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Toward a Theory of Tuition:

Prices, Peer Wages, and Competition

in Higher Education *

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Abstract

College tuition, as the price of higher education services, defies familiar economic analysis in important ways. It is recognized that tuition is a price that covers only a fraction of the cost of producing those educational services (about a third, nationally), creating an in-kind subsidy for students (the balance being made up by large flows of donative resources from gifts, appropriations, and returns on wealth). This paper examines yet another important economic peculiarity of tuition; it takes seriously input and output markets implied by Rothschild-White (1995 JPE) in which a single event – of a student's matriculation – is simultaneously a transaction in both an input market (where a wage is paid for a student's peer quality) and an output market (where a price is paid for the college's educational services). Those two prices are obscured by the fact that the peer wage is paid in the form of a discount on the price of educational services as well as by the fact that the schools' sales (tuition) revenues are significantly augmented by those donated resources. This framing sees a school's access to donated resources (wealth) critical in determining which market – peer quality inputs or educational services sales – will most influence its behavior. Apparent anomalies in the product market – like queues of unsatisfied customers that persist while schools refuse to expand capacity – disappear when they are seen to be the result of an input market where a queue of job applicants is used to allow the firm to select on worker – peer – quality (the result of an Akerlof-Yellen efficiency wage).

I. Introduction

No economic aspect of higher education is of greater interest to the public, policymakers and parents than the setting and changing of tuition, yet economics has not been very successful in explaining it. Why that's so has become increasingly clear. Colleges and universities, as firms, are highly unconventional in their sources of revenue, their production processes and their institutional values, and higher education, as an industry, has an oddly hierarchical structure that shapes both competition and what's competed for. Together, these have made easy economic analogies and borrowings from conventional theory and experience less productive than might have been expected.

This paper presents a model of prices and competition in higher education built in equal measure on the emerging understanding of the economic structure of the industry and the importance of its hierarchy,[1] on growing evidence of its unique production process,[2] and on important theoretical insights of Hansmann (Hansmann 1980) and Rothschild-White (Rothschild and White 1995). It's important to be clear about what the paper does and does not do. It describes what appears to be a promising way to frame the economic understanding of prices, markets, and competition in higher education. It does not present a formal maximization model, though that would give reassurance on the logic of the description and generate more precisely formed hypotheses. (An appendix includes a consistency model – the accountancy of key variables – to help structure the argument.) The analysis of price and competition in higher education is a stick that can be picked up from either end. This paper is informed by economic data, facts, and experience and moves toward formal analysis; others (Rothschild and White 1995; Epple, Romano et al. 2001) have come from the other end with formal models aiming to help understand how higher education might work. The gap remains but is closing. So this paper should be seen as a preliminary report on work in progress describing a conceptual

[1] (Winston 1995, 1999)
[2] See (Winston and Zimmerman Forthcoming) for a review of the literature on peer effects in higher education.

framework with which to make sense of an important economic aspect of US higher education.

The next section will present the model of prices and competition in higher education, showing what has made a clear understanding so elusive. The following section will identify the premises – the assumed characteristics of firms and industry – that underlie the model and the empirical evidence that supports them. A final section concludes, followed by an appendix.

II. Prices and Competition in Higher Education

As firms, colleges and universities are distinguished economically from familiar business firms by three things:

- unconventional revenue sources that significantly alter the role of sales revenues and pricing,
- an unusual production process that ties together two markets that are normally separate, and
- a non-profit objective function that elevates institutional mission and quality ("excellence" or "prestige") over profits.

As an industry and market, US higher education is distinguished by:

- a highly differentiated hierarchy that rests on differences in schools' access to those non-price resources.

The next section will examine the evidence that supports these assumptions; this section will put the pieces together to describe a model of the way the industry works.

The Revenue Sources of a College and Their Distribution in the Industry

In an influential article on the theory of the non-profit firm, Hansmann described a college as "a donative-commercial non-profit enterprise" because its revenues[3] are derived, simultaneously, from charitable donations and from commercial sales. Non-profit firms, said Hansmann, may often rely on one or the other of these sources – on donations or on sales revenues – but the activities of colleges and universities are supported by both as they get charitable donations at the same time that they sell their product for a price. That means, of course, that unlike a normal firm, a college can be in a sustainable equilibrium even when the price it charges for its product – net tuition – is much less than unit production costs. It is necessary only that the gap between cost and price be no greater than the school's donative revenues per student can support. From a student's perspective, that gap between cost and price is an in-kind subsidy as he is sold an expensive product at a price less than its production cost.

To Hansmann's abstractions, my work added a lot of facts, based on analysis of institutional and national collegiate financial data.[4] While we'll return to those numbers in the next section to give systematic empirical support to the model, they established clearly that in the aggregate, donations (past and present, private and public) are of real importance to US higher education and that, in fact, they make a considerably larger contribution to schools' total educational revenues (about 75%) than do commercial, sales revenues (25%). So the "donative-commercial" nature of colleges introduces not simply a minor deviation from the familiar but a dominant fact that must shape any understanding of markets and prices.

More important to prices and competition than the magnitudes of these donative revenues, though – either *per se*, or relative to schools' commercial revenues – is the fact that they are distributed among colleges and universities very very unevenly, creating a

[3] The empirical studies that motivated this work included the imputed costs of and revenues from owned capital stocks; "resources," then, is a more accurate phrase than "revenues," but I will use them interchangeably (Winston-Yen 1995, 1999).

[4] Based largely on Department of Education Data from the Integrated Postsecondary Data System (IPEDS) from 1986-7 to 1995-6 (the most recent year available). See, inter alia, (Winston-Yen 1995; Winston, Carbone et al. 2001).

highly differentiated ability among schools to subsidize their students. Again, not to anticipate the discussion of empirical evidence below, but looking at schools in the national data ranked by the size of the subsidies that they give the average student, those subsidies in the top decile are, on average, more than ten times as large as those in the bottom.

It's worth noting, before leaving the issue of the uneven distribution of donations and therefore of student subsidies among schools, that these subsidies are simply the difference between unit cost and average net price ($s = c - p$) so any given subsidy can be generated by high cost and high price or by low cost and low price so long as their difference is the same. It will be important that in fact, over the hierarchy, as subsidies increase, so do both net prices and unit costs with costs increasing faster than prices – higher-subsidy schools tend to offer their students a more expensive education at a price that doesn't increase as much as costs. High subsidy schools are "a better bargain" in simple terms of what a student has to pay for a dollar's worth of educational services and quality. The hierarchy, then, is defined similarly by both the size of student subsidies and by schools' price-cost ratios, what the student pays for a dollar's worth of education. The fact that they are highly correlated eliminates a potential conflict in school choice and the behavior of the markets described below.

The Production Process and Institutional Values

For present purposes, it is enough to posit an institutional objective function that recognizes both schools' missions and their institutional excellence (quality) and treats revenues simply as means to those ends.[5] So profits, *per se*, aren't seen to be of institutional value. It is clear, of course, that those two objectives, of excellence and mission, will be differently evaluated by different schools and that with limited resources,

[5] In keeping with Hansmann's "donative-commercial" enterprises, schools are both charities and commercial firms – part church and part car dealer.

their satisfaction will often involve tensions and tradeoffs that can play a significant role in pricing.[6]

The process by which the services of higher education are produced is ordinary in every way but one – it utilizes a familiar set of purchased inputs like faculty labor, the services of expensive capital, heating oil, computer technicians, etc. But a critically important input to the production of high quality education is the peer quality that can be bought only from a firm's own customers. Students educate students so the school that wants to produce high quality education will have to enroll high-quality students, not to act as passive buyers of the school's educational services, but as factors of its production.[7] The contribution a given student makes to a school's educational quality will determine his or her desirability to the school. Schools are not indifferent to the quality of their customers.

I want to make this very explicit – that student quality is assumed to be an input in the school's production function for educational services. This is not, in other words, a peripheral characteristic of the process that appeals to buyers, like Becker's increased consumer appeal of those restaurants that serve the rich and famous (Becker 1991) or Basu's appeal of exclusivity, *per se* (Basu 1989). Student peer quality is, in terms of educational services, seen to be a genuinely productive input to education. Students who go to school with good students will, *cet. par*, get more/better education than those who go to school with weak students. This is addressed by empirical evidence in the next section. It is assumed, further, that schools know this about their production process and that awareness motivates their selectivity in admissions – in the interests of student,

[6] It's relevant that Berea and Amherst Colleges have nearly the same endowment per student but Berea's mission is to serve an Appalachian student population at a zero tuition (and a $65,000 cap on family income) while Amherst's choice of institutional excellence regularly puts it at the top of USNews ranking of national liberal arts colleges. An institutional objective function, U = u(X,M), with excellence, X, and mission, M, in frequent tension would seem to capture those choices.

[7] A household production function for an individual who can convert purchased educational services into human capital efficiently would capture "a good student," as *buyer*. The issue here, though, is the very different matter of the student's creating an externality that contributes to the school's production of the educational services, itself – the student's peer quality is an argument of the school's educational production function.

hence institutional, quality, they have an incentive to restrict sales and capacity in order to improve the quality of their peer input.[8]

If there is a single implication of the role of peer quality in production, it is that firms care about who they sell to because a sale of educational services is, simultaneously, the purchase of an important input to production.

Three assumptions about educational "output" need to be made explicit. One is that we can usefully ignore all of the non-educational activities of a multi-product university and focus solely on education.[9] Another is that in educational services, quantity and quality are inseparable – that "more" must mean a more effective or higher quality education, rather than something like more hours of classroom instruction.[10] And finally that educational quality can be proxied by expenditures per student; and while one might be uncomfortable with an assertion that a higher cost education has to be a better education, it seems reasonable to assert that higher quality will usually cost more.[11]

One Event, Two Markets, Two Transactions, and One Price

The significance for markets and pricing of having input and output transactions linked by a single event was implied by Rothschild and White (R-W) in an influential article in the JPE (Rothschild and White 1995). I'd like to build on that framing, taking their two markets more seriously and explicitly tying the analysis, as they did not, both to the peer effects through which student quality is an input to educational quality[12] and to

[8] Note that a school with a fixed yearly flow of donative resources will have an incentive to restrict supply both to protect the level of donative resources *per student* and hence per student subsidy and to improve the average quality of the student body that can be drawn from a given applicant pool. See the Appendix

[9] The empirical work on which this paper rests takes pains to separate the educational function from others done in universities (Winstone-Yen, 1955).

[10] That, of course, gets into the murky question of "assessment" or "accountability," but at the level of abstraction here, the precise measurement of quality needn't be an issue.

[11] "Quality cannot be bought, but it must be paid for." (Carleton College 1997).

[12] Their analysis didn't mention peer effects, *per se*, since it was meant to apply more generally to any instance in which the attributes of customers create an externality that affects sales of the product, though they used higher education and student externalities as their case in point. The primary conceptual differences from the approach taken here, though, were their neglect of the consequences of either donations or the hierarchy of differential donations that influence the market(s) described here.

the donative revenues, unevenly distributed, that allow schools to subsidize those students. In R-W, the first of these was implicit while the second was ignored.

If the two markets were separate – one for a school's output of educational services and the other for its input of peer quality – we could conventionally (and conveniently) assume that a competitive market for educational services would reach an equilibrium price that just covered production costs. In the input market (for peer quality), we could conventionally assume that it, too, would reach an equilibrium wage, determined by the marginal product of peer quality and its availability. Quality differences among peers would be reflected in different equilibrium wages.

But instead, in higher education the same event, the matriculation of a student at a college, is a transaction in each of these two markets. Simultaneously, the school (student) sells (buys) educational services to (from) the student (college) while the student (college) sells (buys) peer quality input to (from) the college (student). Transactions take place in each of the two markets, as a result of that single event. What's more, neither transaction can take place without the other. Either market or both can induce the matriculation event but both will share it: the school that successfully competes for peer quality will not worry about enrollments; the school that competes for enrollments will have little control over peer quality. So those markets are joined in a quite unusual way.

But that's not the end of it since the wage paid by the school to the student for his/her peer quality is not an explicit money wage but, instead, it takes the form of a price discount on the student's purchase of educational services – the student subsidy. Output and input markets are joined twice, then: (1) as the one matriculation event is a transaction in both markets at the same time and (2) as the payment for one of those transactions takes the form of a discount on the price of the other.

To this point, the story is, in essence, a more concrete rewrite of Rothschild-White's with a change in vocabulary (specification of peer quality as the customer-

supplied input and "student subsidy" or "peer wage" instead of their "financial aid") and the emphasis on two markets, one event, two transactions and a single money price.

Donations – Non-price Revenues

The major omission in the Rothschild-White analysis, however – that keeps it from being entirely applicable to US higher education – is that their model is set in a for-profit industry where sales are the only source of revenues. Their individual customer-suppliers can be given different discounts on price (can be paid different wages, via "financial aid") but the zero profit condition requires that the average of those price discounts be zero. A high-quality student bringing lots of productive peer quality to a school will pay less for her educational services (will get a higher peer wage) than the low-quality student who brings little, but over a school's student population, the sum of net prices must equal costs so the average price discount has to be zero.[13] Their for-profit model, then, restricts them to "merit aid" competition between students at schools that have neither endowments nor physical wealth to differentiate them. Theirs is at best a small segment of higher education.

But when it is recognized that only a part of colleges' revenues come from sales, a more useful and familiar picture emerges. In the school that receives donative revenues in addition to sales income, a subsidy (a positive peer wage) will be paid to its average student; potentially to all its students.[14]

With donative revenues, a school can pay its peer wages in two quite different ways that are central to the nature of competition in higher education. Part of its peer wage is paid to all of its students equally as a "general" or "institutional" subsidy if the sticker price (the maximum individual price) is set below average cost. But further,

[13] The sticker price, p_s, is a maximum net price from which discounts ('financial aid') are made. In their model, that price has to be above costs in order that the average price charged be equal to costs to yield zero profit. This would generate the much resented "RobinHooding" in which one student pays more in order that another pay less though in an R-W framing, those prices are different only because the students bring different levels of the peer quality input so are differently compensated. See the Appendix on this.
[14] Assuming that for the college, saving (like profit in R-W's firm) is zero forces all donative resources to be used as student subsidies. Again, see the Appendix.

individual, subsidies can still be paid, as in R-W, by wages additional to the general, institutional rate – by "merit aid" or "scholarships" as discounts below the maximum (sticker) price. Those additional wages reflect individual differences among its students in peer quality. Without recognizing that schools have non-price revenues, the R-W model could describe only those forms of subsidy-wage that average to zero. With donative resources, students can be subsidized uniformly, individually, or both. The distinction between a general institutional peer wage and an individual peer wage is important because the primary mechanism of competition in US higher education appears to be inter-institution competition for peer quality through differences in institutional peer wages – differences in schools' *general* subsidies[15] - with individuated merit wages playing a more minor role (so far).

Markets

All schools enter into the two markets by virtue of their students' matriculation, but schools have very different resources and hence very different involvement in each market. The market for peer quality is the dominant one and essentially the only one for schools at the top of the hierarchy who are able to pay the highest peer wages. The market for sales of educational services becomes apparent only further down the hierarchy as it emerges from the shadow of the peer quality market. Again, either market can motivate students' matriculation, but once it occurs, it's a transaction in both.

In the market for peer quality, two things are central: (a) peer quality is scarce among students and its distribution among them is highly skewed so that not many of those hoping to sell peer quality have a whole lot of it to sell. And (b) on the schools' side of the market, donative revenues – non-price revenues – are scarce among colleges and their distribution, too, is highly skewed. So not many colleges hoping to buy peer quality can afford to pay very high wages for it. Most schools will be outbid by the few

[15] The algebra and accounting of these relationships are spelled out in the Appendix.

that pay the highest peer wages resulting in a concentration of the best students at the highest subsidy schools.[16]

Note that seeing student quality as a purchased labor input turns the selective college admissions process into an Akerlof-Yellen labor market where an efficiency wage – a wage higher than would be needed to clear the market if worker quality were irrelevant – is paid in order to generate the excess supply of 'workers' that allows selection among applicants on the basis of quality (Akerlof and Yellen 1986). Both the excessive wage and consequent excess supply are needed to control input quality.

The market for educational services, too, is very different across the hierarchy of schools: that market is dominated – in the linked transactions of matriculation – by peer competition at the top of the subsidy hierarchy; so the market for educational services (output) emerges only as we move down to less wealthy schools where there's a tradeoff between student quality and enrollments and, finally, to the open admission schools at the bottom that pay very low peer wages and have essentially no control over peer quality but need to sell educational services – enrollments that fill beds and classroom seats.[17]

Competition

There's enough going on here – with two linked markets sharing the single matriculation event and with the wage generated in one of those markets being paid as a price discount in the other – that it's useful initially to look at competition in these markets only with some stark simplification. So first consider the market for peer quality, alone, recognizing that all schools have access to donative resources but in different amounts so the market has a hierarchy of firms paying different peer wages. And start by ignoring the individually differentiated wage rates on which R-W had to focus to consider only the differences in schools' *general* wage rates – as their sticker

[16] (Cook and Frank 1993; Hoxby 1996)
[17] The "student enrollment management consulting" industry works in that middle ground, advising schools on the parameters of tradeoffs between peer wage increases (price discounting), enrollment (sales) reductions and student quality.

prices are set below average costs. Schools care about – in addition to their missions – their institutional excellence which is a positive function of the quality of their enrolled students and students care both about the size of their wage rate and, in the product market, what they pay for their educational quality, schools' price-cost ratios.[18] Assume that there's no contradiction between these – schools' relative peer wages and the relative price of their educational quality give the same ranking, supporting the same college choice.[19]

Competition for Peer Quality Inputs

Then the simplest market allocation would see all of the students lined up by their student quality confronting all of the schools lined up by the size of their general subsidies (peer wage rates) and a queue-and-cascade process would take place. All students would try to get into the highest-wage school which would fill its class with those students of the highest peer quality,[20] then the remaining students would line up to get into the second-highest wage school which would take the best of them, leaving those still in the queue to line up for the school paying the third-highest wage,… and so on until students ran out of schools or vice versa. The result would be the matching of the best students and the highest wage schools. For each school, as noted, the process would look like an Akerlof-Yellen labor market in which its general student subsidy was an efficiency wage that generated an excess supply of students from which it could select (admit) on peer quality.

Competition between schools would be for peer quality and a school's success in that competition would depend on the size of its general student subsidy, relative to that of other schools. So competition among schools would be positional and rest solely on their access to donative resources.[21] Competition between students would be for peer

[18] In a richer development of this model, it may prove quite useful to recognize that a student's "college choice" is influenced both by what he pays, as buyer, for a unit of educational output, c/p_i, and what he is paid, as seller, for his peer quality input, $c-p_i$.
[19] This is probably the weakest assertion of the model and an area for the most fruitful research - where price/cost ratios are relatively low but so are subsidies and educational spending (quality). These dimensions of college choice appear to be central to the competition between public and private sectors.
[20] Assuming that no qualified student had too little income to afford that school's net price – a consideration of the distributional pricing via need-based financial that's returned to below.
[21] (Winston 2000).

wages and low-priced school quality and it, too, would be positional – an improvement in one student's own peer quality, relative to that of other students, would be needed to move up the hierarchy toward a higher-wage school.[22]

While students' efforts to reposition themselves in their competition for admission to a high-wage college have been noted as wasteful; schools' efforts to reposition themselves in their competition for peer quality (or prevent being overtaken by a school from below) appear wasteful, too, as they require an increased peer wage, relative to other schools'. Since the peer wage is subsidy (cost less price), to compete by repositioning in subsidies, a school must gain access to more donative resources (relative to proximate schools in the hierarchy)[23] and then use those resources either to increase cost (hence quality) or to reduce price, or both.

This simple picture of competition among schools for student quality rests on differences between them in their *general* peer wages – on general subsidies, cost less sticker price – and it leads to a mechanical matching of students and schools that appears to capture the broad dimensions of competition in higher education, especially among the high-wage schools. What's missing, of course, is the very different form of peer wage competition implicit in R-W, in which a school may improve its average peer quality by targeting price reductions or quality improvement for individual students whose peer quality is sufficient to get them admitted to a school with a higher general wage. So the student who's good enough to get into Yale and be paid its general peer wage might be induced to go to Syracuse by a higher individual wage, even though Syracuse's general peer wage was well below Yale's. That, of course, is "merit aid" in which a price discount is given to the individually identified student of superior peer quality to induce him to choose a lower-general-wage school. (A variant on that competitive theme manipulates individual cost and educational quality by creating an 'honors college' that pays a higher subsidy to selected high quality students grouped in an enclave within a larger school that has, again, a lower general peer wage. In an honors college, it's done

[22] The wasteful efforts that Frank and Cook identified as the result of the 'winner take all' nature of the positional competition for college admission (Frank 1995).

[23] Most obviously by more successful fund raising or lobbying government but also by borrowing or reducing assets or reducing enrollment so a given level of donative resources support increased non-price revenues per student. See the Appendix.

by increasing per student expenditures and quality, often in addition to reducing price for those students; each of these results in the classic internal cross-subsidy described by James and by Weisbrod.)

Competition for Educational Service Sales

The market for educational services is in many ways more familiar, after it is disentangled from the peer quality market. But because the industry includes such very different qualities of education, it's important to describe the price of educational services relative to institutional quality, to use a school's price-cost or price-quality ratio – the cost of a dollar's worth of educational expenditures.

That said, it appears that because competition for peer quality dominates behavior of those high-wage schools that can compete in that market, the educational service market, *per se*, is not in evidence at the top of the hierarchy, except for the fact that the price of educational services serves is the vehicle for the peer wage payment. But moving down the hierarchy to schools with less donative wealth and therefore less ability to compete for the limited peer quality, educational service sales are no longer a byproduct of the peer quality transaction and there is increasing need to compete for product sales *per se*. In addition to familiar strategies like price discrimination to increase sales revenues – from a product that's impossible to resell – in the gray area where peer quality and educational service markets are both in evidence, complex strategies will be found (and sold by student enrollment management consultants) to minimize the cost of the tradeoff between peer quality and enrollments. And because of students' awareness of the promise of distributional pricing, to which we turn next – of "need-based financial aid" – they may be induced to provide schools with an unusual degree of information on which schools can then base their price discrimination (Steinberg and Weisbrod 2002).

Institutional Mission and Distributional Pricing

Emphasis on the institutional goal of excellence and the contribution to it of peer quality neglects an important aspect of pricing in higher education. Need-based financial

aid is a discount from sticker price that looks just like the competitive merit price discounts we've been discussing, but it is motivated by institutional mission and serves schools' idealistic interest in equality of opportunity.[24] Under need-based financial aid, prices are reduced to the reservation price of those low-income students who are qualified for admission through their peer quality; the school's education is made "affordable" under the institutional conviction that it sells a merit good whose consumption should be increased for selected students (Steinberg and Weisbrod 2002).[25] It's tempting to simplify the analysis, of course, by holding that 'low income' is just another dimension of 'peer quality' – along with academic promise, race, and athletic talent, legacy status or whatever – but it seems important not to obscure the very different institutional motivations involved – that peer quality is seen to enhance institutional excellence while need-based aid for low-income students is a (costly) policy in service of the mission aspect of institutional values. And, in Steinberg-Weisbrod terms, it's also important that the discount is intended to meet the low-income student's reservation price ("full need aid") and not go below that to provide income redistribution. The policy at the wealthiest schools to do "need-blind admission" with "full need-based aid" is intended to make the judgment about a student's peer quality separately from the judgment of distributional pricing.

Prices – Net Tuition

The product prices – net tuition – that emerge from all this are clearly not the result of simple and familiar market processes. Not only is net tuition, the price of educational services, subject to all the normal strategic manipulation and competitive pressures of a product's market price – especially at the bottom of the hierarchy where the educational service market takes over – but net tuition serves two additional functions as peer quality wages are paid to students in the form of discounts on the price of the

[24] By increasing the population of potential students in a world of scarce peer quality, need-based aid may improve a school's access to that quality on the margin. It remains both different from and more costly than merit aid as a route to higher peer quality – it can never be the most effective way to acquire it.
[25] Indeed, since need-based financial aid is both highly respected and concentrated among wealthy and prestigious institutions (as the Steinberg-Weisbrod model predicts (Steinberg and Weisbrod 2002)) while competitive price discounts to buy peer quality are seen as tawdry, considerable effort among colleges goes into obfuscation of those differences in both rhetoric and data (McPherson and Schapiro 2002).

educational services they buy, and as schools, in their role as charities, use distributional pricing to increase the "merit good consumption" of what they produce by making it possible for low income customers to buy it – affordable – through need-based financial aid. And each of these roles of net tuition is of different relative importance at different levels of the market hierarchy. It's small wonder that there has been little understanding of college pricing.

III. Evidence

Since this model has emerged from accumulating economic evidence about and insights into higher education, the fact that it fits with that evidence is no surprise. It is useful, nonetheless, briefly to review the data that support the premises of the model.

The story told is one of price competition taking place in two markets simultaneously - for output and a key input – with the price in one market being paid by discounts in the other and, beneath it all, the use of an efficiency wage to select inputs on the basis of quality. As a story, it hangs together; its central premises are these:

- That non-price revenues – donative resources – are of significant magnitude in US higher education;
- That those donative resources are distributed among colleges and universities quite unevenly;
- That the distribution of peer wages across schools is similar to the distribution of the prices of educational quality so there's little or no contradiction in students' incentives in college choice between the two markets;
- That peer quality is distributed among students unevenly;
- That schools' objective functions have both excellence and mission as arguments and, crucially,

- That student peer quality does, in fact, contribute to the quality of educational services.

The first of these is demonstrated in Table 1 where it is shown that, over most of the colleges and universities in the US – public and private, two and four year – sales revenues cover about a third of production costs, leaving two thirds to be met by donative revenues. So the average student received (in 1995-6, the latest year for which we have complete IPEDS data) an education that cost $12,400 to produce, for which he paid $4,000. The other $8,400 was paid by donations (past and present, public and private) to include gifts, appropriations and earning on assets, financial and physical. In an analysis of data from those schools that allowed estimation of their saving, as noted earlier, fully 75% of schools' total revenues came from those charitable donations and only 25% from sales revenues (Winston, Carbone et al. 2001).

[TABLE 1 HERE]

The bottom part of the table addresses the second premise, showing cost, price, and subsidy for those schools ranked by the size of the subsidies they give their students (average peer wage, to include both general and average individual wage). The differences in donative revenues across that hierarchy are pronounced with those in the top decile giving their students an average peer wage of $21,000 a year while those in the bottom decile paid a peer wage of $1,700. These differences, it's worth noting, would have been greater had we reported public and private sectors separately as the high wages in private sector schools are higher and the low wages in private schools lower than those in the public sector. For schools in the top decile, average subsidies are often $50,000 a year or more.

A useful picture of the distribution of peer wages among schools is given in Figure 1 where the population of student FTEs is plotted against the average peer wage they receive from their schools. Unlike the table, the unit here is the student so the figure pictures the wage associated with student quality – what schools are paying for their peer quality across the population of matriculated students.

[FIGURES 1 AND 2 HERE]

The last column of the table reports price-cost ratios which can, as noted, be read both as a measure of the proportion of his educational costs the average student pays and as the price of a unit of educational expenditure (quality) in the market for educational services. The assumption that students generally don't face contradictions in their prices when making college choices simultaneously in peer quality and educational service markets is supported by the positive correlation between them evident in the decile rankings and in a fairly high rank correlation between schools' wages and price-cost ratios: over all four year schools (0.61) and (0.76) over private four year schools. It's clear that a closer examination of these two price interactions is a promising direction for research, especially in light of the fact that while public and private sector schools are similar in their average peer wages, the public sector sells educational services at significantly lower prices and expenditures.

The distribution of quality among students can, of course, be examined only crudely, if familiarly, with SAT data, but a plot of the cumulative distribution of combined math and verbal scores over all 1993 test takers in Figure 2 indicates a predictably skewed distribution that leaves very few very high-quality students for the high-wage schools to compete for. Comparing Figures 1 and 2, both of which are distributed over the student population, an assignment of the high scoring students to the high wage schools would result from an allocation solely on wage and peer quality. It's clear that there simply aren't many very high quality students or many very high wage schools, compared with either population, so the concentration of competition on peer wage and quality at the top of the hierarchy is predictable. So, too, is the sharply differentiated nature of competition over the hierarchy of schools and students – again, what appears to be excess demand for educational services at the top is seen, instead, to be an excess supply of peer quality seeking high peer wages.

It's interesting, I think, that this conception of student subsidy as a wage rate and even the simplistic identification of student peer quality solely as SAT scores, yield a plausible estimate of a wage function for peer quality in which schools' average SATs are

regressed on the average peer wage they pay with results for four-year schools described in Table 2. It appears that a 100 point increase in students' combined SAT scores – from 1350 to 1450 – yields as much as a $6,500 increase in average yearly peer wage. In the other direction, the implication is that a school would have to increase its subsidy (cut price or raise spending) (*cet. par.*) by $2,100 per student to increase its average SATs by 50 points from 1200 to 1250 and $3,100 to go from 1350 to 1400.[26] This wage function helps in joining the two aspects of "student access" – that matriculation of a student at a school requires both admission (satisfying the peer quality requirements) and affordability (being able to pay the net price).

[TABLE 2 HERE]

The next premise – that colleges are motivated by a very different objective function than familiar for-profit firms (that they have as arguments to their institutional objective function something like both institutional excellence and mission) isn't amenable to statistical evidence, of course, but the existence of decidedly non (anti-) profit behavior, like widespread distributional pricing through need-based aid or Berea's policy of zero tuition combined with a parental income cap, does suggest it. So might the historical role of churches in the establishment of colleges and, indeed, the massive contribution of donations in service of college's goals which would, to put it mildly, represent dubiously rational actions if the donors believed they were contributing to for-profit firms.[27]

Finally, a central element in this analysis has been the role attributed to peer quality as an input to the production of education – an assertion about the production

[26] Note, too, that that relationship suggests the monetary value to a student of being admitted to a more selective and higher-wage school than his peer quality would justify – an issue of relevance, for instance, to those schools that eschew athletic scholarships (so, explicit price discounts for superior athletes) but bend admissions standards (peer quality) to recruit them, giving an implicit wage that appears to be of considerable value. From the table above, a line-backer with a 950 SAT who is admitted to a selective college where the average SAT is 1450 will, with no explicit payment of scholarship, get a bit more than $19,000 a year in in-kind subsidy.

[27] On this, see Hansmann, inter alia.

technology of higher education.[28] Are there "peer effects" in higher education? While there are alternative explanations for schools' selectivity that might even justify their persistent restrictions on supply, genuinely productive peer effects would not only support the model, but create something of social value in enhancing education and learning.

So it is reassuring that the accumulating empirical evidence shows that, in fact, one student's peer quality does affect another's academic performance (Winston and Zimmerman Forthcoming). The evidence so far focuses on that very narrow set of student characteristics (like SAT) and academic performance (like grades) that can be measured for students whose interaction can reasonably be described as random (avoiding the natural contamination of selection effects – the choice of friends), but the evidence is both significant and increasing.

IV. Conclusion

This paper has presented a way of framing the analysis of higher education to incorporate and integrate characteristics that appear to shape its unusual economics. Those characteristics are:

1. A production technology in which institutional quality depends on student peer quality that can be bought only from a school's own customers. What appears to be one market – that for educational services – is also and simultaneously a market for the peer quality input so the behavior that appears inexplicable in the product market is, in fact, efficient in the market for a purchased input: persistent queues of unsatisfied customers, refusal to expand production capacity, selection of customers on their personal qualities, replacement of one customer by another whose reservation price is lower, etc. Apparent

[28] It would be enough for the model if colleges thought there were peer effects, whether they existed or not. And, on the other side, alternative explanations for selectivity exist (signaling, exclusivity, per se, …) . Again, see (Winston and Zimmerman Forthcoming).

excess demand is, in this framing, understood to be excess supply that serves to protect input quality through an efficiency wage.

2. Significant non-price revenues – "donations" – break the link between cost and price, allowing for customer subsidies or, more accurately, the generation of wage payments to those peer quality inputs. They allow, too, a college's service to its 'mission' through distributional pricing.

3. The very uneven distribution of those donative resources creates a hierarchy of firms, differentiated by their ability to compete for peer quality. Those at the top get their students primarily through that peer quality market; those at the bottom get theirs through the market for educational services. So, what a college competes for and how it competes depends largely on its position in that hierarchy. Higher education is distinctly not an industry of homogeneous firms and that heterogeneity makes a large and structural difference. Much of the competition in higher education is positional – dependent on how a school ranks in one hierarchy and how the student ranks in another.

4. Tuition, net price, plays three very different roles:

- It is, in part, the familiar price a student pays for the educational services he buys from a college
- It is the vehicle through which students are paid a wage for the peer quality they sell to the school – either a general wage as sticker price is set below cost creating a subsidy for all students, or as a further price discount for selected students of high peer quality (merit aid), and
- It is a distributional price through which a college makes its merit good affordable to low-income students (need-based financial aid).

As presented here, the model needs formalization but it seems to develop a promising analytical framework that structures facts about higher education markets, the

role of hierarchy, the determinants of prices, and the nature of competition and resolves some evident economic anomalies.

Appendix: The Accounting of Prices and Peer Wages

Even without the complications of two superimposed markets developed here, accounting for familiar economic variables, like price and cost and "profits," is sufficiently unusual in the donative-commercial non-profit enterprise to warrant an unusual level of pedantry. So this appendix will trace out, with some care, what's going on with price, cost, subsidy, and peer wages in higher education, starting very close to Econ 101.

In the normal, for-profit firm, price equals unit cost, c, plus unit profit, π,

(1) $p = c + \pi$,

while profit may be further decomposed into dividends, d, and retained earnings, v, so that

(2) $p = c + d + v$

describes the firm's sources and uses of funds. When profits are assumed to be zero in a competitive equilibrium, price equals cost.

Into this, R-W introduced the fact that some inputs (in the context of this paper, peer quality) can be got only from the firm's own customers, implying the two superimposed markets described in this paper. Both profits, π, and donative revenues, δ, are assumed by R-W initially to be zero.

If there are no differences among peers, then any contribution they may make to production is simply an externality that has no explicit monetary value. But if peers differ in their productivity and they're paid wages that reflect those differences, those

wages take the form of a discount from the price of an individual student's purchase of educational services ("financial aid" in R-W); student i gets a wage of w_i, paid in the form of a price reduction on the educational services he buys – a reduction to p_i from the average price, p, (which must equal unit cost, c, under zero profits),

(3) $w_i = p - p_i = c - p_i$.

This is the definition of a student's subsidy, s_i, in my empirical work ((Winston-Yen 1995), et. al.) Over all of a school's students, the average wage, w, has to be zero in the absence of donative resources, so average price will equal cost.

Any variation among students in peer wage, then, is around zero and any consequent variation in individual prices is around the average price, p. There may be competition among schools for each level of peer quality, creating market-determined individual wages, w_i, but within any school, peer wage differentials must average zero: the weak student is paying a price premium ($p_i > p$) which gives him a negative peer wage ($w_i = c - p_i$) while the strong student gets a price discount and hence earns a positive wage ($p_i < p$). That's "Robinhooding" in that some (weak) students pay premium prices to "support" other (strong) students.

But moving to the non-profit firm, when positive donative, non-price, revenues, δ, are introduced (along with the non-distribution constraint requiring that d = 0), equation (2) becomes

(4) $p + \delta = c + v$.

A zero profit constraint still requires zero institutional saving (v=0), but the average peer wage is no longer zero; instead, it has to be

(5) $w = \delta = c - p$.

An individual's peer wage will be $w_i = c - p_i$, as in R-W's for-profit firm, but it is no longer necessary that any individual wage be negative – even the weakest student selling the least peer quality need not pay a premium over cost, c. A school's peer wages are now distributed around its per student donative resources, δ, while prices are distributed around its average price, $p = c - \delta$. All students can get subsidies as their average wage must now equal δ, not zero. (There's Robinhooding now only in the sense that some (good) students may get higher peer wages than other (weaker) students within a school, but all peer wages can be positive since they are being paid from donative resources, not from other students' commercial payments as in R-W.) Again, there may be competition between schools for levels of peer quality, establishing market wages for peer quality.

A student's subsidy (peer wage, w_i) will be paid in two economically different parts. One is a school's "general" subsidy (general wage, w_g) that's paid to all its students; the other is a further subsidy (wage, w_{pi}) that the school may or may not pay to the individual student. So with the school's sticker price, p_s, defined as

(6) $p_s = \max p_i$,

the general subsidy (general wage, w_g) is

(7) $w_g = c - \max p_i = c - p_s$

while any further discount from the sticker price,

(8) $p_s - p_i = w_{pi}$ (≥ 0),

creates an additional subsidy (wage) component. So an individual's total subsidy (wage, w_i) from a school is

$w_i = (c - p_s) + (p_s - p_i) = w_g + w_{pi} = c - p_i$

with $w_{pi} = 0$ for the "full-pay" student.

A final step recognizes differences between schools, j, in their donative revenues, δ_j (and the institutional hierarchy that those differences create). Within each school, the conditions above apply, but competition for peer quality among schools can now rest, too, on differences between schools in the general wage rates, (7), they pay to all their students. The locus of most competition between schools for peer quality in higher education, the text above asserts, is in differences in their general wage rates; within the resulting positional order, schools can compete further by offering higher individual wages, (8), to students who can be accepted at a higher general wage school. That's "merit aid" competition.

An honors college within a larger institution can award a higher wage to its students to get better than average peer quality either (or both) by price concessions of the sort in (8) or by increasing spending, c_i, on its honors students who are selected to be above the average for the school as a whole. The peer wage paid to students admitted to the honors college, then, would be higher than those in the rest of the university, on both counts as $w_i = c_i - p_i$ carried a higher c_i or a lower p_i or both. Again, this is pure James-Weisbrod cross-subsidy to support institutional 'excellence.'

As noted in the text, emphasis on the contribution of peers and peer quality to the goal of institutional excellence neglects the need-based financial aid that rests on the motivation of institutional mission with the aim of increasing equality of opportunity by using price to increase consumption of a merit good. And while low income might be introduced into the analysis simply as a dimension of "peer quality," it does not seem useful to call that element of subsidy a 'wage' but rather to recognize that it is the result of an explicit policy of distributional pricing. Within need-based aid, however, the distinction made by Steinberg-Weisbrod between merit good pricing that induces consumption by reducing the price to the student's reservation price and, on the other

hand, distributional pricing that lowers price beyond that in order to transfer income to the student, would appear to leave most collegiate need-based aid as merit good pricing.[29]

Saving, v, (retained earnings) has been assumed to be zero, but it can be positive, allowing the school to use some of its donative revenues to accumulate wealth, rather than only to subsidize current students. Non-zero saving allows, too, for saving to be negative in which net worth is reduced in order to subsidize current students by borrowing or reducing assets to reposition competitively (if temporarily).

All variables have been expressed, to this point, per unit output or input – per student – with differences in student quality reflected in their different potential wage rates. But an important difference among colleges recognizes that the donative resources per student that play so central a role in a school's competitive position can come to it either in a form that's relatively impervious to enrollment – extant endowment earnings, the services of buildings, 'normal' yearly gift flows – or a form that reflects enrollment. Donative resources per student

(9) $\delta = DR/N$

where N is enrollment and DR the yearly flow of total donative resources to the school. So in the extreme, a school can have a fixed flow of donative resources, DR, or one that is fully "capitated," varying in proportion to enrollment, $DR = \delta N$. The first is, of course, typical of schools in the private sector; the second has been typical of public schools.

Given the importance of per student donative resources, δ, in pricing and competition, these differences in their financing will clearly influence schools' behavior. For the private school with a yearly total flow, DR, expansion of N must reduce its

[29] Though the politics of financial aid appear increasingly to be using government aid to redistribute income to the middle class. See especially (Winter 2002) (and subsequent New York Times editorial (Nov. 4, 2002)) on the effect of the Georgia HOPE Scholarships in providing luxuries including new cars for middle- and high-income students. This increase in customer income by price reductions is "distributional pricing," in Steinberg and Weisbrod.

donative resources per student, its ability to subsidize students and, as we've drawn it, its competitive position in the hierarchy. Private schools with limited ability to expand total DR, then, will have a strong incentive not to expand capacity. In contrast, the public institution where total DR is adjusted to maintain per student δ can expand enrollment without risk (from that source) to its competitive position in peer quality or educational service markets.[30]

Finally, in the market for educational services, schools produce education of very different quality, c_j, so it is important that the relevant price in that market be seen as p_j/c_j – what the student pays for a unit of educational quality. Table 1 shows both that those prices are highly variable and that they are highly correlated with peer wage rates, so it is unnecessary at this level to try to tease apart the student's reaction as supplier of peer quality from his reaction as buyer of educational services – the same incentive stucture (maximize peer wage and minimize the price of educational quality) serves both ends.

While it should be clear from the algebra, a table that divides the two markets and their prices – with some rough sense of the revenues or costs they represent in national data (IPEDS from 1995-6) – may be useful. Individuated prices, of course, can serve any of three functions – merit wages in the input market and price discrimination or distributive pricing in the product market – so, those roles can be delineated but their individual magnitudes cannot.

[30] The historical analyses of higher education by Noll(Noll 1998) and by Goldin and Katz (Goldin 1997) overlook the power of the incentive for student quality that would differentiate schools in the private sector with their limited donative resources and their incentive not to expand enrollment from schools in the public sector where subsidies are protected with enrollment expansion by capitation.

Wages and Prices
In
Peer and Product Markets
(For Student i)

MARKET	PRICE-WAGE	DEFINITION	DESCRIPTION	MAGNITUDE
Input: Peer Quality	Wage, General	$w_g = c - p_s$	General subsidy per student	$69.1 billion 70%
	Wage, Individual		Merit Aid	
Product: Educational Services	Price, Individual Sales	$w_{pi} = p_s - p_i$	Price discrimination	$21.9 billion 30%
	Price, Individual Mission		Need-based Aid	
Total Subsidy		$s = c - p_i$ $w_i = w_g + w_{pi}$	Total Student Subsidy	$86.9 billion (100%)

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Table 1

Average Cost, Price, Subsidy and Hierarchy in US Higher Education
1995 - 1996

	Subsidy per Student	Average Educational Cost	Net Tuition	Price - Cost Ratio
All Institutions	$8,423	$12,413	$3,989	32.1%
Public	$8,590	$9,896	$1,305	13.2%
Private	$8,253	$14,986	$6,734	44.9%
Institutions ranked by Student Subsidies:				
Decile 1	$20,991	$27,054	$6,063	22.4%
Decile 2	$11,865	$15,801	$3,936	24.9%
Decile 3	$10,009	$13,310	$3,301	24.8%
Decile 4	$8,752	$11,831	$3,080	26.0%
Decile 5	$7,855	$10,565	$2,710	25.7%
Decile 6	$7,020	$9,820	$2,799	28.5%
Decile 7	$6,250	$9,464	$3,214	34.0%
Decile 8	$5,447	$8,848	$3,401	38.4%
Decile 9	$4,262	$9,297	$5,035	54.2%
Decile 10	$1,736	$8,084	$6,348	78.5%

Includes 2791 institutions, of which 1411 are public and 1380 are private. All dollar amounts are per FTE student averaged over their institution. See Winston (2000) and Winston-Yen (1995) for details on derivation from the US Department of Education IPEDS Finance Survey (Medical schools are omitted here).

Figure 1

Distribution of Subsidies over Students

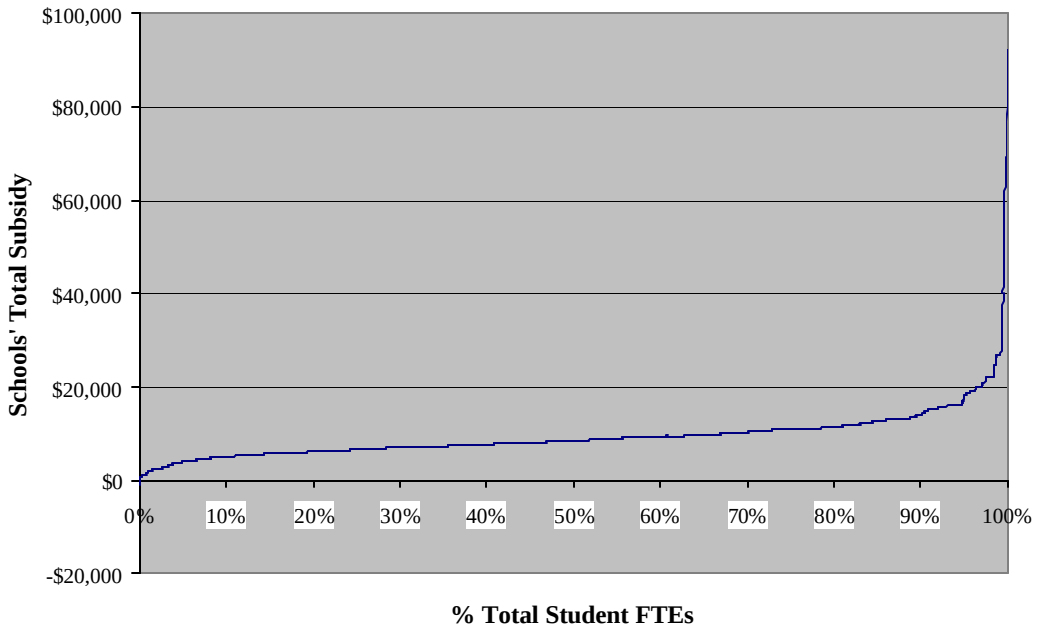
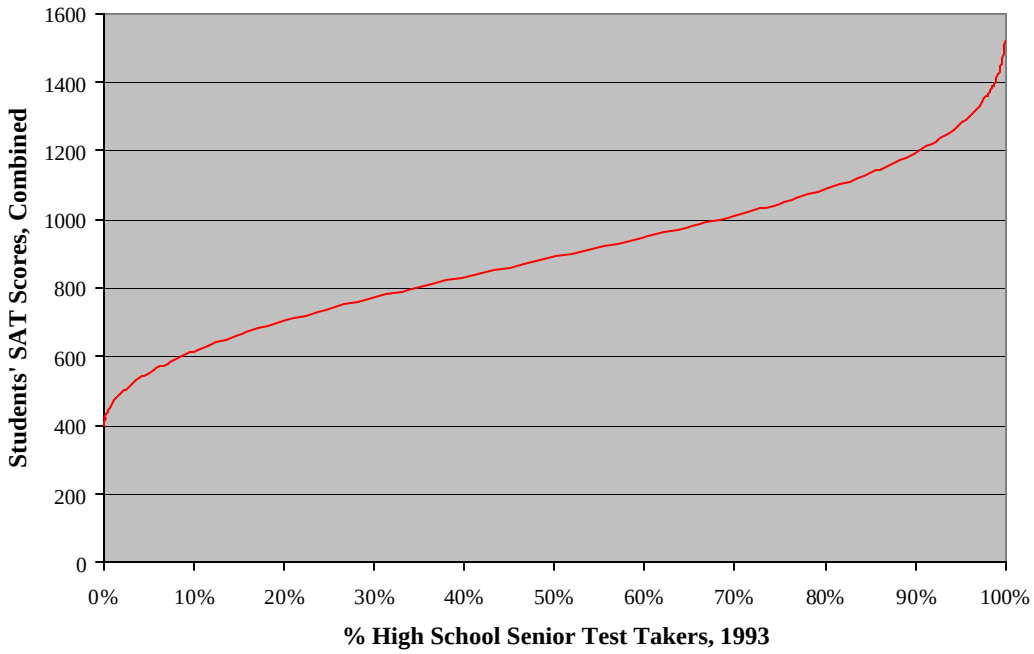


Figure 2

Distribution of SAT Scores over Students



Source: College Board

Table 2
Peer Quality Wage Function
Four Year Schools

School Average SAT	Peer Wage	Value of Last 50 SAT Points	Value of Last 100 SAT Points
	$	$	$
950	7,485		
1000	7,933	448	
1050	8,711	778	1,226
1100	9,819	1,108	1,886
1150	11,257	1,438	2,546
1200	13,025	1,768	3,206
1250	15,123	2,098	3,866
1300	17,551	2,428	4,526
1350	20,309	2,758	5,186
1400	23,397	3,088	5,846
1450	26,815	3,418	6,506

$w = a + bSAT + cSAT^2 + e$ a = 61,673 b = -120 c = 0.066 R^2 = 0.26
t = -13.00 t = 14.18