

# IMPACT OF STUDENT FINANCIAL AID, LABOR COSTS, AND GOVERNMENT APPROPRIATIONS ON COLLEGE TUITION FROM 2012-13 TO 2021-22

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## Abstract

Using institutional-level panel data from 2012-13 to 2021-22 from the Integrated Postsecondary Education Data System (IPEDS), this study re-examines the impact of demand-side factors such as students' financial aid and supply-side factors such as labor costs and government appropriations on college tuition for public four-year and private four-year non-profit institutions. It extends prior research on this topic by using data from more recent years and includes additional factors that may impact tuition. The results reveal that an increase in the average institutional grant will increase tuition for public and private nonprofit institutions. For instance, a \$1000 increase in average institutional grant drives up tuition by 593 dollars for private institutions, 302 dollars (out-of-state) and 104 dollars (in-state) for public institutions. However, an average Pell Grant increase, which is a demand side factor, has a negative effect on tuition, contradicting prior literature's finding that the increase in Pell Grant drives the tuition increase. This study did not find a large effect on tuition for other types of individual subsidies, labor costs, and state appropriations.

Keywords: College Tuition, Higher Education Institutions, Demand and Supply Factors, Fixed Effects

JEL Classifications: I22, I23, H52, H40

## Introduction

College tuition inflation is an essential issue for policymakers because of its substantial effects on a country's educational equality and economic growth. Continuous industrialization requires more educated labor, and if the education costs are high, economic growth may be hampered (Zeira, 2009). Past research has demonstrated that higher educational attainment is sensitive to tuition (Abraham & Clark, 2003; Chin & Juhn, 2010; Bahrs & Siedler, 2019), especially for those from disadvantaged groups. For instance, undocumented students (Conger & Turner, 2015), those with lower socioeconomic status, and Black and Hispanic students (Black & Sufi, 2002) are more sensitive to changes in tuition. Thus, the change in college tuition as a potential cause of furthering educational equality deserves policymakers' and scholars' attention. The average published tuition and fees (sticker price of college<sup>2</sup>) have increased from 2012-13 to 2020-21 with a slight decrease in 2021-22, but the magnitude of the increase varies depending on the type of institution. For instance, the sticker price has increased by \$8,240, \$1,990, and \$840

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<sup>2</sup> Sticker price refers to in-state and out-of-state published tuition and fees for public institutions and models are run separately. For PNP, it is out-of-state tuition and fees only, since PNP institutions charge the same for in-state and out-of-state tuition and fees.

for private nonprofit four-year institutions, public four-year institutions, and public two-year institutions, respectively (College Board, 2023). Charts 1, 2, and 3 in Appendix 1 depict sticker prices<sup>3</sup> and net tuition and fees for 4-year private non-profit, public 4-year, and public 2-year institutions, respectively.

Using a simple demand-supply model, an increase in demand with supply constant or a decrease in supply with demand unchanged could increase college tuition<sup>4</sup>. Bennett's Hypothesis argues that rising financial aid, which increases the demand for college, drives up college prices (Bennett, 1987). On the other hand, Baumol's cost disease (1967) claims that the rise in wages of employees in higher education increases the cost for colleges to provide education. This will increase tuition as colleges pass the cost to consumers (Gordon & Hedlund, 2016). Other factors that can decrease supply and increase tuition may include a decrease in federal and state appropriations toward higher education (Bundick & Pollard, 2019).

This paper uses institutional-level panel data from the Integrated Postsecondary Education Data System (IPEDS) to assess the importance of the above-mentioned factors, namely, financial aid<sup>5</sup>, labor costs<sup>6</sup>, and government appropriations,<sup>7</sup> in determining the sticker price of college from 2012-13 to 2021-22. It adds to the prior research in this field in three ways. First, it extends the time frame beyond what is used in past studies. More importantly, it uses two academic years of data that were impacted by COVID-19, which entailed demand and supply-side shocks to higher education by disturbing colleges' operations and students' plans to pursue higher education. For instance, the government authorized a fund to support higher education (The Regents of the University of California, n.d.). Second, it uses a more extensive set of financial aid variables. This is crucial because prior studies typically focused on the Pell Grant, state grant aid, or reforms in student loans, but financial aid has more types. Lastly, we also utilize non-instructional staff salaries. It is important because in prior literature, the non-instructional staff salaries are a crucial part of a college's operational costs.

The results reveal that supply-side factors only affect sticker prices a little. For demand-side factors, or individual subsidies, after controlling for institution fixed effects, a 1-dollar increase in the average institutional grant increases sticker prices by 0.296 dollars for public institutions (out-of-state) and by 0.584 dollars for private nonprofit institutions. The effect of the average Pell Grant was crucial if institution-fixed effects were controlled for, but it becomes marginal after adding year-fixed effects. Other individual subsidies have minor effects on sticker prices.

## Literature Review

This review focuses on papers that empirically investigate the factors contributing to

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<sup>3</sup> In-state for public 4-year institutions and in-district for public 2-year institutions

<sup>4</sup> It is possible that demand and supply change simultaneously to affect tuition. This case is not explored in our paper.

<sup>5</sup> Student Financial Aid (for full-time, first-time degree/certificate-seeking undergraduate students) includes average other student loan, average federal student loan, average institutional grant, average state/local grant, average other federal grant, average Pell Grant, and average federal grant.

<sup>6</sup> Labor costs include total annual full-time non-medical instructional staff salaries and non-instructional staff salaries. Instructional staff refers to "an occupational category that consists of the following two functions 1. Instruction only and 2. Instruction combined with research and/or public service" (National Center for Education Statistics, 2021).

<sup>7</sup> Government appropriations include total federal appropriations and state appropriations: federal appropriations are "amounts received from the federal government through a direct appropriation of Congress, except grants and contracts" and state appropriations are "amounts received from a state government through a direct appropriation of its legislative body, except for state grants and contracts" (National Center for Education Statistics, 2021)

tuition inflation. Demand-side (Bundick & Pollard, 2019; Singell & Stone, 2007; Cook & Turner, 2022; Gordon & Hedlund, 2016; Lucca & Shen, 2019; Cellini & Goldin, 2014) or supply-side factors (Gordon & Hedlund, 2016; Chakrabarti et al., 2020; Bundick & Pollard, 2019) contribute to tuition inflation. The demand-side factors are essentially individual subsidies that help students cover education expenses, and supply-side factors include institutional subsidies that are granted by the government (state or federal appropriations) (Peltzman, 1973; Lowry, 2016) and labor costs.

For demand-side factors, Bundick & Pollard (2019) use Ordinary Least Squares (OLS) regression models to test the effect of two demand-side factors, namely, the availability of student loans and the rising returns from college degrees on tuition and college enrollment. Results indicate that these factors do not significantly impact tuition. In the paper by Gordon & Hedlund (2015), changes in loan limits, interest rates of federal loans, and increases in state and federal grants increase tuition. Lucca & Shen (2015) use a difference-in-difference approach to investigate the effect of the increase in loan maximums on tuition, and they find results similar to the previous paper: the increase in loan cap can drive up the sticker price. In addition to loan reforms, Cook and Turner (2022) use an instrumental variable of overall state appropriations and find that state grant aid contributes to tuition increases. With a reduced-form panel approach from 1989 to 1996, Singell & Stone (2007) show that an increase in Pell Grants has a nearly one-to-one dollar increase for private institutions, and public institutions behave like private institutions in terms of out-of-state tuition.

For supply-side factors, Bundick & Pollard (2019) examine tuition trends from 1980 to 2018 and argue that rising wages in the education sector and a decrease in state appropriation are important for tuition inflation. Additionally, public institutions are more impacted than private institutions. Chakrabarti et al. (2020) reinforces the negative relationship observed in the previous study: an increase in state appropriation reduces in-state, out-of-state, and net tuition for both two-year and four-year institutions. In Gordon and Hedlund's model with data from 1987 to 2010, there is little support for the negative association between state appropriation and tuition, although they concede they need to include various institution types to explore this claim further (Gordon & Hedlund, 2016). Moreover, they find that the increasing cost for colleges to operate will decrease the tuition, as colleges will increase enrollment and reduce average student spending to pay the higher fixed costs.

As stated before, this study will expand on previous research by including more recent data and variables. This paper employs panel data similar to the paper by Singell & Stone (2007), but with more recent years included in the analysis. Second, prior research usually focuses on one or two specific student financial aid programs, such as the Pell Grant (Singell & Stone, 2007), or reforms and expansion of loans (Lucca & Shen, 2019; Bundick & Pollard, 2019; Gordon & Hedlund, 2016). Bennett's Hypothesis states the effect of "financial aid" in general, but financial aid can take many forms. This study will include more financial aid types to better understand this hypothesis: average federal loan, average other loan, average institutional grant, average state/local grant, average Pell Grant, average other federal grant, and average federal grant. In addition, accounting for multiple variables (student financial aid, labor cost, and state and federal appropriations) in the model makes this study able to check if the existence of each variable affects others' effect on tuition and thus re-test Bennett's Hypothesis and Baumol's cost disease. Third, to the best of the author's knowledge, prior studies did not specifically categorize the rising labor costs as instructional and non-instructional staff salaries. Bundick & Pollard (2019) studied labor costs in general. However, as mentioned above in Baumol's cost disease,

the rising wages in the service sector will result in tuition inflation. Including non-instructional and instructional staff salaries can capture labor costs in detail and examine Baumol's cost disease.

## Data

This study uses institutional-level data from the IPEDS, which collects information about post-secondary institutions across the United States (National Center for Education Statistics, n.d.-c). The survey components involved pertain to Student Financial Aid (SFA), Human Resources (HR), Finance, and Institution Characteristics, which provide independent variables of SFA (average<sup>8</sup> other student loans,<sup>9</sup> average federal student loans,<sup>10</sup> average institutional grant,<sup>11</sup> average state/local grant,<sup>12</sup> average other federal grant aid,<sup>13</sup> average Pell Grant,<sup>14</sup> and average federal grant<sup>15</sup>), labor cost (total non-instructional and instructional staff salaries), government appropriations (state and federal), and dependent variables of sticker price (in-state and out-of-state tuition and fees). It also provides institutional-level information variables such as institution type (public or private) and state.

Two crucial features of IPEDS data shape how the econometric models are designed. First, the availability of labor cost variables on IPEDS ranges from 2012-13 to 2021-22,<sup>16</sup> which constrains the time frame of this study. Second, the government appropriation variables<sup>17</sup> from the Finance component of the IPEDS survey primarily have two different reporting forms for financial information: the Governmental Accounting Standards Board (GASB, all public institutions) and the Financial Accounting Standards Board (FASB) (National Center for Education Statistics, n.d.-b). Due to the significant difference between the number of private nonprofit (PNP) institutions and public institutions in FASB,<sup>18</sup> this paper will use public institutions for GASB and PNP institutions for FASB.<sup>19</sup> FASB has 1,016 institutions and GASB

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<sup>8</sup> For all types of student financial aid, average means the average amount received by full-time first-time undergraduates

<sup>9</sup> "All non-federal loans institutionally and privately-sponsored loans" (National Center for Education Statistics, 2021)

<sup>10</sup> "Any money that must be repaid to the lending institution for which the student is the designated borrower" (National Center for Education Statistics, 2021)

<sup>11</sup> "Scholarships and fellowships granted and funded by the institution and/or individual departments within the institution" (National Center for Education Statistics, 2021)

<sup>12</sup> "State and local money awarded to the institution under state and local student aid programs" (National Center for Education Statistics, 2021)

<sup>13</sup> "Federal money awarded to the institution under federal government student aid programs" (National Center for Education Statistics, 2021). Note that the Pell Grant is not included.

<sup>14</sup> The grant through "Pell Grant program (Higher Education Act of 1965, Title IV, Part A, Subpart I)" (National Center for Education Statistics, 2021)

<sup>15</sup> "Grants provided by federal agencies such as the U.S. Department of Education" (National Center for Education Statistics, 2021)

<sup>16</sup> Academic Year 2012-13 to 2021-22

<sup>17</sup> In the Finance survey component, the variables are in the fiscal year (FY), which extends from October to September, while other surveys list variables in the academic year (AY), which extends from September to June. Hence, government appropriation variables have been converted from FY to AY by taking the average of total appropriations for the earlier and later FYs, multiplying the average from the earlier FY by four and the later one by six and adding them together.

<sup>18</sup> Private for-profit institutions use a form adjusted from the one private nonprofit used (National Center for Education Statistics, n.d.-c). This study has results for private for-profit institutions as well. Please reach out for more information if you are interested.

<sup>19</sup> Note that there are 12 public institutions in FASB in 12-13 to 20-21 data. Thus, these public institutions are missing from the analysis when this paper focuses on GASB for public institutions and FASB for PNP institutions.

has 1,052 institutions from 2012-13 to 2021-22.<sup>20</sup>

Summary statistics are in s 1 and 2, which summarizes government appropriations, student financial aid (SFA), and sticker price variables for public and PNP institutions.<sup>21</sup> Public institutions received fewer state appropriations but more federal appropriations than PNP institutions. PNP institutions had a higher average SFA than public institutions, except for the Pell Grant, where PNP and public institutions are similar. For instance, PNP institutions provided an average of \$18,258 in institutional grants, whereas public institutions provided \$3,659. Sticker prices for public institutions include in-state and out-of-state tuition and fees. They refer to out-of-state tuition and fees only for PNP institutions, and for public institutions, out-of-state tuition and fees are higher than in-state ones. For labor cost variables, public institutions have much higher average total non-instructional and instructional salaries than PNP institutions.

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<sup>20</sup> For FASB private nonprofit institutions: 47 institutions have one-year observation, 29 have two-year observations, 21 have three-year observations, 20 have four-year observations, 27 have five-year observations, 19 have six-year observations, 27 have seven-year observations, 44 have eight-year observations, 73 have nine-year observations, and 756 have ten-year observations. For GASB institutions, 69 institutions have observations for only one year, 46 have two-year observations, 46 have three-year observations, 41 have four-year observations, 54 have five-year observations, 44 have six-year observations, 53 have seven-year observations, 70 have eight-year observations, 90 have nine-year observations, and 608 have ten-year observations.

<sup>21</sup> Note that these variables are in current dollars.

**Table 1: Summary Statistics for Public Institutions with at Least 2-Year Data  
(2012-13 to 2021-22)**

VARIABLES	(1) N	(2) Mean	(3) Standard Deviation
<i>Sticker Price</i>			
Out-of-State Tuition and Fees	8,749	15,341	8,242
In-State Tuition and Fees	8,749	7,213	3,139
<i>Labor Costs</i>			
Non-Instructional Staff Salaries	8,749	5.354e+07	1.008e+08
Instructional Staff Salaries	8,749	3.199e+07	4.897e+07
<i>Student Financial Aid (Average Amount Received by Full-Time First-Time Undergraduates)</i>			
Other Student Loan Aid	8,749	9,262	4,317
Federal Student Loan Aid	8,749	5,050	919.4
Institutional Grant Aid	8,749	3,659	2,651
State/Local Grant Aid	8,749	3,006	1,931
Other Federal Grant Aid	8,749	1,139	939.6
Pell Grant Aid	8,749	4,602	503.4
Federal Grant Aid	8,749	4,650	750.7
<i>Government Appropriations</i>			
State Appropriations	8,749	279,715	1.928e+06
Federal Appropriations	8,749	5.022e+07	7.773e+07

**Table 2: Summary Statistics for PNP Institutions with at Least 2-Year Data (2012-13 to 2021-22)**

VARIABLES	(1) N	(2) Mean	(3) Standard Deviation
<i>Sticker Price</i>			
Out-of-State Tuition and Fees	9,205	32,283	11,290
<i>Labor Costs</i>			
Non-Instructional Staff Salaries	9,205	2.985e+07	8.188e+07
Instructional Staff Salaries	9,205	1.703e+07	3.578e+07
<i>Student Financial Aid (Average Amount Received by Full-Time First-Time Undergraduates)</i>			
Other Student Loan Aid	9,205	13,215	5,662
Federal Student Loan Aid	9,205	5,783	1,129
Institutional Grant Aid	9,205	18,258	9,863
State/Local Grant Aid	9,205	3,993	2,086
Other Federal Grant Aid	9,205	1,555	1,311
Pell Grant Aid	9,205	4,524	491.6
Federal Grant Aid	9,205	4,986	986.1
<i>Government Appropriations</i>			
State Appropriations	9,205	407,237	7.182e+06
Federal Appropriations	9,205	446,426	8.842e+06

There are three primary reasons for choosing this data source. First, the IPEDS survey is administered by the National Center for Education Statistics (NCES) (National Center for Education Statistics, n.d.-c) and includes many institutions over a broad time frame. Second, institutions participating in Title IV (T4) programs must report to IPEDS (National Center for Education Statistics, n.d.-a), which reduces missing values. Third, the definitions of variables have been consistent over the years, and institutions have been assigned unique IDs, which allows for the generation of a panel data set and fixed effects. Although IPEDS is a reliable data source, there are two caveats. First, IPEDS will impute data in case of nonresponse, but only for T4 institutions (National Center for Education Statistics, n.d.-c). Thus, this study may disproportionately include more T4 than non-T4 institutions, thus not be representative of non-T4 institutions.<sup>22</sup> Second, student financial aid and tuition variables are specified only for first-time and full-time undergraduates. Hence, the results cannot be generalized to part-time students or students who are not attending postsecondary institutions for the first time.

<sup>22</sup> IPEDS include data for T4 and non-T4 institutions, but only T4 is required to report to IPEDS and will be imputed for missing data; non-T4 institutions are voluntary in reporting to IPEDS.

## Econometrics

After generating an institution-level panel data set from the IPEDS, this paper runs OLS regression models, controlling for demand and supply factors that impact tuition along with year and institution-fixed effects. For both private and public institutions, the dependent variable is the sticker price of going to college. However, for public institutions, results are presented separately for in-state and out-of-state tuition. The independent variables pertain to various student financial aid, labor costs, and government appropriations, as stated in the data section above. Institution and year-fixed effects are utilized to help control for time-invariant and institution-specific factors that affect tuition, such as geographic location.

The primary fixed effect regression models with student financial aid, labor cost, and government appropriations are as follows:

$$Y_{it} = \beta_0 + \beta_1 \text{Student Financial Aid}_{it} + \beta_2 \text{Labor Cost}_{it} + \beta_3 \text{Government Appropriations}_{it} + \beta_4 \text{Institution}_i + \beta_5 \text{Year}_t + \varepsilon_{it}$$

$Y_{it}$  is the sticker price of the institution  $i$  in the academic year  $t$ , and it is the dependent variable. Independent variables are as follows:  $\text{Student Financial Aid}_{it}$  includes different types of average student financial aid of the institution  $i$  in the academic year  $t$ ;  $\text{Labor Cost}_{it}$  refers to the instructional and non-instructional staff salaries of the institution  $i$  in the academic year  $t$ ;  $\text{Government Appropriations}_{it}$  includes the state and federal appropriation of the institution  $i$  in the academic year  $t$ ;  $\varepsilon_{it}$  is the error term.  $\text{Institution}_i$  is the institution-fixed effect and  $\text{Year}_t$  is the year-fixed effect. They will capture potential omitted variables affecting the relationship between dependent and independent variables.

To better compare with the past literature (Singell & Stone, 2007), this study also runs the models with only average Pell grants and state appropriations as independent variables, controlling for year and institution fixed effects, which are close to the models used by Singell and Stone.<sup>23</sup> Results are in Appendix, Table 6.

## Results

Results from the fixed effect models with institution-fixed and year-fixed effects are in Tables 3. Column (1) and (2) are for public institutions with out-of-state and in-state sticker prices as dependent variables, and Column (3) is for PNP institutions with out-of-state sticker prices as the dependent variable. This study focuses on results from institution fixed-effects models because the robustness tests (Hausman test, Breusch Pagan test) indicate the fixed-effects model is preferred<sup>24</sup> over pooled OLS and random effect models.<sup>25</sup> The multicollinearity test shows the non-instructional and instructional staff salary outlays for public institutions have worrisome correlation, so the instructional staff salary is dropped from the regressions in Table

<sup>23</sup> Models from Singell and Stone's work (2007) also includes interaction term of time and institution-specific characteristics (e.g., south), which are not included here due to data eligibility.

<sup>24</sup> From Breusch Pagan test, the null hypothesis is rejected, implying RE is preferred over the pooled OLS; from the Hausman test, the null hypothesis is rejected implies only FE is preferred over RE. Overall FE is preferred.

<sup>25</sup> OLS and random effect results are not presented in the main text, because the tests show the fixed effect model is preferred. If one is interested, please refer to Table 4 and 5 in Appendix for OLS and random effect results.

3.<sup>26</sup>**Table 3: Fixed-Effect Models<sup>27</sup>**

VARIABLES	(1) Out-of-State Tuition (Public Institutions)	(2) In-State Tuition (Public Institutions)	(3) Out-of-State Tuition (PNP Institutions)
Average Other Student Loan	0.0257*** (0.00698)	0.0141*** (0.00231)	0.0669*** (0.00598)
Average Federal Student Loan	0.0262 (0.0340)	0.0119 (0.0113)	-0.0442** (0.0220)
Average Institutional Grant Aid	0.302*** (0.0208)	0.104*** (0.00691)	0.593*** (0.00677)
Average State/Local Grant Aid	0.0474* (0.0253)	0.0773*** (0.00839)	-0.0441** (0.0222)
Average Other Federal Grant Aid	0.0454* (0.0271)	-0.0214** (0.00899)	0.00736 (0.0198)
Average Pell Grant Aid	-0.0848 (0.0705)	-0.0473** (0.0234)	-0.450*** (0.0600)
Average Federal Grant Aid	-0.113*** (0.0340)	-0.0423*** (0.0113)	-0.0290 (0.0262)
Federal Appropriations	4.96e-06 (1.82e-05)	9.56e-06 (6.03e-06)	9.22e-05*** (2.75e-05)
State Appropriations	1.79e-06 (1.60e-06)	-3.63e-06*** (5.30e-07)	2.60e-06 (6.37e-06)
Total Full-Time Non-Instructional Staff Salary Outlays	2.64e-05*** (1.28e-06)	2.38e-06*** (4.24e-07)	8.19e-06*** (1.41e-06)
year = 2013-14	358.4*** (74.52)	196.2*** (24.70)	509.3*** (69.66)
year = 2014-15	726.4*** (74.90)	411.4*** (24.83)	1,033*** (70.55)
year = 2015-16	1,072*** (75.49)	612.0*** (25.02)	1,612*** (72.59)
year = 2016-17	1,383*** (75.94)	815.1*** (25.17)	2,110*** (74.57)

<sup>26</sup> Variance inflation factors (VIF) for instructional and non-instructional staff salary outlays are above 10 for public institutions, but are below 10 for PNP institutions. To be consistent with the public institution models, I also drop the instructional staff salary variable for PNP institution models. If including instructional staff salary for PNP institutions, a non-instructional staff salary change will have negative (instead of positive) effect on tuition. Other coefficients are similar as in Table 3.

<sup>27</sup> I did both covid (equals to 1 if in the pandemic and post-pandemic years and 0 otherwise) and year fixed effects but only presented year fixed effects in this paper. Results are available upon request. If having covid dummy instead of year fixed-effects, average Pell grant will have a significant positive effect on published TF for public and PNP institutions.

year = 2017-18	1,715*** (79.96)	1,042*** (26.51)	2,674*** (78.55)
year = 2018-19	1,929*** (84.22)	1,239*** (27.92)	3,085*** (83.87)
year = 2019-20	2,041*** (87.97)	1,375*** (29.16)	3,668*** (88.61)
year = 2020-21	2,168*** (90.83)	1,490*** (30.11)	4,168*** (93.20)
year = 2021-22	2,246*** (98.66)	1,645*** (32.71)	4,278*** (100.5)
Constant	11,692*** (318.1)	6,001*** (105.4)	20,567*** (260.0)
Observations	8,749	8,749	9,205
R-squared	0.369	0.597	0.836
Institution FE	YES	YES	YES
Year FE	YES	YES	YES
Number of Institutions	1,052	1,052	1,016

Standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

In the primary fixed effect model (Table 3), the average Pell grant has a negative or insignificant effect on sticker price, varying by institution type (less significant and less negative effect for public institutions). For public institutions, the change in average Pell Grant has no significant impact on out-of-state sticker price, but a 100-dollar decrease in the average Pell Grant will decrease the sticker price by 4.73 dollars (Table 3, Column (2)). For PNP institutions, a 100-dollar increase in the average Pell Grant will decrease the sticker price by 46.3 dollars (Table 3, Column (3)). Similarly, the average institutional grant positively affects sticker price, and the effect is greater for PNP institutions: a 100-dollar increase in the average institutional grant will increase sticker price by 59.3 dollars (Table 3, Column (3)). For public institutions, a 100-dollar increase in the average institutional grant will increase the out-of-state sticker price by 30.2 dollars and in-state by 10.4 dollars (Table 3, Column (1-2)).

From the above results, for individual subsidies, the initial hypothesis that the increase in student financial aid will increase tuition holds for the average institutional grant. Still, this hypothesis does not fully support the negative effect of the average Pell Grant. For instance, the increase in the average Pell grant will decrease the (in-state) sticker price for public and PNP institutions and have no effect on the out-of-state sticker price for public institutions (Tables 3). This contradicts Singell and Stone's (2007) finding about the fixed-effect model that the increase in Pell grants will increase the sticker price for private and public institutions. The possible explanation is that this study uses more recent years of data, since the similar fixed-effect models only reveal that an average Pell grant change has no significant effect on sticker price for public or PNP institutions (Appendix, Table 6). Cook and Turner's results revealed that the average state grant positively correlates with net tuition in 2008-2019 data (2022). Such a conclusion only holds for sticker prices in limited cases. As shown by this study, the effect of the average state/local grant is minor (Tables 3).

The study by Lucca and Shen (2015) shows that the increase in the loan cap will drive up

tuition with 2007-2009 data. In contrast, this paper finds that with more recent data until 2021-22, the increase in average federal student loans indicates only a minor impact on tuition. For instance, its effect is insignificant for the public (Table 3, Column (1-2)) and not very significant for PNP institutions (Table 3, Column (3)). Thus, the increase in average federal student loans generally does not affect sticker prices.

For supply-side factors, unlike Bundick and Pollard's analyses, staff salaries have minor effects on tuition for all models and are contrary to the initial hypothesis established on Baumol's cost disease (1967) about rising wages. In particular, a 100-thousand-dollar increase in non-instructional staff salaries increases the out-of-state sticker price by 2.64 dollars for public institutions (Table 3, Column (1)) and decreases it by 1.77 dollars for PNP institutions (Table 3, Column (3)). Prior research has proposed an adverse effect of state appropriation on tuition: a \$1,000 increase in appropriations per student can reduce sticker prices for public institutions by \$713 (Chakrabarti et al., 2020). This resonates with the finding that the increase in state appropriations decreases the in-state sticker price for public institutions (Table 3, Column (2)). However, state appropriations have insignificant effects on PNP sticker price (Tables 3, Column (3))<sup>28</sup>. This refutes the initial hypothesis that the increase in appropriations will reduce tuition, regardless of institution type.

Supply-side factors and the average state grant, federal loan, and Pell Grant from individual subsidies do not lead to a rise in tuition, as hypothesized. The state-level endogeneity might explain this: some state-level characteristics, such as state policies, can affect independent and dependent variables, leading to endogeneity since the analysis only controls for year and institution-fixed effects. This paper does not present state-fixed effects because there are states that only have one institution in the data.

## Conclusion

This study generates institutional-level panel data with the institution and year-fixed effects to understand the factors driving college prices from 2012-13 to 2021-22, which is more recent data relative to past studies. The supply-side factors, including labor costs and institutional subsidies, only have a minor impact on sticker prices. However, among individual subsidies, the average institutional grant and average Pell Grant have more significant and larger effects on sticker prices than other aids. In particular, controlling for year and institution-fixed effects, the increase in the average institutional grant will drive up sticker prices for public and PNP institutions, with a greater increase in PNP institutions. The increase in the average Pell Grant will decrease the in-state sticker price for public and out-of-state sticker price for PNP institutions, with a greater decrease for PNP institutions, but has no significant effect on out-of-state sticker prices for public institutions.

This paper contributes to the field by using recent years, introducing specific student financial aid variables, and accounting for non-instructional staff salaries. The results can have the following policy implications: the increase in average Pell Grant will have a smaller negative effect on sticker prices for public institutions as compared to PNP institutions. This supports the future Pell Grant expansion, as it decreases the sticker price and does not impose financial burdens on low-income students.

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<sup>28</sup> The above results are from unbalanced panel data, ensuring every institution has at least two years of observations. This helps prevent sample selection bias as we are unsure what are the reasons for those institutions to have unbalanced data. However, results from balanced panel data that only include institutions with all years of observations are similar to the above results. Details are not presented in this paper but are available upon request.

Additional analyses in the future will help to build on the findings of this paper. First, the analysis could include investigating the impact of institutions' characteristics (such as the number of high-ability students in this institution) or state-level characteristics on tuition, which cannot be included in the IPEDS panel data. Second, IPEDS data is more representative of Title IV institutions because they are mandated to report to IPEDS (National Center for Education Statistics, n.d.-a), and non-Title IV institutions may have more missing data points. It will be interesting for future research to examine if the results hold for non-Title IV institutions using relevant data sets.

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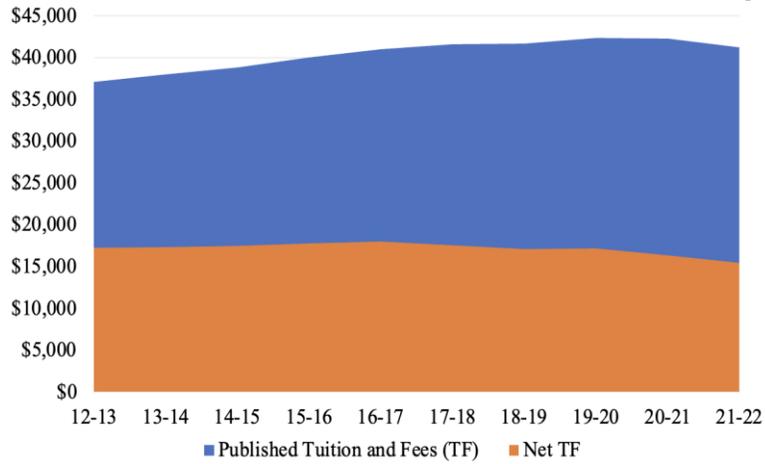
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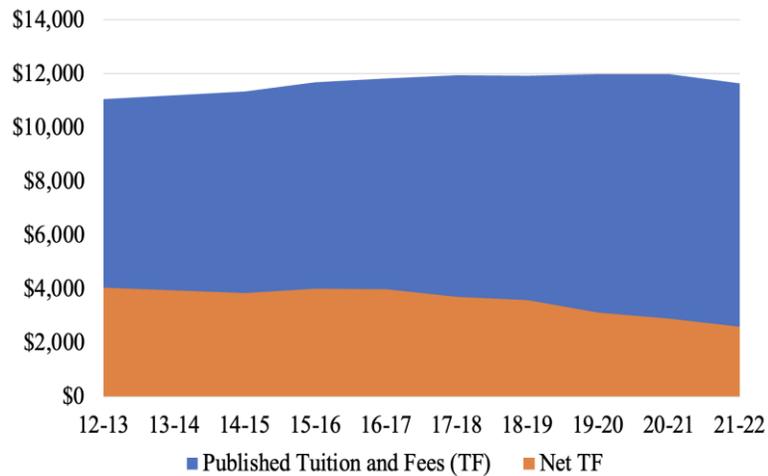
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Appendix

**Chart 1: Published Tuition and Fees and Net Price for Private Nonprofit 4-Year<sup>29</sup>**



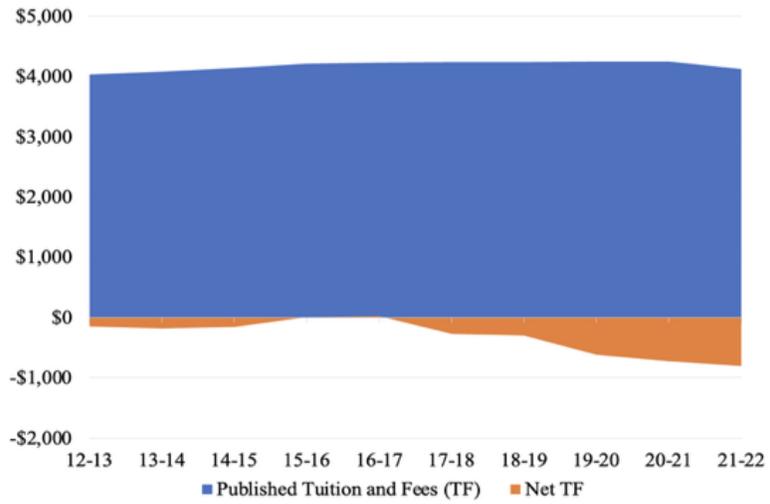
**Chart 2: Published In-State Tuition and Fees and Net Price for Public 4-Year<sup>30</sup>**



<sup>29</sup> Published TF refers to the blue area and net TF refers to the orange area.

<sup>30</sup> Published out-of-state TF for public 4-year institutions is not available on college board data.

**Chart 3: Published In-District Tuition and Fees and Net Price for Public 2-Year**



**Table 4: OLS Models for Public and PNP Institutions (Year Dummies Suppressed)**

VARIABLES	(1) Out-of-State Tuition, Public	(2) In-State Tuition, Public	(3) Out-of-State Tuition, PNP
Average Other Student Loan	0.386*** (0.0137)	0.144*** (0.00626)	0.495*** (0.00822)
Average Federal Student Loan	0.647*** (0.0572)	0.457*** (0.0261)	-0.138*** (0.0412)
Average Institutional Grant Aid	1.227*** (0.0240)	0.506*** (0.0109)	0.950*** (0.00543)
Average State/Local Grant Aid	0.927*** (0.0291)	0.342*** (0.0133)	0.465*** (0.0210)
Average Other Federal Grant Aid	0.299*** (0.0607)	0.0233 (0.0277)	-0.0187 (0.0376)
Average Pell Grant Aid	-0.973*** (0.145)	-0.837*** (0.0662)	-1.804*** (0.121)
Average Federal Grant Aid	-0.0109 (0.0894)	0.0312 (0.0408)	0.484*** (0.0577)
Federal Appropriations	-7.67e-05*** (2.71e-05)	5.89e-05*** (1.24e-05)	-4.22e-05*** (5.97e-06)
State Appropriations	9.18e-06*** (1.30e-06)	-3.87e-06*** (5.92e-07)	2.36e-05*** (5.02e-06)
Total Full-Time Non-Instructional Staff Salary Outlays	1.44e-05*** (1.03e-06)	3.99e-06*** (4.69e-07)	-9.29e-06*** (6.17e-07)
Constant	3,789*** (569.4)	3,595*** (259.9)	13,049*** (479.6)
Observations	8,749	8,749	9,205
R-squared	0.693	0.558	0.869
Institution FE	NO	NO	NO
Year FE	YES	YES	YES
Breusch-Pagan test (p-value)			
Number of Institutions			

Standard errors in parentheses

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

**Table 5: Random Effect Models for Public and PNP Institutions (Year Dummies Suppressed)**

VARIABLES	(2) Out-of-State Tuition, Public	(4) In-State Tuition, Public	(6) Out-of-State Tuition, PNP
Average Other Student Loan	0.0543*** (0.00726)	0.0205*** (0.00242)	0.108*** (0.00628)
Average Federal Student Loan	0.154*** (0.0350)	0.0466*** (0.0117)	-0.0992*** (0.0235)
Average Institutional Grant Aid	0.473*** (0.0208)	0.144*** (0.00707)	0.693*** (0.00653)
Average State/Local Grant Aid	0.199*** (0.0254)	0.108*** (0.00862)	0.0327 (0.0224)
Average Other Federal Grant Aid	0.0828*** (0.0284)	-0.0106 (0.00943)	0.0381* (0.0212)
Average Pell Grant Aid	-0.202*** (0.0734)	-0.0874*** (0.0244)	-0.594*** (0.0643)
Average Federal Grant Aid	-0.106*** (0.0358)	-0.0412*** (0.0118)	0.0156 (0.0282)
Federal Appropriations	9.39e-06 (1.87e-05)	1.53e-05** (6.27e-06)	-3.25e-06 (1.53e-05)
State Appropriations	7.12e-06*** (1.51e-06)	-2.03e-06*** (5.26e-07)	8.08e-08 (6.32e-06)
Total Full-Time Non-Instructional Staff Salary Outlays	2.95e-05*** (1.20e-06)	4.19e-06*** (4.20e-07)	8.34e-06*** (1.14e-06)
Constant	9,311*** (347.0)	5,211*** (125.2)	18,743*** (299.5)
Observations	8,749	8,749	9,205
R-squared			
Institution FE	NO	NO	NO
Year FE	YES	YES	YES
Breusch-Pagan test (p-value)	0.000	0.000	0.000
Number of Institutions	1,052	1,052	1,016

Standard errors in parentheses

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

**Table 6: Fixed Effect Model - Comparison with Singell and Stone's Paper 2007 (Year Dummies Suppressed)**

VARIABLES	(1) Out-of-State Tuition (Public Institutions)	(2) In-State Tuition (Public Institutions)	(3) Out-of-State Tuition (PNP Institutions)
Average Pell Grant Aid	-0.0443 (0.0654)	-0.0322 (0.0213)	0.119 (0.0750)
State Appropriations	2.01e-05*** (1.43e-06)	-1.54e-06*** (4.64e-07)	3.56e-05*** (8.93e-06)
Constant	12,918*** (285.9)	6,458*** (93.04)	27,245*** (318.8)
Observations	8,749	8,749	9,205
R-squared	0.307	0.573	0.667
Institution FE	YES	YES	YES
Year FE	YES	YES	YES
Number of Institutions	1,052	1,052	1,016

Standard errors in parentheses

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1