at schools in the category, weighted by the number of students at each institution. The net data subtract grants and tax credits but not loans or work-study allocations. These data are available for public 2-year, public 4-year, and private 4-year institutions from 1990-91 to 2007-08. Our final sources of data are the 1990 and 2004 National Postsecondary Student Aid Surveys (NPSAS). The NPSAS data allow us to measure the effect of family income on grant aid to students, and thus to form affordability measures based on net prices at various points on the income distribution.

To account for the sensitivity of grants to income, we used NPSAS data to determine the average grant given to students with family incomes at the 20th, 40th, 60th and 80th percentiles of the income distribution for each institution type. We then determined the percentage of the average grant that this grant represented. Table 1 presents the results of this exercise.

Table 1. Multiples of the Average Grant by Income

Percentile	**NPSAS 1990**			**NPSAS 2004**		
	Public 4-yr	**Private 4-yr**	**Public 2-yr**	**Public 4-yr**	**Private 4-yr**	**Public 2-yr**
20th	2.06	1.50	1.52	2.02	1.31	1.98
40th	1.01	1.28	0.83	0.99	1.13	0.86
60th	0.62	1.07	0.51	0.67	1.06	0.51
80th	0.41	0.79	0.19	0.57	0.88	0.33

The entries in the tables are the multiple of the average grant given by the various institution types. The first entry, 2.06, was calculated in the following way. In the 1990

[7] See Figure 8a. and Figure 8b. The actual data we used were extracted from the data from ***Trends*** that the College Board makes available.

NPSAS the average grant was $1361.70 for students attending public four-year institutions and whose family income was in a range centered at the upper limit of the first fifth (poorest twenty percent) of the income distribution. This is 2.06 times the average grant for all students attending public four-year institutions.

The entries in Table 1 show that grants are income sensitive for all institution types. Also, the pattern between grants and income has been fairly stable across time, particularly at public institutions. Grants at private institutions are ***not*** as targeted to students from low income families as are grants at public institutions, and the income sensitivity of grants at private institutions is lower in 2004 than it was in 1990.

Table 2 focuses on private four-year institutions. It presents our results for the impact on families of changes in average list-price tuition and fees and of changes in net tuition and fees.[8] We are comparing two time periods. The first is the three-year average for 1990-92 and the second is the three-year average for 2003-05. These are the two ends of the available data. The averaging ensures that we avoid end point problems from picking a single year that is an outlier, while the fifteen-year time span allows us to speak about longer-term trends. As in the previous section on cost, we evaluate two concepts of affordability. The first is the change in the budget share allocated to higher education. The second is the change in income left over for other spending after paying for college.

We can explain the entries in the table by looking at two rows. The first row in the table tells us that, on average for 1990-92, list-price tuition and fees at a private 4-year institution were 60.16% of the income of a family at the 20th percentile of the income distribution. This percentage increased to 80.64% in 2003-05, an increase of

[8] Similar tables covering tuition and fees and room and board are available on request from the authors. These results are very similar. We did not focus on these results here because there is no requirement to live or eat on campus, but there is a requirement to pay tuition and fees.

20.48 percentage points. Five rows below displays the amount of income left over after a family at the 20th percentile of the income distribution pays list-price tuition at a private 4-year institution. On average over 1990-92 the family would have $9,442 (in 2005 dollars) left over. That amount decreases to $4,957 for the 2003-05 period, a decrease of $4,484. The rest of the entries in the table refer to different points on the income distribution and to net price tuition and fees.

Table 2. - Affordability Results for Tuition and Fees and Net Tuition and Fees at PRIVATE FOUR-YEAR Institutions, 1990-92 and 2003-05

	1990-92	2003-05	Change
List-Price Tuition and Fees			
	Budget Shares		
20th Percentile of Income	60.16%	80.64%	20.48%
40th Percentile of Income	36.11%	46.05%	11.43%
60th Percentile of Income	23.55%	30.17%	6.61%
80th Percentile of Income	16.12%	19.94%	3.82%
	Income Left Over		
20th Percentile of Income	$9,442	$4,957	-$4,484
40th Percentile of Income	$26,864	$24,189	-$3,675
60th Percentile of Income	$46,120	$47,785	$1,668
80th Percentile of Income	$73,937	$82,906	$8,968
Net Tuition and Fees			
	Budget Shares		
20th Percentile of Income	25.00%	39.20%	14.19%
40th Percentile of Income	17.32%	25.55%	8.23%
60th Percentile of Income	13.74%	17.65%	3.91%
80th Percentile of Income	11.12%	13.05%	1.93%
	Income Left Over		
20th Percentile of Income	$17,735	$15,568	-$2,167
40th Percentile of Income	$33,120	$33,378	$259
60th Percentile of Income	$52,038	$56,355	$4,316
80th Percentile of Income	$78,346	$90,043	$11,697

The information in the table follows some fairly predictable patterns. First, the income distribution has widened. Real income in 2005 is 4.87% higher than in 1990 for families in the 20th percentile of the income distribution. The comparable increases are

6.79%, 11.50%, and 14.64% for the 40th, 60th, and 80th percentiles. Since we apply the same average list price tuition and fees to all families, the fact that income is growing more rapidly as we move up the income distribution drives our results for tuition and fees. This is the reason that the change in the budget share always declines, and the change in the income left over always rises, as we move up the income distribution. The widening income distribution means that the increase in the average list price tuition and fees takes a smaller bite out of upper income families than it does to lower income families, and the differences are quite large.

The average level of tuition and fees is a number that gets into public discussions of college cost increases and of how these rising costs create a burden on families. But since it is an undiscounted list price of a year in school, this part of the table is not a real measure of affordability. Instead, these results for the budget share of ***list-price*** tuition and fees effectively captures the sticker-price-shock effect that colors much of the contemporary debate about college affordability, especially since the rising average list price of a year in college absorbs a greater fraction of family income of even the wealthiest families.

One complicating factor in any analysis based on family income is that social and economic factors can influence the composition of the family. This might affect affordability for reasons that are far removed from general economic growth or changing college costs. Two issues are of interest. The first are composition effects that might alter the mean or median of the family income distribution and the second are changes that affect the spread of the distribution. The real income of the median family could change if the number of wage earners in that family rose or fell. In our data, this is not an

issue. Between 1990 and 2005 the average number of wage earners per household remained steady at 1.46.

Even with a constant average number of wage earners per family, the spread of family income could rise if the fraction of married couples with two wage earners rose over time while the fraction of married couples in the population of families itself declined. This has indeed happened. In 1990 the fraction of all families composed of married couples was 78.6%. By 2005 the percentage had declined to 75.2%. Yet within the group of married couples, the percentage with two wage earners rose from 58.1% of all married couples to 60.9%. Double income families earned a median income of $78,755 in 2005, compared to $44,457 for married couples with only one wage earner. Another factor that suggests a slight increase in the variance of family income is the small increase in the percentage of female-headed households, from 17% of all households in 1990 to 18.2% in 2005. Female-headed households have the lowest median family income ($27,244 in 2005) of the reported subgroups. These composition effects increase the likelihood of finding college affordability problems during our time frame independent of any changes in college cost. Nonetheless, these composition effects are rather small in comparison to the changes in the structure of the family that occurred in the 1970s and 1980s.

We argued earlier that the notion of income left over is a better measure of affordability. For private four-year institutions the percentage of income required to cover tuition and fees has increased. This is why many people argue that a higher education has become **less** affordable over time. Yet the amount of income left over after paying tuition and fees has increased more often than it has decreased, particularly after we

account for the impact of financial aid, which suggests that a higher education has become **more** affordable. This is basically the same result we found comparing higher education costs and the average income of workers in the previous section. Increases in the percentage of family income devoted to higher education need not translate into less money for other things. The one negative entry for the change in the amount of income left over for net tuition and fees indicates that the affordability problem is limited to the bottom of the income distribution.

Changes in financial aid seem to have been important across the board. Comparing the list-price and net-price results for both budget shares and income left over suggests that changes in financial aid have made tuition and fees more affordable. This is not simply a result of the fact that net tuition and fees are lower than list-price tuition and fees. We are measuring the change ***over time*** in the percentage of income spent on higher education and in the income left over after the college bill is paid.

Table 3 repeats the exercise for public 4-year institutions. There are a couple of unusual entries on the row for the 20th percentile of the income distribution for net-price tuition and fees. The negative entries in this row tell us that at this income level the average grant is larger than list-price tuition and fees. This means that the average grant covers both tuition and fees ***and*** some of the room and board charges. The results in this table are similar to the previous table, but since tuition and fees are much lower at public institutions, the numbers involved are smaller.

Again we see that the two measures of affordability give us different results. For seven of the eight changes the budget share measure of affordability suggests that college has become less affordable. In contrast, the income left over measure of affordability

gives the opposite conclusion, again seven out of eight times. This is exactly the result we showed in Figures 4 and 5, the percentage spent on a public 4-year higher education goes up, but so does the amount of income remaining after paying for the education.

Table 3. - Affordability Results for Tuition and Fees and Net Tuition and Fees at PUBLIC FOUR-YEAR Institutions, 1990-92 and 2003-05

	1990-92	2003-05	Change
List-Price Tuition and Fees			
	Budget Shares		
20th Percentile of Income	12.90%	20.51%	7.60%
40th Percentile of Income	7.42%	11.71%	4.29%
60th Percentile of Income	5.05%	7.67%	2.63%
80th Percentile of Income	3.46%	5.07%	1.62%
	Income Left Over		
20th Percentile of Income	$20,605	$20,352	-$253
40th Percentile of Income	$38,028	$39,584	$1,556
60th Percentile of Income	$57,284	$63,183	$5,899
80th Percentile of Income	$85,101	$98,301	$13,200
Net Tuition and Fees			
	Budget Shares		
20th Percentile of Income	-0.18%	-4.62%	-4.44%
40th Percentile of Income	3.73%	4.65%	0.93%
60th Percentile of Income	3.49%	4.55%	1.06%
80th Percentile of Income	2.76%	3.31%	0.53%
	Income Left Over		
20th Percentile of Income	$23,693	$26,787	$3,309
40th Percentile of Income	$39,543	$42,745	$3,201
60th Percentile of Income	$58,221	$65,320	$7,100
80th Percentile of Income	$85,712	$100,122	$14,410

Table 4 repeats the exercise for public 2-year institutions. Here we see a slightly different pattern. The basic result, that budget shares go up, but so does the income left over is repeated for list-price tuition. Things change when we shift to net-tuition. The two measures of affordability agree in this case. Measured either way, public 2-year institutions have become more affordable. Net-tuition takes a smaller percentage of

income in 2003-05 than it did in 1990-92, and there is more income left over in 2003-05 than there was in 2003-05. It is difficult to see any affordability problem in this table.

Table 4 - Affordability Results for Tuition and Fees and Net Tuition and Fees at PUBLIC TWO-YEAR Institutions, 1990-92 and 2003-05

	1990-92	2003-05	Change
List-Price Tuition and Fees			
	Budget Shares		
20th Percentile of Income	6.49%	8.29%	1.81%
40th Percentile of Income	3.73%	4.74%	1.01%
60th Percentile of Income	2.54%	3.10%	0.56%
80th Percentile of Income	1.74%	2.05%	0.31%
	Income Left Over		
20th Percentile of Income	$22,119	$23,480	$1,361
40th Percentile of Income	$39,541	$42,711	$3,170
60th Percentile of Income	$58,797	$66,311	$7,513
80th Percentile of Income	$86,614	$101,428	$14,814
Net Tuition and Fees			
	Budget Shares		
20th Percentile of Income	1.43%	-6.12%	-7.55%
40th Percentile of Income	2.13%	1.13%	-1.00%
60th Percentile of Income	1.88%	1.70%	-0.18%
80th Percentile of Income	1.56%	1.45%	-0.11%
	Income Left Over		
20th Percentile of Income	$23,312	$27,170	$3,858
40th Percentile of Income	$40,198	$44,327	$4,129
60th Percentile of Income	$59,195	$67,269	$8,073
80th Percentile of Income	$86,767	$102,046	$15,280

To summarize, after accounting for financial aid the notion that college has become less affordable is only true for the poorest students attending private four-year colleges and universities. The only negative entry for net-tuition and fees in the Income Left Over sections of our three tables is in Table 2 (Private four-year Institutions) for families at the 20th percentile of the income distribution. A large part of this affordability problem can be attributed to the factors that are widening the American income distribution.

It is revealing, however, to focus on the affect of decisions taken within the academy itself. Students from families at the 20th percentile of the income distribution received grants at private four-year schools that were 1.50 times the average grant in 1990 but only 1.31 times the average grant in 2004 (see Table 1). This information allows us to construct a simple counterfactual exercise. We can adjust the affordability measures we calculated by presuming that the multiple of the average grant had stayed the same. In that case the change in income left over using net tuition for students from families at the 20th percentile of the income distribution attending private four year institutions would change from -$2,167to -$670. This indicates that a substantial part of the affordability problem faced by students at private four-year schools from families in the bottom of the income distribution had to do with changes in the distribution of grant aid at private institutions.

The recent much heralded changes in financial aid at several prominent private institutions that replace loans with grants in the financial aid packages for students from families with incomes below some level will probably redress the affordability problem at these institutions. These institutions, essentially the Ivy League and its competitors, are very well endowed. It is very difficult for less well endowed private institutions to follow the lead of these institutions. Still, the emphasis that these institutions are putting on channeling aid to their poorest students is clearly a step in the right direction.

7. Conclusions

Over the period 1990 to 2005 the cost of a year in college took an increasing share of the median worker's real income. This fact is an important element in any contemporary discussion of college cost. Yet over the same time frame the rise in

median real income per worker exceeded the increase in college costs. We have argued that the difference between income and the cost of college is a better way to understand affordability, and by that criterion there is no national affordability problem. As a result talk of a college cost crisis is unnecessarily alarmist.

It is important to recognize that what we have discovered about the affordability of college is just the result one should expect based on the cost disease explanation of the rapid rise in college costs. According to this theory rapidly rising college costs are driven by rapidly increasing productivity in other parts of the economy. This productivity growth also creates the income necessary to pay the higher college costs and have more left over to buy other goods and services.

Our information also confirms that the rich are getting richer faster than the poor. The amount of income left to spend on other things is growing more rapidly for families at the upper end of the income distribution. This is not a surprise, but it is not driven by any pathology in the higher education industry. The widening of the American income distribution and the 'hollowing out' of the middle class are broad phenomena that go well beyond the scope of higher education policy. The causes include skill-biased technical change that increases the relative demand for skilled labor, changes in the composition of the family, immigration into the US of a pool of labor with less formal education than the native-born population, and trade liberalization in the developing world that puts downward pressure on unskilled wages in developed nations. To the extent that this 'rich getting richer' phenomenon is driven by technological progress that advantages the college educated we would expect to see continued increases in demand for places at American universities. This increased demand also is a force for cost increases, at least

in the short run. But since the demand reflects the increased value of the college degree, the fact that people are willing to pay a greater fraction of their income to attain a degree is not particularly surprising.

Lastly, the affordability story we are telling is about hypothetical families at different points of the U.S. income distribution. It is not about any particular family. There are surely families whose circumstances lead them to forego higher education for their children because of cost increases. And there are surely families who are forced by cost pressures to 'trade down' to cheaper and perhaps less desirable educational alternatives. Not every family receives the 'average' increase in income. Some families see their income fall. To some extent the financial aid system cushions families in those circumstances, but in the time period we study the financial aid processes at private four-year universities have become slightly more regressive despite a stretching of the national income distribution. Nonetheless, we must be careful not to fault higher education policy for failing to act as a complete substitute for an effective national social safety net, or for things that result from broad economic and social trends in which higher education plays only a bit part in the drama.

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