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## Wealth and the Allocation of Resources At Private Institutions of Higher Education

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Utilizing a model whereby institutional wealth is allocated between financial and physical capital assets, this paper tracks the growing inequality of resources among institutions of higher education. Multivariate analyses are employed to discern the determinants of within institutional wealth allocation.

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## **I. Introduction**

Institutional wealth has always been a critical issue facing higher education administrators. Wealth allows colleges and universities to maintain adequate institutional operations and to guarantee the perpetuation and continued success of their explicit academic and social goals. Furthermore, additional institutional capital allows schools to reap additional status as an academic institution among peer groups through the recruitment of better students, more respected faculty, and the obtainment of more extensive institutional resources (i.e. athletic complexes, science labs, new residence halls).

In recent years, a large number of academic and popular articles on the subject of institutional wealth have appeared. Both the increasing inequality of wealth and resources between public and private institutions, and the rapidly escalating amounts of wealth found at top private schools, has been addressed. However, with this discussion about changes in institutional wealth, very little attention has been directed to how colleges and university's decide whether to hold their wealth in the form of financial or physical assets. Although Tuckman and Chang (1990) and Massy (1996) sought to theoretically explain how myriad, sometimes disparate university goals affect resource allocation decisions and how trustee's attempt to maximize intuitional utility in making capital allocation, decisions, respectively, no empirical study on the actual allocation of wealth between physical and financial assets has been conducted. And, while Ehrenberg (2000, Chapter 11) provided data on the distribution of assets between financial and capital assets at a number of wealthy institutions and discussed institutional characteristics that would affected differences in allocation decisions across institutions, he did not formally test any of his hypotheses.

This paper presents a formal analysis of how private institutions of higher education allocate their wealth between physical and financial assets. In the next section, definitions of the measurement of wealth and its allocation within higher education institutions are introduced. Section III presents historical and cross-sectional data on the variations in institutional wealth and its allocation across financial and physical assets. In Section IV a multivariate statistical analysis of institutional capital allocation decisions is presented using longitudinal institutional level data on private colleges and universities. A short conclusion follows.

## II. The Measurement of Wealth and Allocation Decisions

For the purposes of this paper, the wealth of an institution  $I$  is defined as its financial assets (endowment) plus the current replacement value of its physical assets (buildings and equipment) in year  $t$ .

$$(1) \text{ TotalWealth}_{it} = \text{Endowment}_{it} + \text{CurrentReplacementValue}_{it}$$

Standardizing for discrepancies in institutional size, the total wealth of a school in year  $t$  is divided by the full time number of students enrolled at the institution in year  $t$ , to obtain a wealth per student ratio ( $WPS$ ).

$$(2) \text{ WPS}_{it} = \frac{\text{TotalWealth}_{it}}{\text{TotalEnrollment}_{it}}$$

Of key interest is how such wealth is allocated within an institution, across both financial and physical assets. This paper will focus on the ratio of an institution's endowment to the replacement value of its physical plant - its capital allocation ratio ( $CAR$ ).

$$(3) \text{ CAR}_{it} = \frac{\text{Endowment}_{it}}{\text{CurrentReplacementValue}_{it}}$$

The higher an institution's *CAR*, the greater its share of its capital resources that are devoted to producing current and future income to support its operations. Likewise, the lower an institution's *CAR*, the greater the share of the wealth used to provide the physical infrastructure for an institution's educational and research aims, and other activities.

### **III. Contemporary Trends in Institutional Wealth**

Over the reported 21-year period, colleges and universities in this study, on average, have experienced both an increase in total wealth and an increase in the share of capital devoted to financial resources. However, for every year, substantial variations occur in both of these variables across institutions.

Figure 1 displays the 25<sup>th</sup>, 50<sup>th</sup>, 75<sup>th</sup>, 90<sup>th</sup>, and 95<sup>th</sup> percentile levels of institutional wealth per student, in real terms. What is so striking about these figures is the magnitude of the growing disparity between the “haves” and the “have-nots” among academic institutions. While in real terms the wealth per student of the wealthiest 5% of institutions in this study increased *by a minimum* of \$55,000 dollars per student (a 77.5% minimum increase), wealth per student at the poorest 25% of academic institutions only increased *by a maximum* of \$3,000 per student (a 33% maximum increase).<sup>1</sup>

Upon closer look at the range in institutional wealth, it is clear that only the truly well off academic institutions have experienced such a substantial rise in their wealth per student. In fact, the median institutions in this study only experienced a \$4,000 per student (26.7%) increase. At the 75<sup>th</sup> percentile, a \$12,000 per student increase (41.4%) occurred, while at the 90<sup>th</sup> percentile,

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<sup>1</sup> It should be noted that the top 5% or bottom 25% of schools are not necessarily the same institutions in 1975 and 1996, rather, simply the schools that constitute such a classification in that particular year.

institutional per student wealth increased by 74% or \$37,000. Indeed, the rich institutions of higher learning have gotten a lot richer than the poor institutions.

In terms of resource allocation at these institutions ( $CAR$ ), an increasing range over time in the ratio of financial to physical assets is again observed. While the median academic institution saw a rise in its  $CAR$  by 0.5, the top 5% institutional category experienced a *minimum* increase of 1.05 in the  $CAR$  over the same time period.

#### IV. The Determinants of Resource Allocation at Academic Institutions

A utility maximizing higher education institution will allocate its resources to allow for the greatest possible use of their resources as constrained by the multitude of institutional interests. Consequently, a log-linear least squares regression model is employed to explain the determinants of an institution's allocation decisions. The natural log of an institution's capital allocation ratio for any given year,  $CAR_{it}$ , is specified to be linearly related to a constant,  $\alpha$ , a vector of variables,  $(X_I)$  that represent institutional characteristics that do not vary over time, a vector of variables that represent institutional characteristics that do *change* over time,  $(Y_{It})$  and an error term,  $\varepsilon_{It}$ .<sup>2</sup>

$$(iv) \ln(CAR_{it}) = \alpha + \beta X_I + \delta Y_{It} + \varepsilon_{It}$$

This model is estimated separately for three samples, one including only PhD granting universities, another including only non-PhD institutions, and a third, pooled sample, comprised of all of the institutions in the samples.

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<sup>2</sup> Dichotomous variables are also included in the model to control for the non-reporting of some of the explanatory variables.

Data from a wide array of sources is used in the estimation of the determinants of an institution's *CAR*. Institutions in this study are institutions where all necessary data for any given year in the study are available. Therefore, it is important to remember that not all institutions are reported in every year.

In each of these regressions,  $X_I$ , the vector of variables that do not change with time, is specified to include a dichotomous variable for whether an institution owns a medical school or hospital (*HOSP*). In this study, only PhD granting universities own and operate hospitals or medical schools. Hence, in the pooled sample regression, the *HOSP* variable will be zero for all non-PhD observations and its coefficient will capture the impact of hospital or medical school possession on capital allocation decisions at PhD granting universities. Another dichotomous variable present in the  $X_I$  vector is one representing the geographic location of an institution (*URBAN*), whereby an institution is "urban" if it is not considered to be located in a suburban or rural area.<sup>3</sup> The  $X_I$  vector also includes a measure of physical size of an institution (*LAND*), or the logarithm of the institution's land area, in acres.<sup>4</sup>

Meanwhile, the vector  $Y_{It}$ , which encompasses those explanatory variables that vary for an institution over time, is specified to include the natural log of wealth per full-time student in thousands of dollars in the year  $t$  (*WPS*)<sup>5</sup>, the logarithm of the total number of full-time students, or full-time equivalent students at the institution in a year (*ENROLL*), the proportion of enrolled

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<sup>3</sup> Data on both *HOSP* and *URBAN* collected from the 1995-1996 IPEDS Institutional Characteristics Survey.

<sup>4</sup> Source: <http://www.review.com> While it is possible that some institution's campus sizes have changed over time, historical data of this sort was not available and only current data was used as a result.

<sup>5</sup> As discussed earlier, this data comes from: National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS). "Financial Statistics."

students that were graduate students in the year (*GRAD*)<sup>6</sup>, the proportion of students living in on-campus student housing in 1995 (*ONCAMPUS*)<sup>7</sup>, and the logarithm of the total amount of federal research funding per student at institution *I* in year *t*, in thousands of dollars (*FRFPS*).<sup>8</sup> Also included in these models are two variables representing the yearly economic climate faced by an institution - the logarithm of construction wages in an institution's geographic area (*WAGE*)<sup>9</sup> and the natural logarithm of the ratio of the year-end value of the Standard & Poor's 500 stock index to NAREIT's Performance Index of Mortgage REITs (*INDICES*).<sup>10</sup>

In addition to presenting ordinary least squares estimates, instrumental variable estimates are offered to account for the fact that wealth per student is comprised of the elements of the *CAR*. The instrument is based upon all of the other exogenous variables in the model as well as a variable composed of Baron's selectivity rankings of schools in 1988 (*RANK*).<sup>11</sup>

Table 1 displays the empirical findings of this paper, which are very similar across the three samples (pooled, PhD, non-PhD) and both the ordinary least squares and instrumental

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<sup>6</sup> Both total enrollment and the percent of students who are graduate students comes from: National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS). "Opening Fall Enrollment."

<sup>7</sup> Calculated from the number of beds found on campus, as reported IPEDS Institutional Characteristics Data Set, 1995 and the total enrollment at the school in 1995. Historical data of this sort was unable to be obtained for the time period used.

<sup>8</sup> National Science Foundation Survey Databases, Federally Financed R&D Expenditures

<sup>9</sup> Construction wage data was calculated as moving averages from the 1972, 1977, 1982, 1987, 1992, and 1997 *Census of Construction* volumes. If wages for a particular Metropolitan Statistical Area was reported, that value was used for its respective institution(s), if not then aggregate state data was used.

<sup>10</sup> Data obtained from: <http://finance.yahoo.com/>

<sup>11</sup> Rankings obtained from "Barron's Profile of All Schools." 1988.

variable analysis.<sup>12</sup> Both wealth per student and total enrollment positively affect an institution's *CAR*. As wealth per student increases, the amount of capital allocated to financial resources in the form of an endowment increases. This makes intuitive sense, especially for the wealthiest of institutions; some institutional threshold in physical capital exists so that after building all its desired physical outlay, any further capital acquired may be devoted to financial assets. These findings echo what was presented in Part III of this paper; that the richest academic institutions are increasingly gaining more and more wealth relative to their lesser counterparts.

Similarly, as the number of enrolled students at an institution rises, all other things held constant, an institution's *CAR* will rise too. This suggests the existence of economies to scale with respect to capital facilities.<sup>13</sup>

Federal research funding in thousands of dollars per student (*FFPS*), is found to cause a statistically significant increase in an institution's *CAR* in all but the non-PhD sample (a sample which features institutions which are not primarily engaged in research). In effect, increased federal research funding acts as an indirect cost recovery and subsidizes research expenses in the form of lab space, lab costs, and materials, and allows institutions of higher learning to allocate relatively more of their resources towards financial reserves.

The percentage of total full-time students that are graduate students, *GRAD*, also is a statistically significant determinant of an institution's capital allocation decisions. For both the

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<sup>12</sup> A fixed effects model was also employed in an attempt to isolate intra-institutional determinants of resource allocation. However, the results of such a model were highly ambiguous, most likely due to the small amount of institutions consistently found in the sample on a yearly basis.

<sup>13</sup> This economy of scale is documented when the wealth per student variable is replaced with a variable simply representing total wealth. Indeed, enrollment levels now have a statistically significant, negative effect on the *CAR*.

pooled and the PhD sample regression, other variables held constant, as the percentage of full-time students on campus that are graduate students increases, the percentage of assets that an institution dedicated to its physical plant outlay increases, presumably for additional lab space and offices. However, *GRAD* was found to be a positive significant predictor of *CAR* in the non-PhD samples, meaning that for these institutions, an increase in the percentage of graduate students results in an expected increase in the amount of financial resources relative to physical assets.

Furthermore, an increase in the percentage of total enrolled students that live on campus, as measured by *ONCAMPUS*, is seen to have a negative effect on the *CAR* across all modes – the increased cost of housing motivating colleges and universities to devote relatively more of their capital into physical assets. However, it should be noted that on-campus residences and dormitories have the potential to act as income producing property for higher education institutions, and the construction of such facilities doesn't necessarily compromise an institution's ability to produce a steady source of income off of its endowment. Campus size, or an institution's acreage, was not found to be a significant predictor of a school's capital allocation ratio, nor was the geographic setting it was located in, as measured by *URBAN*.

It is not surprising to find that whether or not an institution owns a hospital or medical school was also found to be a significant predictor in this regression analysis. For all four models that contained institutions with hospitals (the non-PhD samples contained no institutions with hospitals), *HOSP* was found to be a statistically significant negative predictor of an institution's *CAR*. In other words, the substantial physical costs of a medical school or hospital cause institutions to devote relatively less capital to their financial assets.

Finally, the economic climate that an institution faces has also been found to have statistically significant effects upon the way that an institution of higher education will allocate its resources between financial and physical capital. The higher construction wages an institution faces, the relatively less resources it allocates to its financial assets. Therefore, it does not appear that universities and colleges consciously choose to invest relatively more of their wealth into financial resources, and build a less extensive physical plant, due to higher construction labor costs. On the other hand, increases in the returns to financial investment relative to real estate investment in any given year, as represented by the ratio of the Standard & Poor's 500 stock index to the NAREIT's Performance Index of Mortgage REITs, increase the amount of institutional wealth that an academic institution has invested in financial resources relative to physical capital. While this finding may simply reflect an increase in the *CAR* ratio due to an increase in the endowment, institutions may also realize that during periods of increased stock market growth relative to the real estate market the opportunity costs of not-investing assets into financial resources are greater, and subsequently, consciously choose to allocate more resources into fiscal, rather than physical, forms of capital.

## **V. Conclusion**

Thus, through the multivariate analysis presented in this paper, a clear understanding of the empirical determinants to an institution of higher learning's resource allocation decisions has been uncovered. Indeed, different institutions choose different mixes of capital and financial assets due to a vast spectrum of institutional and economic characteristics. The prudently operated university or college will allocate its wealth among physical and financial resources to maximize its institutional prerogatives and operating principles, subject to environmental

constraints. Taken together, the regression models presented in this paper provide a stable basis for understanding the rationale operating behind resource allocation decisions at institutions of higher education.

Uncovering the determinants to resource allocation within institutions of higher education is especially important in light of the growing disparity in institutional wealth, documented in the third section of the paper. As resource inequality increasingly becomes prevalent among private institutions of higher learning, more and more institutions are finding that, quite simply, they do not have enough resources to go around, and are faced with making such drastic decisions as starkly cutting back operations or closing up shop all together – a phenomenon which is increasingly prevalent in America’s historically black colleges and universities.<sup>14</sup>

For this reason, further research in this paper’s vein is suggested to explore more of the issues surrounding wealth allocation at institutions of higher education. For one, how do institutional debt levels affect the functioning of a university or college and its related resource allocation decisions? Secondly, could a more developed and dynamic approach to resource allocation decisions be conceived utilizing Bradburd’s and Mann’s (1993) conceptual framework by incorporating more periodic influxes and measurements of wealth, like tuition and alumni giving?

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<sup>14</sup> Samuels, Allison. “No More Teachers, No More Books.” *Newsweek*. 29 September 2003.

## References

- Bradburd, Ralph M. and Duncan P. Mann, 1993, Wealth in higher education institutions, *Journal of Higher Education* 64, 472-493.
- Ehrenberg, Ronald G. 2000 *Tuition rising: Why college costs so much.* (Harvard University Press, Cambridge).
- Ehrenberg, Ronald G. and Julia Epifantseva, 2001, Has the growth of science crowded out other things at universities?, *Change* 33, 46-52.
- Ehrenberg, Ronald G., Michael J. Rizzo and George H. Jakubson. 2002 Who bears the growing cost of science at universities?" *CHERI WP 35.* <http://www.ilr.cornell.edu/cheri>
- Massy, William F., 1996, Optimizing capital decisions, in: Massy, William F. ed. *Resource allocation in higher education,* (University of Michigan Press, Ann Arbor).
- Tuckman, Howard P. and Cyril F. Chang. 1990, Participant goals, institutional goals, and university resource allocation decisions, in: Hoenack, Stephen A. and Eileen L. Collins eds., *The economics of American universities: Management, operations, and fiscal environment,* (State University of New York Press, Albany)

Figure 1

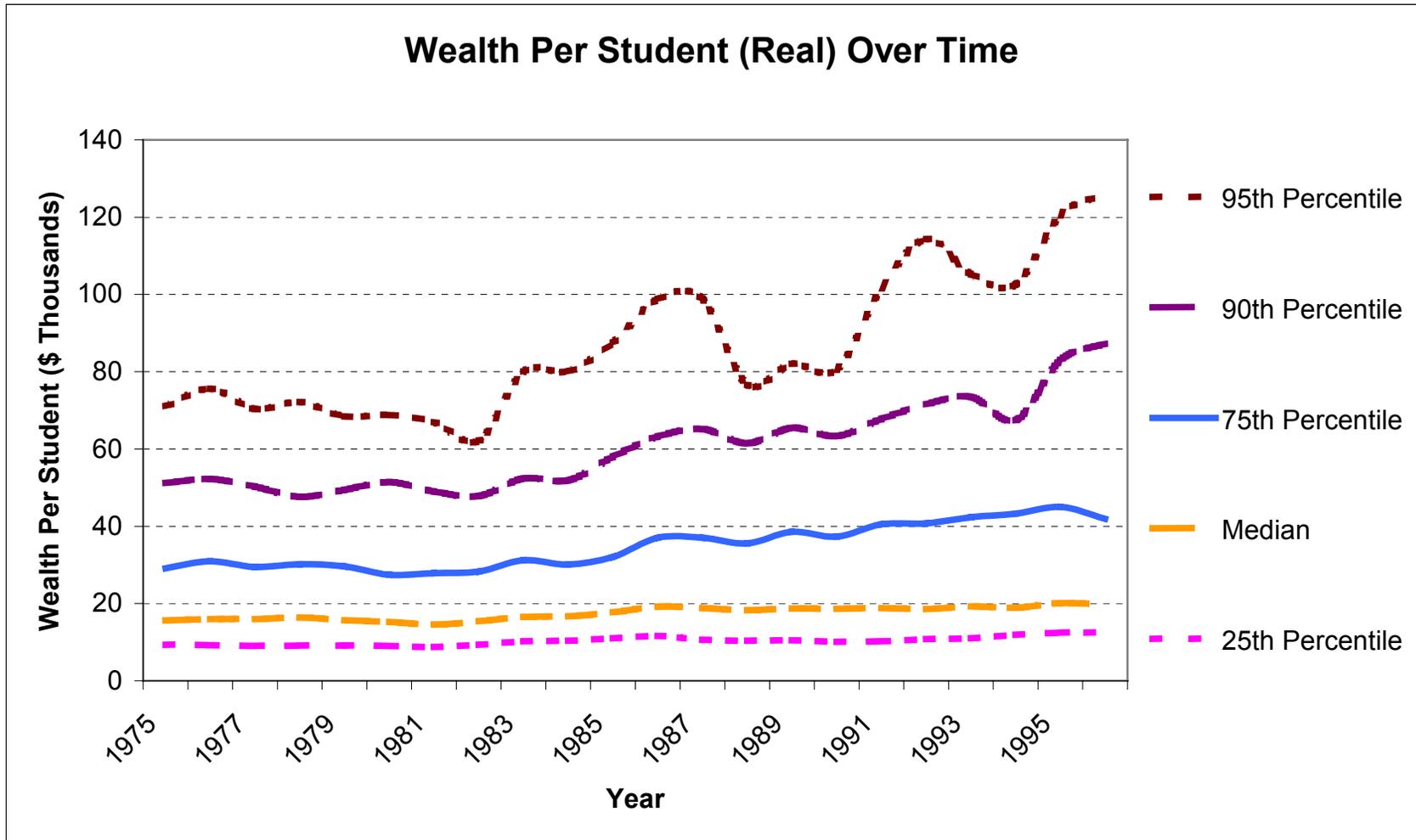
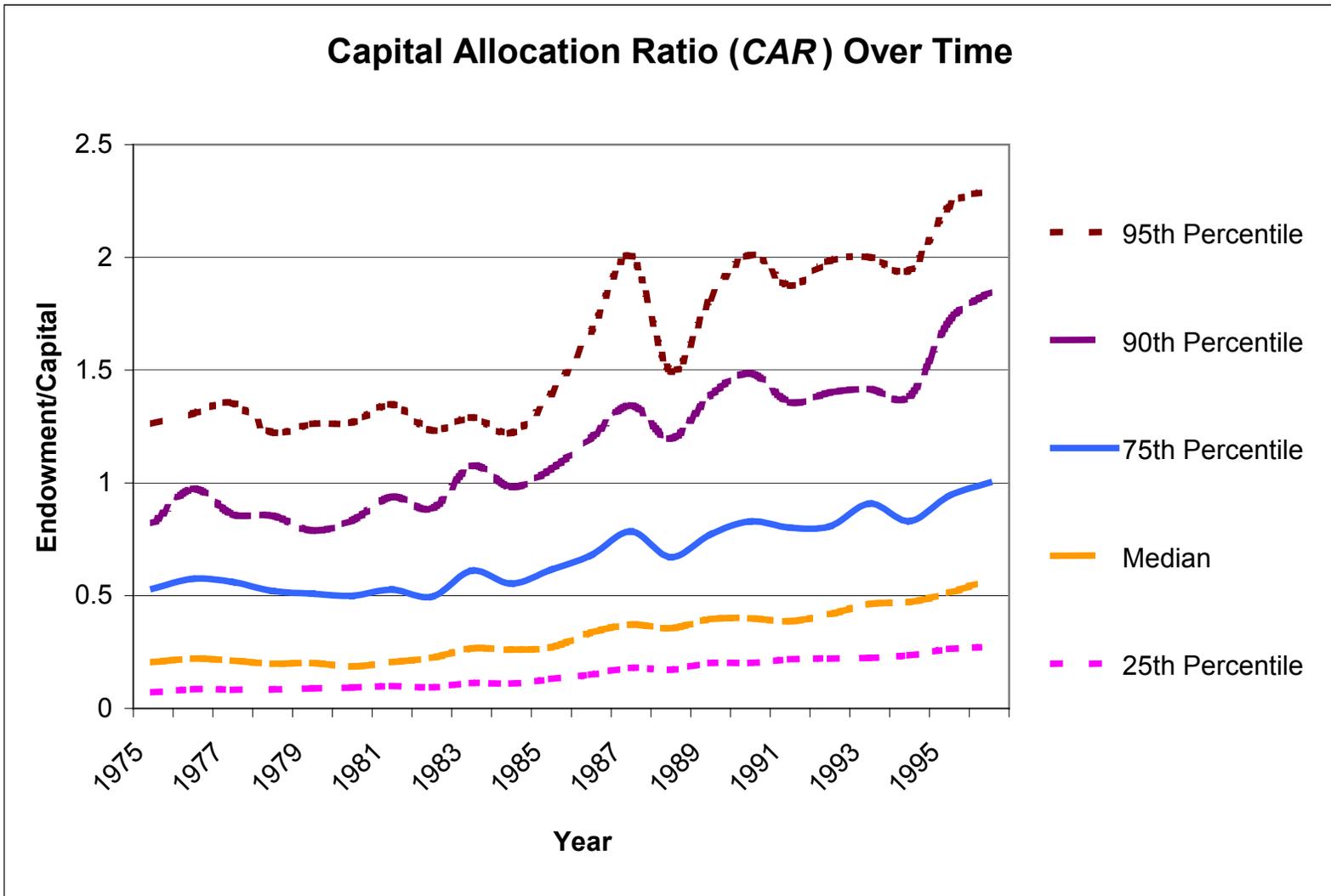


Figure 2



**Table 1**  
**Weighted Regression Equations (absolute value t statistics)\***  
Determinants of the Endowment To Capital Ratio (*CAR*) Across Institutions

	OLS			IV		
	ALL	PHD	NON-PHD	ALL	PHD	NON-PHD
<i>WPS</i>	<b>0.7631</b> ( 31.3 )	<b>0.6461</b> ( 18.3 )	<b>1.0291</b> ( 26.4 )	<b>0.7794</b> ( 14.2 )	<b>0.6995</b> ( 7.6 )	<b>1.2969</b> ( 15.3 )
<i>FRFPS</i>	<b>0.0457</b> ( 4.3 )	<b>0.1382</b> ( 8.0 )	-0.0115 ( -0.8 )	<b>0.0423</b> ( 2.6 )	<b>0.1207</b> ( 3.7 )	-0.0238 ( -1.5 )
<i>ENROLL</i>	<b>0.2275</b> ( 8.2 )	<b>0.2778</b> ( 7.0 )	<b>0.1347</b> ( 2.8 )	<b>0.2263</b> ( 6.8 )	<b>0.2935</b> ( 6.2 )	<b>0.2126</b> ( 3.7 )
<i>GRAD</i>	<b>-0.6788</b> ( -5.2 )	<b>-0.9647</b> ( -5.4 )	<b>0.9632</b> ( 4.5 )	<b>-0.6765</b> ( -5.0 )	<b>-1.0095</b> ( -5.2 )	<b>1.2748</b> ( 5.8 )
<i>HOSP</i>	<b>-0.4717</b> ( -12.0 )	<b>-0.4808</b> ( -10.1 )	.	<b>-0.4791</b> ( -11.6 )	<b>-0.4907</b> ( -9.8 )	.
<i>ONCAMPUS</i>	<b>-0.4739</b> ( -4.0 )	<b>-0.8569</b> ( -4.7 )	<b>-0.7753</b> ( -4.8 )	<b>-0.4773</b> ( -3.3 )	<b>-0.9371</b> ( -4.2 )	<b>-1.0937</b> ( -5.6 )
<i>LAND</i>	-0.0128 ( -1.0 )	0.0033 ( 0.2 )	0.0374 ( 1.8 )	-0.0155 ( -1.1 )	-0.0027 ( -0.1 )	0.0122 ( 0.5 )
<i>INDICES</i>	<b>0.3137</b> ( 7.9 )	<b>0.2448</b> ( 4.4 )	<b>0.4370</b> ( 7.9 )	<b>0.3071</b> ( 7.6 )	<b>0.2337</b> ( 4.0 )	<b>0.3774</b> ( 6.6 )
<i>WAGE</i>	<b>-0.7703</b> ( -7.7 )	<b>-0.8464</b> ( -5.1 )	<b>-0.8731</b> ( -8.0 )	<b>-0.7798</b> ( -7.5 )	<b>-0.8927</b> ( -4.9 )	<b>-0.9858</b> ( -8.6 )
<i>URBAN</i>	-0.0012 ( 0.0 )	0.0345 ( 0.7 )	-0.0659 ( -1.3 )	0.0049 ( 0.1 )	0.0255 ( 0.5 )	-0.0414 ( -0.8 )
<i>CONS</i>	<b>-2.9727</b> ( -8.0 )	<b>-2.7621</b> ( -5.0 )	<b>-3.1487</b> ( -5.8 )	<b>-2.9754</b> ( -7.3 )	<b>-2.8914</b> ( -4.9 )	<b>-4.0549</b> ( -6.5 )
<i>adj. R2</i>	0.5094	0.5668	0.465	0.5114	0.5661	0.4584
<i>n</i>	2792	1303	1489	2773	1303	1470

\*Coefficients for non-dummy explanatory variables represent the percentage change expected in the dependent variable with a one-unit percentage change in the explanatory variable. Coefficients that are statistically significant at the 99% confidence interval are in bold. Also included in the equations is a dichotomous variable for the reporting of land area size and percent of students on campus to control for institutions with missing information. The instrument for *ENROLL* is *RANK*, or the Barron's selectivity ranking for an institution *I* in 1988. Regressions weighted by the square root of total enrollment at an institution in year *t*.

*WPS* natural log of wealth per student of institution (endowment plus physical capital over total enrollment), in thousands of dollars, for year *t*

*FRFPS* natural log of total federal research funding per student at institution in year *t*, in thousands of dollars

*ENROLL* natural log of total student enrollment of institution in year *t*

*GRAD* ratio of graduate students to total enrolled students at institution in year *t*

*HOSP* dummy variable reporting an hospital at an institution; 1 = institution has a hospital, 0 = no hospital

*ONCAMPUS* percent of students living on campus, 1995

*LAND* natural log of the size of the institutions campus (acres)

*INDICES* natural log of the ratio of the Standard & Poor's 500 and the NAREIT's Performance Index of Mortgage REITs

*WAGE* natural log of the construction wages faced by the institution in year *t*

*URBAN* dummy variable reporting an institution's setting as 'urban'; 1 = urban, 0 = other

*CONS* regression equation intercept