Money for Nothing? The Institutional Impact of Changes in Federal Financial Aid Policy

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Abstract: Using new institution-level data we assess the impact of changing federal aid levels on institution-level Pell revenues and examine whether changes in the Federal Pell Grant program correlate with the college access of needy students differently at institutions of different levels of selectivity. While not surprising that institutional Pell revenues are sensitive to the generosity of the Pell Grant program in general, we document significant and interesting asymmetries across institutional selectivity, both in terms of magnitude and in terms of which channel accounts for the measured sensitivity – Pell-award values or Pell enrollment.

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The Higher Education Act of 1965 authorized the creation of the Pell Grant that first provided financial aid in 1973. From its inception, Pell has been the largest need-based financial aid program in the United States, allocating over $12 billion in assistance to roughly one-quarter of all US undergraduates in 2003. In this paper, we assess the impact of changes in the generosity of the federal Pell program on institution-level Pell revenues. In particular, we utilize exogenous variation in federally-determined maximum Pell Grant and federal appropriation levels, as well as annual variation in the total number students who are deemed to be Pell eligible, to empirically examine how generosity correlates with institutional Pell revenues.

Previous research on the Pell program has largely focused on efficacy with regard to raising the enrollment of low-income students in college. In short, while other forms of aid have been found to have significant enrollment effects (e.g., Bound and Turner, 2002; Dynarski, 2003) there is little evidence that the Pell Grant significantly affects the college-going behavior of needy students. For example, Hansen (1983) reports no significant increase in the propensity for Pell-eligible individuals in the CPS and NLSY to attend college after the introduction of the Pell program. Kane (1995) replicates the analysis with a sample of female students, which again reveals no effect of Pell Grants on enrollment. Likewise, Kane (1994) uses CPS data for 18-19-year-old black males, which further documents that the Pell Grant program has no significant effect on the college attendance of African-American youth. Other such examples include Heller (1997) and McPherson and Schapiro (1998).

On the other hand, the Pell program has been found to impact more-narrowly-defined institutions or groups of low-income students. For example, Kane (1995) finds that the Pell program increases enrollment at public two-year colleges, which implies that enrollment effects

may vary with the selectivity of the institution. Seftor and Turner (2002) uses variation in the Pell eligibility formula in the late 1980s that increased the generosity of the program for financially independent students to show that the Pell program improved college access for non-traditional students. Thus, changes in the generosity Pell program, while not necessarily affecting overall college enrollment of low-income youth, may still affect who among the needy apply for federal aid and where these needy student enroll.

Exploiting variation in the generosity of the Pell program, we find significant increases in institutional Pell revenues with increased generosity. Adopting admissions selectivity as a metric by which to separate institutions into approximate quality-groups, our analysis demonstrates that changes in the generosity of the Pell program yield asymmetric responses across admissions selectivity. Consistent with prior literature documenting asymmetries in enrollment-responses to Pell and, more generally, consistent with Pell awards being made to individuals rather than institutions, our analysis suggests that revenue specifications alone do not reveal the true nature of the underlying allocation of revenue across institutions. In the end, we document that asymmetries in overall sensitivity to Pell generosity arise through the sensitivity of both enrollments and award values, each of which correlate asymmetrically with admissions selectivity.

After describing some of the mechanics of the federal Pell Grant program, the following section of the paper assesses the impacts of changing federal aid levels on institution-level Pell revenues over the 1989 through 2003 period. In Section 2, we then continue with the proposed dissection of institutional revenue into separate analyses of Pell-student enrollment and average award values reported to institutions. Throughout our analysis, strong asymmetries across institutional selectivity are made evident in the data.

In Section 3, we separately test the efficacy of the 1992 Higher Education Amendment (HEA) using a sub-sample of relatively low-cost institutions. In so doing, we identify how granting practices affect institutional choice by following the enrollment decisions of low-income youth around the 1992 HEA that removed tuition-based caps on maximum Pell awards. Measured against a group of slightly higher-cost but otherwise similar institutions, we report a significant increase in the enrollment of low-income students at low-cost institutions that experienced this exogenous increase in Pell generosity. In short, results are suggestive that student enrollment does respond to aid. We summarize the results in Section 4 and offer some additional discussion and concluding remarks regarding enrollment effects and average award values.

1. Total Institutional Pell Revenue and Variation in Pell Generosity

To receive federal aid, a student must first complete a Free Application for Federal Student Aid (FAFSA) form, which provides financial aid administrators with the information needed to determine the size of an applicant's Pell grant. The award value is formulaic, determined by the student's expected family contribution (EFC) and the institution-specific cost of attendance (COA) such as tuition, room, board and other expenses such as books and travel. For dependent students, the EFC is a function of parent income and wealth (although home equity was removed from the formula in 1993) and the number of siblings in college. Conditional on being above the federally-mandated minimum grant, the level of an individual student's grant in any given year is the minimum of: (1) the difference between the Federal maximum Pell Grant and the student's

EFC; (2) the difference between the institution's COA and the student's EFC; and (3) prior to 1993, 60 percent of the institution's COA.[1]

1.1 Data

Our empirical analysis exploits institution-level data for a panel of institutions over the 1989 through 2003 period, drawn from the Integrated Post-Secondary Data System (IPEDS) which provides institution-specific information, including information on the costs of attendance.[2] Where related research has relied on indirect measures for the number of low-income students, such as minority enrollments or other student-background measures that are correlated with income (e.g., Kane, 1994; Dynarski, 2004), our analysis exploits unique institution-level Pell-related data to directly examine the effects of changes in the Pell Grant program on low-income students and the associated revenues they bring to institutions. Made available by the Department of Education, these data therefore supplement the IPEDS panel with information on the number of Pell recipients and revenues for each institution. State-specific labor market and economic measures were acquired from the Bureau of Labor Statistics.

To focus on a well-defined set of colleges with a common academic mission, we restrict the sample to non-profit institutions that offer at least an associates degree, excluding for-profit and trade schools. Given the potential contribution of COA to the grant determination, we further restrict the sample in an attempt to alleviate concern for endogenous tuition responses to changes

[1] The percentage-cap on Pell grants was 50 percent from 1973 through 1984 and 60 percent from 1985 through 1992. Following the 1992 Higher Education Amendments, the percentage cap was abolished. This exogenous variation is the natural experiment that forms the basis for the analysis in Section 4.

[2] Actual room and board measures are incomplete in IPEDS for many schools. Thus, the COA at institution *i* is approximated by the in-state tuition plus a measure of the average statewide room and board for a particular institution type. As the average EFC is unobserved for each individual, calculations are based on students who have an EFC of zero. In 1994, approximately 59% of Pell recipients had and EFC of zero (1994-1995 Title IV / Federal Pell Program End-of-Year Report, Table 4).

in Pell generosity.[3] In particular, defining the institution-specific maximum Pell grant in year *t* as $MaxPell_{it}$, we report the results of our analysis only for the sample of institutions with COAs sufficiently high such that $MaxPell_{it} = MaxPell_t$ for all years in the sample period. As only Congress can change the maximum Pell grant each year, constructing a sample of institutions conditional on all COAs being sufficiently high so as to never be the binding constraint on the maximum Pell grant allows any remaining variation in $MaxPell_t$ to be exploited as exogenous. Table 1 provides the summary statistics for the 21,789 observations and 1,784 institutions that are never restricted by the COA rule.

1.2 Empirical specification

As suggested above, two attributes are arguably of most interest in terms of measuring institutional revenues against the generosity of the Pell Program, both of which depend on congressional authorization. First, the maximum Pell award available in a given year, $MaxPell_t$, captures generosity at the relatively disaggregate level of individual awards. Second, federal appropriations for Pell grants, $FedApprop_t$, captures the intended generosity of the Pell program in aggregate. While not the actual sum of award values in a given year, such a measure may be argued to better capture the expected or intended generosity in aggregate.[4] However, as we can control for variation in the typical-student-aged population, a third measure can also speak to the generosity of the Pell program – the number of eligible Pell recipients, $Eligibles_t$. For example, in conjunction with the eligible population, as a given increase in $MaxPell$ can provide additional assistance to those already receiving relatively large Pell awards and also induce new, smaller awards to those who would previously not have qualified (i.e., changing the number of

[3] Prior research on whether costs of attendance respond to aid being made more generous has provided only weak evidence (e.g., Long, 2004).

[4] Further, the sum of actual award values would be prone to simultaneity bias, where federal appropriations would not.

eligible students), including *Eligibles* allows one to measure the effect of *MaxPell* holding constant the number of eligible students. In fact, having the ability to measure the effect of *Eligibles* while holding *MaxPell* and the size of the potential student population constant may indirectly illustrate the effect of changes to the calculation of EFC.[5]

With all three measures being exogenous to individual institutions, we regress institution-specific Pell revenues on these attributes and a set of controls. Throughout the analysis, we adopt the Peterson's 1989 Guide to Four-Year Colleges ranking of institutions as our metric of institution selectivity, which allows us to separate two-year institutions from four-year institutions classified as non-competitive, minimally difficult, moderately difficult, very difficult and most difficult. Given the small cell size of the non-competitive and minimally difficult classes of institution, we combine these into a single category. Likewise, we combine very and most difficult four-year institutions into a single category. We therefore relax the constraint that the set of controls influences Pell revenues similarly across institution selectivity and estimate the following fixed-effect specification separately for each of these selectivity categories:

$$[1] \qquad \log(TR_{it}) = \alpha_i + \beta_1 \log(MaxPell_t) + \beta_2 \log(FedApprop_t) + \beta_3 \log(Eligibles_t) + \gamma' \mathrm{X}_{it} + \varepsilon_{it},$$

where TR_{it} is the total revenue received by institution *i* from all Pell grants associated with enrolling students in year *t*.

As total revenue is a simple product of Pell enrollment and individual award values, X_{it} is a vector of controls that are expected to correlate with enrollment and need. In particular, we follow prior work (e.g., Leslie and Brinkman, 1987; Heller, 1997) in assuming that enrollments and award values potential vary with prices, institution characteristics and local market

[5] Including a measure of the number of eligible Pell applicants in a given year may also alleviate any concern that one's propensity to complete a FAFSA depends on *MaxPell*, which would otherwise bias the estimated effect of maximum Pell awards without its inclusion.

conditions. Specifically, we include a measure of the direct cost of attendance (in-state tuition plus room and board), a size measure (the lag of total enrollment minus of Pell enrollment), and State-level measures of employment opportunities (unemployment rate), demographic conditions (per-capita disposable income, median home values and average weekly manufacturing earning) and demographics (the number of high-school graduates and the 18-19 year-old population). A quadratic trend is also included to allow for unobserved time-dependence. We also capture any time-invariant unobserved heterogeneity specific to institutions by including an institution-specific fixed effect.

1.3 Results

Overall, the empirical relationships with regard to the non-aid-related controls mostly confirm prior expectations. For example, total Pell revenue at an institution generally decline as income increases in the state suggesting that there are fewer Pell-eligible students, whereas total Pell revenue increases with the number of high-school graduates in the state indicating a larger pool of potential Pell recipients. The sign of the coefficient on the mean weekly manufacturing wage is significantly negative at two-year institutions and significantly positive at two of the three types of four-year institutions, suggesting that the manufacturing wage may better represent a direct measure of the opportunity cost of attending two-year schools. For brevity, the remainder of the discussion focuses on the measures of Pell generosity that are of primary interest.

The results presented in Table 2 generally demonstrate that institutional Pell revenues are increasing in generosity. Generally, there are three strong regularities revealed through the analysis. First, for all levels of selectivity, institutional Pell revenues behave quite differently around changes in federal appropriations and to changes in the maximum Pell award available to

students. In particular, while institutional Pell revenues are relatively less responsive to federal appropriations, changes in the maximum available Pell award are associated with elasticity measures in excess of one in all cases. For example, the pooled-sample estimates (in Column 5) suggest that a 10 percent increase in the maximum Pell award is associated with a 16 percent increase in revenues received at the average institution in the sample.[6] Estimates from the pooled-sample also suggest that Pell revenues respond strongly to the number of eligibles with an estimated elasticity of 0.7. On the other hand, pooled-sample point estimates suggest that federal appropriations explain little if any variation in institutional Pell revenues.

The second regularity evident in the results is the systematic nature by which the effect of generosity differs across institution selectivity, both in terms of *MaxPell* and *FedApprop*, although the patterns are in some sense mirror images of each other. As selectivity increases among four-year institutions, point estimates suggest a monotonic decrease in the elasticity of institutional Pell revenues with respect to changes in *MaxPell*. However, the estimated sensitivity of revenues to *MaxPell* is lowest at two-year institutions, where the elasticity is not statistically different from one. Interestingly, the largest relative difference revealed in the elasticity point-estimates is the difference between two-year and non-competitive or minimally-difficult four-year institutions. Holding constant the size of the applicant pool and federal appropriations for the program, this may suggest that the maximum grant available has the strongest effect on the margin of enabling some two-year enrollees to access the less-selective four-year institutions. Also among four-year institutions, as selectivity increases, point estimates

[6] Of course, one might expect that such elasticities be greater than one as not all students at an institution receive the maximum available Pell award. Where the maximum grant is not received by all students, a given dollar-increase in *MaxPell* necessarily amounts to a smaller proportional increase in the average Pell award than in *MaxPell* itself. Note that if we do not discard institutions for which *MaxPell* is endogenous to the institution's own costs of attendance, the results are predictably that variation in *MaxPell* is less associated with variation in the institution's total revenue collected through Pell awards. In particular, as many of the low-cost institutions are two-year or less-selective four-year institutions, this effect is more pronounced in such specifications.

suggest a monotonic increase in the elasticity of institutional Pell revenues with respect to changes in *FedApprop* . However, two-year institutions are, in fact, the most sensitive to *FedApprop* . Again, the largest relative difference revealed in the elasticity point-estimates is the difference existing between two-year and non-competitive or minimally-difficult four-year institutions.

The third empirical regularity demonstrated in the results of Table 2 is that, holding constant the maximum Pell award and controlling for the characteristics of the student body through the population of 18-19 year-olds, high-school graduating class and family income, increases in Pell generosity measured through changes in the number of Pell students in a given year also appear to have significant explanatory power in predicting institutional Pell revenues. Further, the effect of *Eligibles* is monotonically decreasing in selectivity, with the highest point-estimate at two-years (i.e., an elasticity of 1.4). To the extent other controls leave changes in how expected family income is determined as the primary factor systematically contributing to the variation in the number of eligibles, this is consistent with any such changes in generosity being sufficiently small as to be overcome by other costs associated with a student accessing more-selective institutions.

2. Pell-Student Enrollment and Average Award Value

In general, any systematic relationship between institution Pell revenues and the generosity of the Pell program is due to the sensitivity of enrollment of Pell students, individual award values or some combination of both. In the following analysis, we examine the proportional breakdown of the total-revenue estimates of Table 2 into these two contributing factors. In considering the underlying factors, one will recognize that the sensitivity of enrollment to changing generosity is itself non-trivial. In fact, as the generosity of the Federal Pell Program

changes, there are clearly four margins around which the number of Pell students enrolling in post-secondary institutions may change, as well as their distribution across institutions. First, conditional on the granting of support, increases in overall generosity will tend to decrease the expected cost of college and may increase overall needy-student enrollment rates. Second, as the expected value of grants increases it may become in the best interest of a student previously on the margin of filing a FAFSA to now do so, increasing the number of applicants and potentially the number of students meeting Pell's minimum-eligibility requirement.[7]

Third, certain marginally needy students who filed a FAFSA and who would have been denied Pell prior to an increase in generosity may now receive a small Pell award. Last, given significant cross-sectional variation in costs of attendance, increases in generosity will change institutions' prices relative to each other. If prices rise with selectivity, a general increase in the funds available to needy students can also change the distribution of needy students across selectivity, as additional generosity lowers the relative cost of more-selective institutions. As such, generosity may enable Pell students to switch from two-year to four-year schools with no additional out-of-pocket costs. Likewise, some Pell students may switch to more-expensive, more-selective four-year schools.

The discussion of enrollment margins also implies that the sensitivity of Pell award values to generosity is not separate from similar considerations. For example, it need not be the case that an increase in the maximum Pell award increases the average award value, for such an increase in generosity implies an enrollment response that could offset the direct effect of increasing the maximum award. For example, an increase in *MaxPell* would trigger the contemporaneous granting of new small Pell awards to those previously on the margin of qualifying for Pell.

[7] Of course, year-to-year changes in congressional funding are hard to anticipate and occur after the student applies for college. As such, this effect is not likely to be significant.

2.1 Empirical specification

Without obvious reason for specifying correlates differently across the specification of average award values and enrollments, we propose the following specifications:

[2] $\log(AR_{it}) = \alpha_i + \beta_{AR} Z_{it} + \varepsilon_{it}$,

and,

[3] $\log(PellEnroll_{it}) = \alpha_i + \beta_{NP} Z_{it} + \varepsilon_{it}$,

where AR_{it} is the average revenue received by institution *i* from all Pell grants associated with the $PellEnroll_{it}$ Pell students enrolling at the institution in year *t* and Z_{it} captures all correlates included in [1]. Re-writing [1] as $\log(TR_{it}) = \alpha_i + \beta_{TR} Z_{it} + \varepsilon_{it}$, it can easily be shown that if $\hat{\beta}_{TR}$ is an unbiased estimate of β_{TR}, then $\hat{\beta}_{AR} + \hat{\beta}_{PellEnroll}$ is also unbiased in predicting β_{TR}. This property is easily seen in the reporting of estimation results in tables 3 and 4.

When considering the estimation of the [2] and [3] separately, recall that we have discarded all institutions with costs of attendance sufficiently low as to have Pell eligibility or award value depend on institution-specific costs. Thus, at the underlying disaggregated level, the award values of the individual students, which then contribute to the observed institution-level average, are, in fact, exogenous to the particular institution in which the student enrolls. That is, the students represented by our sample of institutions would have received equivalent-valued awards at any and all institutions in the sample. Further, within our sample of institutions, if an individual student was eligible to enroll as a Pell student anywhere, he or she would be eligible everywhere.[8] Therefore, in terms of our interest in separating the correlation of generosity with total revenue into that associated with average Pell-award values and that associated with Pell

[8] Of course, in an unrestricted sample, some low-cost institutions could potentially influence the Pell award values and, therefore, the number of Pell students (i.e., if their COA attendance was below *MaxPell*, which would imply that the Pell award would be determined by COA – EFC). Even if we did not discard low-cost institutions from the analysis, less than one percent of all institutions had COA < *MaxPell* in 1992 (Li, 1999).

enrollments, questioning the potential for simultaneity on causal grounds is unfounded. We do note that there is some validity to the question of, for example, omitted variables correlating cross-sectionally with AR_{it} and $PellEnroll_{it}$.[9] With our extensive list of controls, considering the proportional breakdown of the revenue-sensitivities of Section 1 into that derived from award values and that derived from enrollments we believe to be instructive. In the following sections, we therefore document separately the sensitivity of institution-level Pell enrollments and average award values to the time-varying measured of generosity: *MaxPell*, *FedApprop* and *Eligibles*.

2.2 Results

Tables 3 and 4 report the results of estimating equations [2] and [3] on institution-level Pell enrollments and institution-level mean Pell award values. First, we note that proportionately, increases in *MaxPell* expand Pell enrollments most at the less-selective among four-year schools, which could arise for two reasons. For example, it could simply be that students are being made newly eligible for small Pell grants in greater proportion at the less-selective four-year schools than at other institutions. Of course, such regularity is also consistent with increases in the maximum providing marginally-greater access to four-year schools for low-income students who might otherwise attend two-year institutions.

Given the consideration of need in determining award values, these two potential margins can be informed by an analysis of average award values. In particular, consider three potential student-types at a more disaggregate level than is afforded by our data. First, for a student receiving a Pell award below the maximum, a one percent increase in *MaxPell* would necessarily increase the award value by more than one percent. Second, for a student already receiving the maximum Pell award, a one percent increase in *MaxPell* would increase the award value by

[9] Note that any bias in the estimation of *APR* and *NP* will be such as to maintain $\hat{\beta}_{AR}+\hat{\beta}_{PellEnroll}=\hat{\beta}_{TR}$.

exactly one percent. Third, an increase in *MaxPell* may allow previously ineligible students to qualify for small Pell awards, which would tend to yield a coefficient less than one on *MaxPell*.

At the institution-level of disaggregation permitted by the data, the point-estimates across all levels of selectivity are, in fact, less than one. However, the less-selective four-year institutions again stand out as different from two-year and more-selective four-year institutions, with point estimates on *MaxPell* not significantly different from one. Thus, while the results may be most-consistently interpreted as higher *MaxPell* allowing previously-ineligible students to qualify for small Pell awards, this seems most probable at two-year and the most-selective four-year institutions.

As would be expected from specifications that have captured the systematic patterns in overall Pell generosity, with respect to the value-based and student-based measures of Pell generosity, institution-level Pell enrollments are largely sensitive to only the number of eligibles (Table 3) and institution-level average award values are largely sensitive to only Federal appropriations (Table 4). Table 5 provides a summary of the proportional breakdown of the total-revenue estimates of Table 2 into the two underlying factors of number of Pell students and average Pell awards, which provides the estimated strength of each contributing factor. In considering the general empirical patters in this way, the sensitivity of institutional Pell revenue due to changes in *MaxPell* appears more-strongly associated with average Pell awards than with enrollments. While this is true across all selectivity levels, the two channels are much more similar in strength at four-year institutions than they are at two-year institutions. In this regard, one may also note that the most-selective institutions (Column 4) are more like two-year institutions than other less-selective four-year institutions. On the other hand, Federal

appropriations contribute largely through enrollment at four-year institutions while working largely through average award values at two-year institutions.

Clearly, not only are there significant asymmetries across schools of different selectivity in their sensitivity to Pell generosity, but scrutinizing the overall influence in this way reveals further empirical regularities that, in particular, set two-year institutions apart. In short, our analysis reveals that, in addition to changes in maximum award values and overall appropriations affecting institutions differently according to selectivity, these effects need not even materialize through the two channels in like fashion.

As might be expected, holding constant the population, maximum award value and Federal appropriations, increasing the generosity of the Pell program measured by increases in the number of eligible Pell students is almost entirely through enrollment effects. However, at the most-selective four-year institutions, increasing the eligible population increases total Pell revenues through increases in average Pell awards also suggests that more-needy students may access these selective schools in response to this dimension of increased generosity.

3. The 1992 Higher Education Amendments

In this section, we analyze the set of low-cost institutions that we had initially discarded from the rest of the sample (i.e., those with COA sufficiently low such that $MaxPell_{it} < MaxPell_t$). While the endogeneity of *MaxPell* at these institutions made this sample restriction appropriate in the above analysis, it need not be the case that we learn nothing from the analysis of these schools. In fact, it is this sample of institutions for which the 1993-removal of the cost-of-attendance cap exogenously raised Pell aid.

Figure 1 illustrates how the institution-specific Pell award, $MaxPell_{it}$, changes with the federally-determined maximum, $MaxPell_t$, before and after the 1992 HEA. In particular, Figure

1 demonstrates that, prior to 1993, maximum Pell grants at institutions with relatively low costs of attendance (i.e., specifically, less than COA_1) were constrained to be a maximum of 60 percent of the institution's cost of attendance. With the 1992 HEA, these low-cost institutions therefore experience a one-time increase in the maximum Pell from their institution-specific value determined by the binding percent-of-cost rule. At institutions with higher costs of attendance (i.e., above COA_1), the binding constraint on maximum Pell grants is merely the Federal maximum ($MaxPell_t$). The 1992 HEA would therefore not directly affect net costs of attending such institutions.

*** Insert Figure 1 approximately here. ***

The previous analysis uses exogenous increases in the maximum Pell grant to assess whether equal absolute changes in the level of need-based aid alter the distribution of low-income students across institutional selectivity. To reduce the possibility of an endogenous tuition response to changes in Federal Pell rules, low-cost institutions with maximum Pell awards constrained by the COA rule over the sample period are excluded from the analysis because the level of need-based aid received by these institutions depends on their tuition setting decisions. However, a 1992 Federal change in the COA rule provides a unique natural experiment to study whether exogenous variation in the level of Pell aid affects the choice of students among these low-cost institutions. In other words, whereas the previous analysis examines whether a given increase in the Pell award affects the distribution of students across a hierarchy of institutions, this section examines whether variation in the level of Pell award affects the enrollment choice of students across a similar set of low-cost institutions.

3.1 Empirical Model and Data

Following prior work in higher education (e.g., Dynarksi, 2004; Cornwell, Mustard and Sridhar, 2004), we employ a difference-in-difference strategy around the natural experiment brought about a federal change in aid policy. Specifically, the following institutional-level fixed effect model is estimated:

$$[5] \qquad \log(PellEnroll_{it}) = \alpha_i + \beta_1(HEA1992_t \times Treatment_i) + \beta_2 HEA1992_t + \gamma' X_{it} + \varepsilon_{it} \ ,$$

where $HEA1992_t = 1$ for years after the 1992 HEA (i.e. $t \geq 1993$) and $Treatment_i = 1$ for those institutions with maximum Pell awards that were restricted in 1992, the year prior to the rule change.

Equation [5] is estimated using the same institutional-level dataset as in earlier sections, where the sample is restricted to contain all institutions that at any time between 1989 and 1992 had maximum Pell awards that were restricted, not by the Federal Maximum, but by the cost-of-attendance rule (i.e., institutions with a cost of attendance less than COA_1 in Figure 1). Given the definition of the treatment group above, the control group is all institutions which were constrained by the cost-of-attendance rule at any time between 1989 and 1991, but were not constrained by the rule in 1992. Thus, the control group of institutions did not experience an increase in their maximum allowable Pell award due to the 1992 rule change. We adopt the same set of controls in X as in the previous empirical specifications. The descriptive statistics for the 357 treatment and 367 control institutions are provided in Table 6.

3.2 Empirical Results

Table 7 provides estimates of Eq. [5], which generally yield significant coefficient estimates that are qualitatively similar to the prior findings with regard to the control variables. Overall, the difference-in-difference results confirm the prior finding that Pell enrollments decline at low-cost institutions coincident with increasing generosity. However, all else equal, the removal of

the percent-of-cost rule in 1992 provides a one-time exogenous increase in the maximum Pell awards for institutions in the treatment group, which would be expected to raise the number of Pell recipients at the treated versus the control institutions (i.e., $\beta_2 > 0$). This expectation is confirmed in the results presented in Column (1) for the full sample of low-cost institutions. Specifically, institutions which were restricted by the percent-of-cost rule in 1992 enrolled 5.2 percent more Pell recipients after the removal of the rule than those in the control group.[10]

The ability of the difference-in-difference approach to identify the exogenous impact of a change in financial aid depends on whether the control and treatment groups represent comparable institutions. In this particular case, the higher average tuition level at four-year versus two-year institutions implies that the most institutions which were constrained by the percentage cost rule were two-year institutions. Nonetheless, although the removal of the percent-of-cost rule predominately affects two-year institutions, Table 7 shows that 12 percent of the control group and 40 percent of the treatment group are comprised of four-year institutions. Thus, four-year institutions appear to be over-represented in the control group, and the difference-in-difference effect may be identifying on differences between two- and four-year institutions in addition to the exogenous increase in the maximum Pell awards.

To examine the possible importance of the distinction between two- and four-year institutions on the empirical results, Column (2) restricts the sample to two-year institutions. The positive enrollment effect from an increase in the level of the maximum Pell award is robust for an exclusive sample of two-year institutions. Specifically, cost of attendance restricted, two-year

[10] A common concern with difference-in-difference analysis is that serial correlation in the error term may understate standard errors and increase the probability that the null hypothesis of no treatment effect is rejected. In our particular analysis, Bertrand, Duflo and Mullainathan (2001) would imply ignoring the time series component in the estimation by first calculating an average before and after the 1992 HEA and then estimating the earlier equations on this averaged outcome variable as a panel of length 2. Results are robust to this alternative specification with the null hypothesis of no treatment effect rejected at traditional levels.

institutions experience a 2.6 percent increase in Pell recipients relative to those institutions not constrained by the cost-of-attendance rule in 1992. Nonetheless, it is also the case that the magnitude of the difference-in-difference coefficient declines by restricting the sample to two-year institutions (i.e., from 5.2 percent), which may suggest that needy students who enroll in two-year (locally oriented) institutions are less responsive to aid because they face additional constraints that require them to attend institutions close to home.

Thus, the results in Section 2 indicate that increases in the overall generosity of the Pell awards across all institutions may provide low-income students access to more-selective institutions, whereas the results of Section 3 suggest that low-cost institutions that experience a relative increase in the Pell award attract more low-income students than those that do not. Jointly, the empirical findings indicate that the college selection of low-income students responds both to the absolute and relative magnitude of Pell awards offered by higher educational institutions.

4. Discussion and Concluding Remarks

In this paper, we assess the impact of changing federal aid levels on institution-level Pell revenues using institution-level data on the number of Pell recipients and total Pell revenues from 1989 through 2003. We report significant asymmetries across schools of different selectivity in their sensitivity to Pell generosity in general, and in the degree to which three different measures of generosity relate to institutional revenues. Moreover, scrutinizing the overall influence through separate analyses of award values and Pell enrollments reveals other important regularities in the data.

In short, our analysis reveals that in addition to changes in maximum award values and overall Federal appropriations affecting institutions differently according to selectivity, these

effects need not even materialize through the two channels of Pell enrollments and average Pell awards in like fashion across selectivity. For example, holding Federal appropriations and the maximum potential award-value constant, the benefits afforded to two-year institutions in response to increasing the number of eligible Pell recipients are sizably larger than that afforded to four-year institutions. On the other hand, revenues at two-year institutions are least sensitive to variation in the maximum award value, in particular with respect to middling four-year institutions, where there is evidence of a relatively strong enrollment response to changes in the value of the maximum grant.

The apparent variation in the response of Pell recipients across the selectivity spectrum of institutions is compelling from an institutional policy standpoint because it suggests that changes in the various margins of generosity can have distinctly different impacts that vary with selectivity. While the available data do not easily permit an analysis of individual student choices with regard to enrollment decisions, the 1992 Higher Education Amendments can be exploited to study whether differences in aid levels yield different enrollment patterns for comparable institutions. Results are suggestive that student enrollment does respond to aid. In particular, the HEA removed the cost-of-attendance rule and raised the institution-specific maximum Pell award at some, but not all, low-cost institutions. Around this margin, we demonstrate that the number of Pell recipients increased at those institutions that experienced an increase in their Pell award relative to those that did not, suggesting that low-income students may, in fact, substitute toward those institutions with relatively generous need-based aid. Thus, although prior evidence suggests that Pell grants do not move a student over the threshold from non-enrollment to enrollment, low-income students appear sensitive to the level of aid conditioned on the decision to enroll.

Table 1: Sample Characteristics by Institution Selectivity

Sample means (in 1990 dollars) are reported for the sample used in the estimation procedures reported in Table 2, Table 3, Table 4 and Table 5. Standard errors are in parentheses.

	Two-year institutions	Non-competitive or Minimally difficult	Moderately difficult	Very difficult or Most difficult	Full Sample
	(1)	(2)	(3)	(4)	(5)
MaxPell	-	-	-	-	$2,315
					(264)
FedApprop	-	-	-	-	$5,520 [a]
					(968)
Eligibles	-	-	-	-	5,054,099
					(474,516)
In-State tuition plus room and board	$6,462	$8,707	$11,508	$17,306	$10,207
	(2,434)	(3,.019)	(4,335)	(5,699)	(4,896)
Lagged enrollment less Pell students	3,077	1,295	3,041	3,684	2,778
	(4,027)	(2,243)	(4,391)	(4,108)	(4,020)
Per-capita disposable income in State	$21,457	$19,623	$20,615	$21,881	$20,750
	(3,026)	(2,757)	(2,895)	(3,003)	(2,994)
Unemployment Rate in State	5.4	5.5	5.3	5.5	5.4
	(1.5)	(1.5)	(1.5)	(1.5)	(1.5)
Mean weekly manufacturing earnings in State	$462	$441	$452	$450	$452
	(54)	(57)	(51)	(40)	(52)
Median home value in State	$90,395	$80.206	$87,056	$97,416	$87,500
	(23,800)	(26.296)	(29,182)	(27,956)	(27,645)
Number of high school graduates in State	88,740	81,436	92,647	114,977	91,472
	(57,110)	(70,057)	(74,383)	(79,592)	(7,0569)
Number of 18-19 year olds in State	242,674	234,604	25,8961	323,661	255,826
	(164,917)	(205,430)	(21,8917)	(237,561)	(207,068)
Observations / Number of institutions	5,491 / 503	4,081 / 339	10,354 / 817	1,863 / 148	21,789 / 1,784

[a] Millions of dollars.

Table 2: Effect of Changes in the Pell Generosity on Institutional Pell Revenue

In all specifications, the dependent variable is Log(Total institutional Pell revenue). Coefficients are estimated while controlling for institution-specific unobserved heterogeneity. Standard errors are in parentheses. Dependent variables means for columns (1) through (5) are $1,200,724, $1,071,024, $1,444,473, $1,280,246 and $1,299,059 respectively.

Independent variable	Two-year institutions	Non-competitive or Minimally difficult	Moderately difficult	Very difficult or Most difficult	Full Sample
	(1)	(2)	(3)	(4)	(5)
Log(*MaxPell*)	1.039	1.845	1.693	1.305	1.583
	(0.136)***	(0.149)***	(0.073)***	(0.134)***	(0.058)***
Log(*FedApprop*)	0.094	-0.074	0.042	0.072	0.027
	(0.043)**	(0.049)	(0.024)*	(0.042)*	(0.019)
Log(*Eligibles*)	1.425	0.780	0.381	0.279	0.653
	(0.113)***	(0.116)***	(0.058)***	(0.111)**	(0.047)***
Log(In-State tuition plus room and board)	-0.075	0.167	-0.006	-0.099	-0.034
	(0.045)*	(0.061)***	(0.031)	(0.052)*	(0.022)
Log(Lagged enrollment less Pell students)	0.101	0.076	0.130	0.009	0.105
	(0.011)***	(0.012)***	(0.010)***	(0.038)	(0.006)***
Log(Per-capita disposable income in State)	-0.685	-0.012	-0.442	-0.527	-0.502
	(0.228)***	(0.249)	(0.120)***	(0.221)**	(0.096)***
Lagged Unemployment Rate in State	0.022	0.008	0.005	0.002	0.014
	(0.006)***	(0.006)	(0.003)*	(0.006)	(0.002)***
Log(Mean weekly manufacturing earnings in State)	-0.542	0.354	-0.066	0.572	0.005
	(0.160)***	(0.159)**	(0.082)	(0.165)***	(0.066)
Log(Median home value in State)	-0.937	-0.307	-0.871	-0.471	-0.707
	(0.084)***	(0.091)***	(0.044)***	(0.079)***	(0.035)***
Log(Number of high school graduates in State)	0.398	0.240	0.396	0.368	0.329
	(0.058)***	(0.069)***	(0.030)***	(0.055)***	(0.025)***
Log(Number of 18-19 year olds in State)	0.145	-0.196	-0.463	-0.520	-0.272
	(0.098)	(0.116)*	(0.052)***	(0.092)***	(0.042)***
t (1989 = 1)	0.031	0.045	0.044	0.055	0.046
	(0.011)***	(0.013)***	(0.006)***	(0.012)***	(0.005)***
t^2	-0.001	-0.004	-0.002	-0.003	-0.002
	(0.001)	(0.001)***	(0.000)***	(0.001)***	(0.000)***
Constant	-20.286	-23.883	-6.866	-5.080	-11.752
	(3.230)***	(3.350)***	(1.694)***	(3.181)	(1.350)***
Observations / Number of institutions	5,491 / 503	4,081 / 339	10,354 / 817	1,863 / 148	21,789 / 1,784
R-squared	0.39	0.35	0.44	0.43	0.38

* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3: Effect of Changes in the Pell Generosity on Institutional Pell Enrollment

In all specifications, the dependent variable is Log(Total institutional Pell enrollment). Coefficients are estimated while controlling for institution-specific unobserved heterogeneity. Standard errors are in parentheses. Dependent variables means for columns (1) through (5) are 925, 702, 966, 833 and 895 respectively.

Independent variable	Two-year institutions	Non-competitive or Minimally difficult	Moderately difficult	Very difficult or Most difficult	Full Sample
	(1)	(2)	(3)	(4)	(5)
Log(*MaxPell*)	0.264	0.867	0.749	0.430	0.679
	(0.126)**	(0.143)***	(0.070)***	(0.129)***	(0.055)***
Log(*FedApprop*)	0.017	-0.079	0.025	0.048	-0.003
	(0.040)	(0.047)*	(0.023)	(0.040)	(0.018)
Log(*Eligibles*)	1.462	0.781	0.412	0.255	0.685
	(0.105)***	(0.112)***	(0.056)***	(0.107)**	(0.044)***
Log(In-State tuition plus room and board)	-0.101	0.203	-0.003	-0.123	-0.026
	(0.042)**	(0.059)***	(0.030)	(0.050)**	(0.021)
Log(Lagged enrollment less Pell students)	0.116	0.085	0.152	0.032	0.121
	(0.011)***	(0.012)***	(0.009)***	(0.036)	(0.006)***
Log(Per-capita disposable income in State)	-0.328	-0.000	-0.328	-0.603	-0.369
	(0.213)	(0.238)	(0.115)***	(0.213)***	(0.091)***
Lagged Unemployment Rate in State	0.017	0.009	0.003	-0.000	0.011
	(0.005)***	(0.006)	(0.003)	(0.005)	(0.002)***
Log(Mean weekly manufacturing earnings in State)	-0.507	0.243	-0.015	0.592	0.017
	(0.149)***	(0.152)	(0.079)	(0.159)***	(0.062)
Log(Median home value in State)	-0.910	-0.222	-0.844	-0.447	-0.674
	(0.078)***	(0.088)**	(0.042)***	(0.076)***	(0.033)***
Log(Number of high school graduates in State)	0.384	0.237	0.395	0.405	0.336
	(0.054)***	(0.066)***	(0.028)***	(0.053)***	(0.023)***
Log(Number of 18-19 year olds in State)	0.039	-0.112	-0.419	-0.494	-0.246
	(0.092)	(0.111)	(0.050)***	(0.089)***	(0.040)***
t (1989 = 1)	0.016	0.046	0.044	0.056	0.043
	(0.011)	(0.012)***	(0.006)***	(0.011)***	(0.005)***
t^2	-0.000	-0.004	-0.002	-0.003	-0.002
	(0.001)	(0.001)***	(0.000)***	(0.001)***	(0.000)***
Constant	-13.335	-15.467	-0.004	4.340	-4.699
	(3.009)***	(3.214)***	(1.620)	(3.065)	(1.281)***
Observations / Number of institutions	5,491 / 503	4,081 / 339	10,354 / 817	1,863 / 148	21,789 / 1,784
R-squared	0.27	0.15	0.24	0.27	0.20

* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4: Effect of Changes in the Pell Generosity on Mean Institutional Pell Awards

In all specifications, the dependent variable is Log(Mean institutional Pell revenue). Coefficients are estimated while controlling for institution-specific unobserved heterogeneity. Standard errors are in parentheses. Dependent variables means for columns (1) through (5) are $1,309, $1,507, $1,482, $1,525 and $1,446respectively.

Independent variable	Two-year institutions	Non-competitive or Minimally difficult	Moderately difficult	Very difficult or Most difficult	Full Sample
	(1)	(2)	(3)	(4)	(5)
Log(*MaxPell*)	0.775	0.978	0.944	0.875	0.905
	(0.044)***	(0.038)***	(0.018)***	(0.041)***	(0.016)***
Log(*FedApprop*)	0.076	0.006	0.017	0.024	0.030
	(0.014)***	(0.013)	(0.006)***	(0.013)*	(0.005)***
Log(*Eligibles*)	-0.038	-0.001	-0.032	0.023	-0.032
	(0.037)	(0.030)	(0.015)**	(0.034)	(0.013)**
Log(In-State tuition plus room and board)	0.026	-0.036	-0.003	0.024	-0.008
	(0.015)*	(0.016)**	(0.008)	(0.016)	(0.006)
Log(Lagged enrollment less Pell students)	-0.015	-0.010	-0.022	-0.023	-0.016
	(0.004)***	(0.003)***	(0.002)***	(0.012)**	(0.002)***
Log(Per-capita disposable income in State)	-0.357	-0.012	-0.114	0.076	-0.133
	(0.074)***	(0.064)	(0.030)***	(0.068)	(0.027)***
Lagged Unemployment Rate in State	0.005	-0.001	0.003	0.002	0.003
	(0.002)***	(0.002)	(0.001)***	(0.002)	(0.001)***
Log(Mean weekly manufacturing earnings in State)	-0.035	0.112	-0.051	-0.020	-0.012
	(0.052)	(0.041)***	(0.021)**	(0.050)	(0.018)
Log(Median home value in State)	-0.027	-0.084	-0.027	-0.024	-0.033
	(0.027)	(0.023)***	(0.011)**	(0.024)	(0.010)***
Log(Number of high school graduates in State)	0.014	0.004	0.001	-0.037	-0.007
	(0.019)	(0.018)	(0.007)	(0.017)**	(0.007)
Log(Number of 18-19 year olds in State)	0.106	-0.084	-0.044	-0.026	-0.026
	(0.032)***	(0.030)***	(0.013)***	(0.028)	(0.012)**
t (1989 = 1)	0.015	-0.001	-0.001	-0.001	0.003
	(0.004)***	(0.003)	(0.002)	(0.004)	(0.001)*
t^2	-0.000	0.000	0.000	0.000	0.000
	(0.000)*	(0.000)	(0.000)*	(0.000)	(0.000)
Constant	2.259	0.794	2.349	-0.209	2.157
	(1.051)**	(0.860)	(0.427)***	(0.972)	(0.379)***
Observations / Number of institutions	5,491 / 503	4,081 / 339	10,354 / 817	1,863 / 148	21,789 / 1,784
R-squared	0.55	0.73	0.82	0.85	0.72

* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 5: Proportional Breakdown of the Sensitivity of Revenue to Generosity

	Two-year institutions	Non-competitive or Minimally difficult	Moderately difficult	Very difficult or Most difficult	Full Sample
	(1)	(2)	(3)	(4)	(5)
Log(*MaxPell*)	1.039***	1.845***	1.693***	1.305***	1.583***
Estimated contribution of Average Pell Award	.775 (75%)	.978 (53%)	.944 (56%)	.875 (67%)	.905 (57%)
Estimated contribution of Pell Enrollment	.264 (25%)	.867 (47%)	.749 (44%)	.430 (33%)	.679 (43%)
Log(*FedApprop*)	0.094**	-0.074	0.042*	0.072*	0.027
Estimated contribution of Average Pell Award	.076 (81%)	.006 (8%)	.017 (40%)	.024 (33%)	.030 (111%)
Estimated contribution of Pell Enrollment	.017 (19%)	-.079 (-108%)	.025 (60%)	.048 (67%)	-.003 (-11%)
Log(*Eligibles*)	1.425***	0.780***	0.381***	0.279**	0.653***
Estimated contribution of Average Pell Award	-.038 (-3%)	-.001 (0%)	-.032 (-8%)	.023 (8%)	-.032 (-5%)
Estimated contribution of Pell Enrollment	1.462 (103%)	.781 (100%)	.412 (108%)	.255 (92%)	.685 (105%)
Observations / Number of institutions	5,491 / 503	4,081 / 339	10,354 / 817	1,863 / 148	21,789 / 1,784

* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 6: Sample Characteristics: Treatment and Control Groups

Sample means (in 1990 dollars) are reported for the sample used in the estimation procedures reported in Table 7. Standard errors are in parentheses.

	Treatment Group [a]		Control Group	
	Pre 1992 HEA	Post 1992 HEA	Pre 1992 HEA	Post 1992 HEA
Number of Pell Recipients	927	1,013	1,614	1,850
	(1,068)	(1,171)	(1,576)	(1,747)
In-State tuition plus room and board	$3,186	$3,372	$3,970	$4,317
	(296)	(421)	(399)	(464)
Lagged enrollment less Pell students	2,479	2,568	6279	6,221
	(3,467)	(3,441)	(5,897)	(5,609)
Per-capita disposable income in State	$16,838	$17,667	$18,572	$18,982
	(1,441)	(1,434)	(23,970)	(1,902)
Unemployment Rate in State	5.7	5.6	5.9	6.5
	(1.5)	(1.2)	(1.3)	(1.7)
Mean weekly manufacturing earnings in State	$403	$404	$427	$422
	(44)	(38)	(51)	(47)
Median home value in State	$63,434	$65,856	$90,332	$85,666
	(29,480)	(27,673)	(42,967)	(31,291)
Number of high school graduates in State	62,839	64,640	113,012	119,041
	(51,005)	(57,864)	(99,994)	(107,644)
Number of 18-19 year olds in State	198,471	195,640	36,0741	347,722
	(169,557)	(174,736)	(327,587)	(310,030)
Four-year Institution	0.40	0.40	0.12	0.12
	0.49	0.49	0.32	0.32
Observations / Number of institutions	1,356 / 357	1,742 / 357	1,453 / 367	1,826 / 367

[a] The treatment group consists of all institutions with maximum Pell awards which were restricted by the cost-of-attendance rule in 1992, the year prior to the Higher Education Amendments. The control group consists of all institutions which were constrained by the cost-of-attendance rule at any time between 1989 and 1991, but were not constrained by the rule in 1992. Thus, the control group of institutions did not experience an increase in their maximum allowable Pell award due to the 1992 rule change.

Table 7: Effect of the 1992 Higher Education Amendments on Institutional Pell Enrollments

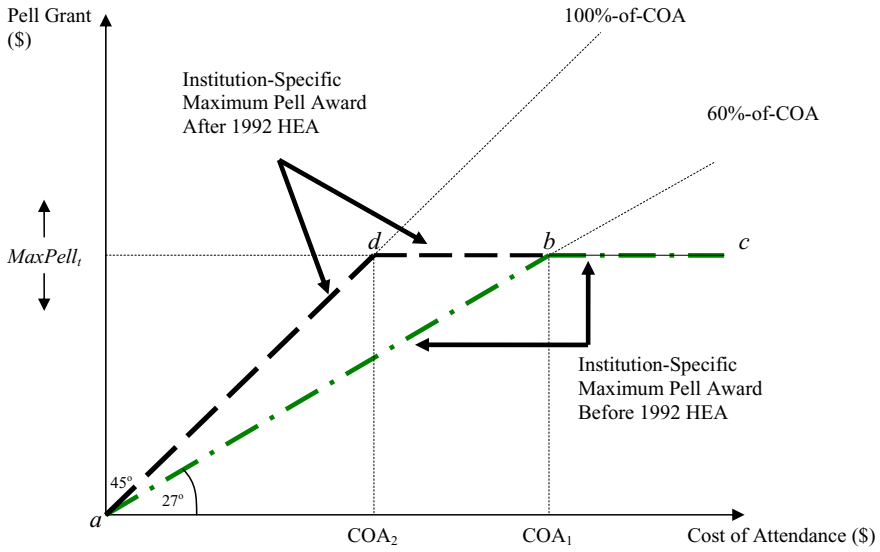
In all specifications, the dependent variable is Log(Number of Pell Students). Coefficients are estimated while controlling for institution-specific unobserved heterogeneity. Standard errors are in parentheses.

Independent variable	Full sample	Only two-year institutions
	(1)	(2)
Post 1992 Higher Education Amendments X Treatment Group	0.051	0.026
	(0.010)***	(0.013)*
Post 1992 Higher Education Amendments	-0.147	-0.128
	(0.012)***	(0.016)***
Log(In-State tuition plus room and board)	-0.156	-0.139
	(0.044)***	(0.054)**
Log(Lagged enrollment less Pell students)	0.027	0.021
	(0.011)**	(0.012)*
Log(Per-capita disposable income in State)	-0.436	-0.135
	(0.173)**	(0.225)
Lagged Unemployment Rate in State	0.041	0.037
	(0.004)***	(0.005)***
Log(Mean weekly manufacturing earnings in State)	0.160	0.137
	(0.142)	(0.179)
Log(Median home value in State)	-0.724	-0.719
	(0.066)***	(0.079)***
Log(Number of high school graduates in State)	0.254	0.206
	(0.038)***	(0.048)***
Log(Number of 18-19 year olds in State)	-0.544	-0.649
	(0.090)***	(0.111)***
t (1989 = 1)	0.128	0.143
	(0.008)***	(0.010)***
t^2	-0.006	-0.008
	(0.001)***	(0.001)***
Constant	17.386	16.135
	(2.165)***	(2.781)***
Observations / Number of institutions	6,377 / 724	4,713 / 539
R-squared	0.41	0.45

* significant at 10%; ** significant at 5%; *** significant at 1%.

Figure 1: Relationship Between the Maximum Institutional Pell Grant and Costs of Attendance

The maximum Pell grant at any institution *i* with costs of attendance less than 'COA_1' is constrained by 60 percent of that institutions cost of attendance, as illustrated by the line-segment *ab*. Maximum Pell grants at institutions with cost of attendance above 'COA_1'are constrained by the Federal maximum ($MaxPell_t$) as illustrated by the line-segment *bc*. With the 1993 removal of the explicit 60-percent cap, a student's Pell Grant of any institution *i* with costs of attendance less than 'COA_2' will be constrained by institutions cost of attendance, and all institutions with cost of attendance greater that 'COA_2' constrained by the Federal maximum as illustrated by the line-segment *adc*.



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