CPE

Investigating the Financial Tipping Point:

The Effect of Unmet Financial Need on Retention of First-Time, In-State Students at Kentucky Public Colleges & Universities

March 2023

Table of Contents

Executive Summary

In Kentucky and around the nation, the cost of college attendance has risen steadily over the past two decades, while total undergraduate enrollment has leveled off or declined. Kentucky has taken aggressive measures to limit tuition increases and increase state and institutional aid; nevertheless, increasing college costs may be constricting our postsecondary enrollment pipeline, with negative consequences for Kentucky's educational attainment rates and economic well-being.

Are college affordability concerns causing Kentucky students, particularly those from vulnerable populations, to be left behind?

This study aims to answer this question by probing the relationship between affordability and retention of first-time, in-state, degree-seeking students to a second year of college. Paying for college is one of the most significant obstacles students must overcome to get and keep a foot in the door that leads to credential attainment. Accordingly, the first year in college acts as a critical check-valve in the enrollment pipeline, the point at which many students decide whether to continue their studies. If affordability concerns are pricing out Kentucky students and reducing flow through the system, we expect to see a subsequent decline in retention, ultimately reducing the number of degrees produced.

In contrast to affordability research that focuses on net price, this study investigates the practical impact of affordability on first-time student retention using a measure of unmet financial need. For our purposes, unmet financial need represents the gap between college costs and what students are expected to pay on their own after accounting for any expected family contribution and financial aid (grants and scholarships)[1]. Simply put, unmet financial need signifies the out-of-pocket cost of attending college, which is often met by borrowing student loans.

This study investigates the relationship between affordability, unmet financial need, and retention to discern the precise values at which affordability concerns influence students' continued enrollment at Kentucky public institutions.

Research Questions

- How have cost of attendance, institutional aid, state aid, federal aid, and unmet financial need for first-time Kentucky students changed across institutional sectors and over time?

- How do levels of unmet financial need vary for first-time Kentucky students from different demographic backgrounds and institutional sectors?

- Does unmet financial need impact first-year to second-year retention among first-time Kentucky students?

- Across institutions, what are the critical thresholds at which unmet financial need causes the probability of first-time student retention to fall below institutional goals or cohort averages?

As a first step, we review the literature on affordability and unmet financial need. Several threads emerge in extant research that shape our expectations about the prevalence of unmet financial need and its impact on retention in Kentucky. Based on the literature, we would expect:

1. *Unmet financial need is higher among underrepresented minority (URM) and low-income Kentucky students.*

2. *Unmet financial need negatively impacts first-year to second-year retention.*

3. *Unmet financial need exerts a substantively larger impact on retention for URM and low-income students.[2]*

We test these hypotheses using a mixed-methods approach that includes trend analysis, demographic analysis, and structural equation modeling. In each of these analyses, we input indicators from an original dataset containing information about 171,270 first-time, degree-seeking Kentucky students enrolled at in-state

public institutions over the past decade. The rich variance in data - across time, context, and institutional sectors - enables us to make accurate inferences about how unmet financial need impacts first-time student retention. Key findings are summarized below.

The report concludes with a discussion of the contributions of this research and next steps. This retention model is replicable and can help postsecondary stakeholders estimate how unmet need impacts their students. These findings also contribute to growing national conversations around unmet need. Where prior studies tend to describe unmet need in specific sectors, this holistic approach investigates trends in unmet need and retention across sectors and time. In doing so, our research conclusively reveals that, regardless of sector, unmet need represents a significant affordability barrier to most students and exacerbates inequities for vulnerable populations.

We hope our findings empower postsecondary leaders with actionable business intelligence to implement strategies aimed at making higher education more accessible for Kentucky students. Moving forward, we will develop this statistical model into a predictive learning model that will help inform affordability strategies in real time. We plan to bring institutional and policy partners together to discuss the implications of this research, and, more importantly, begin the important work of reducing affordability barriers to postsecondary education in the Commonwealth.

Key Findings for Kentucky Public Institutions

- Since 2011, median cost of attendance remained flat at KCTCS and grew by 41.8% and 33.8% for first-time, degree-seeking resident students at research and comprehensive institutions, respectively.[3]

- Around 70% of first-time, degree-seeking students had some unmet need. After removing students with $0 of unmet need, the median grew from $9,323 to $11,714 for first-time students at research institutions, and from $8,880 to $9,770 at comprehensive institutions. Median unmet need declined from $8,031 to $6,391 at KCTCS.

- Institutional grants have been effective at reducing low levels of unmet need to zero for many students, but they are less likely to help the neediest students. Over the last decade, the proportion of students with zero need rose from 20.6% to 31.7%. However, the proportion of students with need higher than $15,000 increased from 7.7% to 14.5%.

- Across sectors, median unmet need was higher and had steeper consequences for first-year to second-year retention among URM and low-income students. Importantly, when unmet financial need is zero, students from vulnerable populations are as likely as their peers to be retained.

- The probability of retention decreases significantly as unmet financial need increases. The overall impact is about a 1% decline in retention likelihood per $1,000 in unmet financial need. That impact is stronger at comprehensive institutions, at about 1.5% per $1,000 in unmet financial need, and even stronger at KCTCS institutions, at about 2.4% per $1,000 in unmet financial need.

- At comprehensive institutions, $8,000 is generally the threshold at which the likelihood of retention falls below most institutional performance goals. In 2020-21, nearly 40% of students at these institutions had unmet need greater than or equal to $8,000.

- At KCTCS institutions, $5,000 is generally the threshold at which the likelihood of retention falls below institutional performance goals. In 2020-21, nearly 40% of KCTCS students had unmet need greater than or equal to $5,000.

- At research institutions, unmet financial need has become less likely to diminish the likelihood of retention below institutional goals for substantive amounts of students. This is mainly due to targeted financial aid programs around unmet need, such as the University of Kentucky's Leads (Leveraging Economic Affordability for Developing Success) initiative.[4]

Part One:
Review of National Research & Resulting Hypotheses

America's Disinvestment in Higher Education

Over the past two decades, states have disinvested in public postsecondary education, primarily due to economic recessions in 2001 and 2008. In particular, the Great Recession of 2008 caused negative labor market impacts that led to demand spikes for unemployment insurance and Medicaid (Mitchell, Leachman, and Masterson 2017; State Higher Education Executive Officers Association 2021). As states moved to fund these mandatory programs and help struggling citizens, education spending often was crowded out of budgets. Consequently, state funding for two-year and four-year public postsecondary institutions fell by approximately $7 billion over the ensuing decade (Mitchell, Leachman, and Saenz 2019).

In recent years, several states began reinvesting in education, but the COVID-19 pandemic and rising inflation created familiar budget challenges for lawmakers. As a result, education spending has yet to recover to pre-2008 levels. At the beginning of 2022, thirty-two states, including Kentucky, were still spending less on public education compared to 2008 (National Education Association 2022). On average, the spending decrease was about $1,500 per student.

Kentucky has been particularly hard hit by these budget challenges (see Figure 1). In the post-recession decade, Kentucky experienced the 13th largest decline in percent change (-25.6%) of state spending per student and the 9th largest decline in dollar amount (-$2,792) of state spending per student (Mitchell, Leachman, and Saenz 2019).[5] With the passage of the 2022 biennial budget, Kentucky made its largest investment in postsecondary education in decades. Still, as spending per student remains below pre-recession levels, a greater share of college costs has shifted onto students and their families (Council on Postsecondary Education 2022).

Understanding the impact of these budget cuts on postsecondary enrollment is increasingly of great interest to higher education researchers and policy makers. After the 2008 recession, postsecondary spending cuts triggered a 30% increase in resident tuition and fees at national universities, while total enrollment decreased by more than 10% (Kerr and Wood 2022).[6] Undergraduate enrollment has been flat in Kentucky, but median cost of attendance has increased 40%.

As postsecondary enrollment continues to fall, states are concerned about the long-term effects on their economies, workforces, and quality of life. Accordingly, we ask:

Are increasing costs of attendance causing Kentucky students, particularly those from vulnerable populations, to be left behind?

The Great Student Squeeze

In today's competitive job market, having a postsecondary credential has never been more important. Automation is fundamentally changing most industries and, as a result, employers increasingly need employees with higher level analytical skills to solve problems and social skills to articulate solutions to end users (Harvard Business School 2017). Consequently, employer recruiting tactics have changed. Rather than query each applicant about their analytical and communication abilities, many employers default to credential attainment as a proxy for a candidate's range and depth of skills (Harvard Business School 2017).

Recent workforce data shed light on these trends. In 2022, nearly half of all online job postings listed a four-year degree as a minimum requirement. Furthermore, four-year degree holders were half as likely as high school graduates to be unemployed (Association of Public and Land-Grant Universities 2022; Burning Glass Institute 2022). Many studies show that postsecondary attainment is a strong predictor of employment viability.

For credential earners, returns on educational investment have never been higher. According to Georgetown University researchers, students who earn postsecondary credentials are likely to have higher lifetime earnings than individuals with high school diplomas (Carnevale et al. 2011). Compared to a high school graduate, bachelor's and
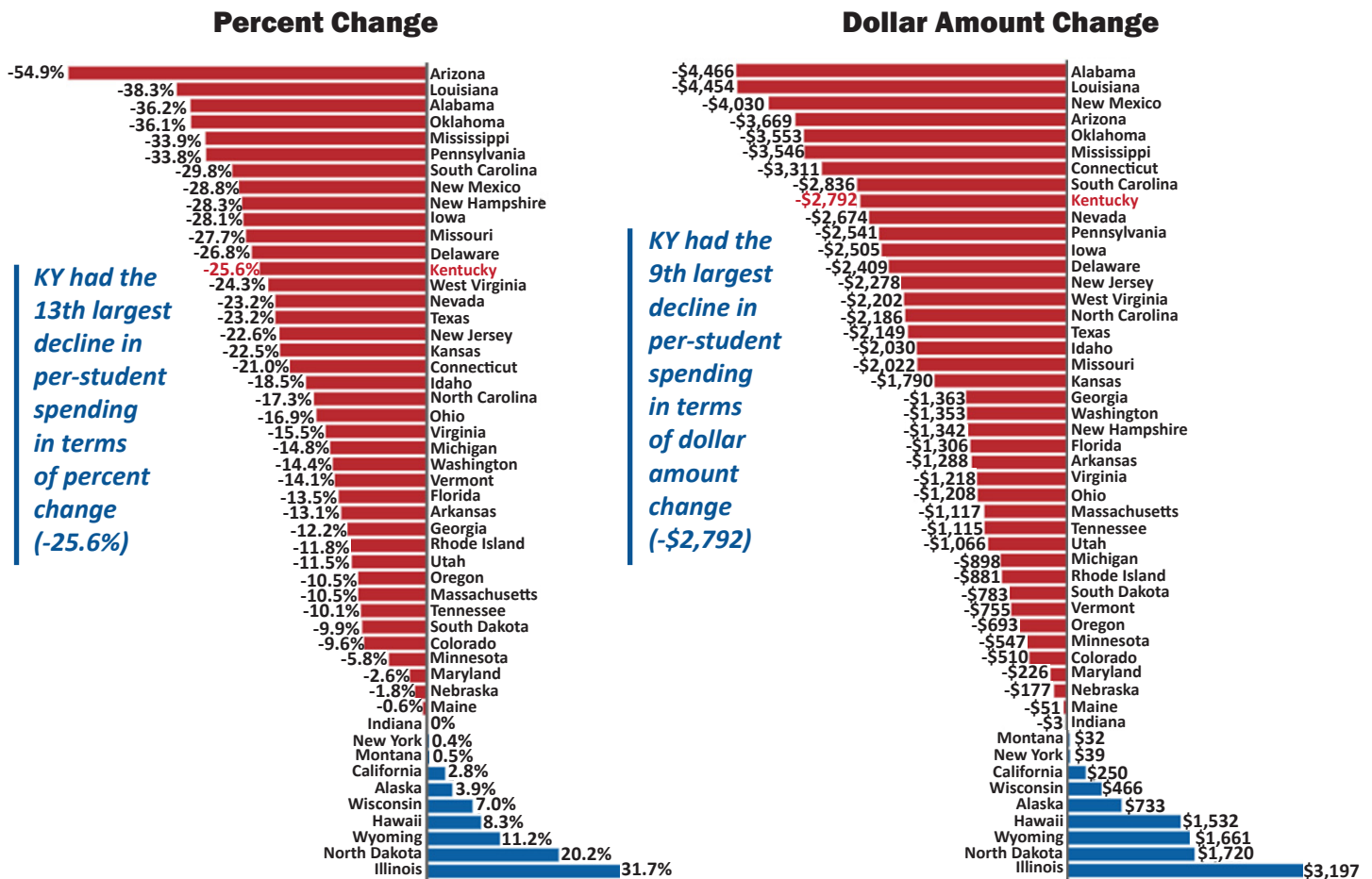
associate degree holders are projected to earn on average about $1,000,000 and $400,000 more over their lifetimes, respectively (Carnevale et al. 2011).

In Kentucky, projected earnings across attainment levels comport with these national statistics. A recent state workforce study finds that between 2010 and 2019, 53.3% of working-age Kentuckians who earned a postsecondary credential increased their earnings, compared to the 33.2% who did not earn a postsecondary credential (Kentucky Center for Statistics 2022). Both in Kentucky and around the nation, there is considerable empirical support for the conventional wisdom that postsecondary attainment is the surest path to economic mobility.[7]

Suffice it to say, it is critical that aspiring students are able to afford the postsecondary credential needed to enhance their job prospects and financial security. Years of disinvestment in higher education have left ordinary Kentucky students, like their peers across the country, between a figurative rock and a hard place. The cost of postsecondary education continues to rise, while the ability to earn sufficient wages without a postsecondary credential continues to diminish. As a result, too many students face the difficult choice of taking on onerous debt to get that ever-important credential or bypassing postsecondary education altogether.

In 2022, Kentucky legislators made the largest investment in postsecondary education in decades. It is incumbent upon us to use new resources to address the college affordability crisis.

Figure 1. Change in State Spending Per Postsecondary Student, 2008-2018

KY had the 13th largest decline in per-student spending in terms of percent change (-25.6%)

KY had the 9th largest decline in per-student spending in terms of dollar amount change (-$2,792)

Source: Center on Budget and Policy Priorities. Finance data was obtained from SHEEO's State Higher Education Finance Report.

Figure 2. Calculating Unmet Financial Need

Cost of Attendance (Set by Institution) − { **Expected Family Contribution (EFC)** + **Grant & Scholarship Aid** } = **Unmet Financial Need**

- Tuition & fees
- Room & board
- Books, supplies, transportation
- Misc. expenses

The amount students & their families are expected to pay toward college based on a formula

- Pell grants
- KEES & CAP money
- Scholarships
- Other aid students do not repay

The amount students & families must pay above & beyond EFC & financial aid (grants & scholarships)

Note: This figure was adapted from the Center for Postsecondary and Economic Success (Choitz and Reimherr 2013). The Kentucky Educational Excellence Scholarship (KEES) is a merit scholarship funded by the Kentucky Lottery. The College Access Program (CAP) is a need-based, lottery-funded scholarship.

College Affordability as a Growing Concern

A host of studies highlight that a majority of U.S. postsecondary students are concerned about college affordability and the availability of financial aid (Seftor & Turner 2002; Dynarski 2003; Dynarski 2005; Dynarski and Scott-Clayton 2008; Long 2008; Denning et al. 2017; Bettinger et al. 2019). According to a recent national survey, 70% of students indicate that concerns around affordability affected their fall enrollment decisions in 2021 (Citizens Financial Group 2021). Further, 56% of continuing students express concern that their overall cost of attendance will increase, and 43% report that their families had discussions about paying for college (Citizens Financial Group 2021).

Cumulatively, these insights suggest that college affordability is a growing concern. Unless addressed, rising college costs will continue to endanger not only the prospects of individual students, but communities and states that depend on educated workforces to thrive (Mitchell et al. 2019). .

Understanding How Unmet Need Affects First- to Second-Year Retention

As we investigate how college affordability impacts the retention of first-time Kentucky students, particularly those from vulnerable populations, our work is informed by a growing body of research on unmet financial need. As

Thomas Mortenson (1999) aptly suggests, understanding how cost of attendance impacts retention requires us to explore how bottom-line costs affect students and their families. To reach this understanding, Mortensen argues for exploring the moderating influence of unmet financial need, or the gap between college costs and what students are expected to pay out-of-pocket after accounting for expected family contribution (EFC) and financial aid. For our purposes, unmet financial need is calculated by subtracting EFC and grant and scholarship aid from the total cost of attendance (see Figure 2).

Earlier studies of college affordability primarily explore the impact of net cost of attendance on student retention. Net cost is generally understood as a student's cost of college once grants and scholarships are taken into account. This focus has led to a reliance on tuition policy as a means of moderating college costs and mitigating affordability concerns. However, Mortenson (1999) argues that unmet financial need is more influential than net cost in determining whether students choose to continue their education. He contends that unmet financial need represents the precise value at which affordability affects enrollment decisions.

Unmet Financial Need Among U.S. College Students

Accordingly, we dig deeper into national research on college affordability and unmet financial need. Analyzing data from the U.S. Department of Education, Walizer

(2018) finds unmet need is prevalent across the United States. Nearly 75% of college students have unmet financial need. On average, community college students have just under $5,000 in unmet financial need in their first year of college, and public four-year students have just over $9,000 in unmet financial need (Walizer 2018). More disturbing, a consistent conclusion in existing research is that unmet financial need is more prevalent among and costly to students from URM and low-income backgrounds (Choitz and Reimherr 2013; Saunders 2015; Walizer 2015; Walizer 2018).

Walizer (2018) highlights several summary statistics that put these inequities in stark perspective. As Figure 3 illustrates, at community colleges, 66% of white students have unmet need, but percentages for each URM category are 10% to 15% higher. Similar trends are observable

across four-year public institutions, where 59% of white students have unmet financial need, and percentages for each URM category are 13% to 17% higher. In both sectors, low-income students tend to have more unmet need than those in higher income quartiles, and URM students generally have higher levels of unmet need than non-URM peers in the same income quartile (see Figure 4 on the following page).

Figure 3. Percent of Students with Unmet Financial Need by Race/Ethnicity

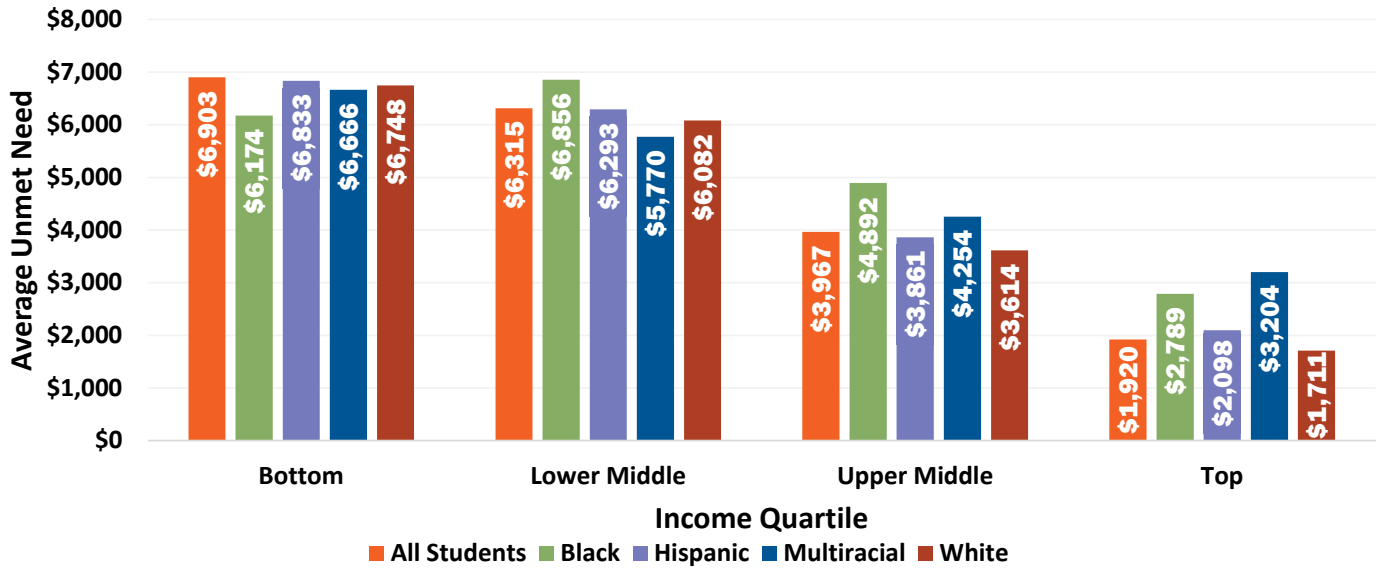### U.S. Public Two-Year Institutions
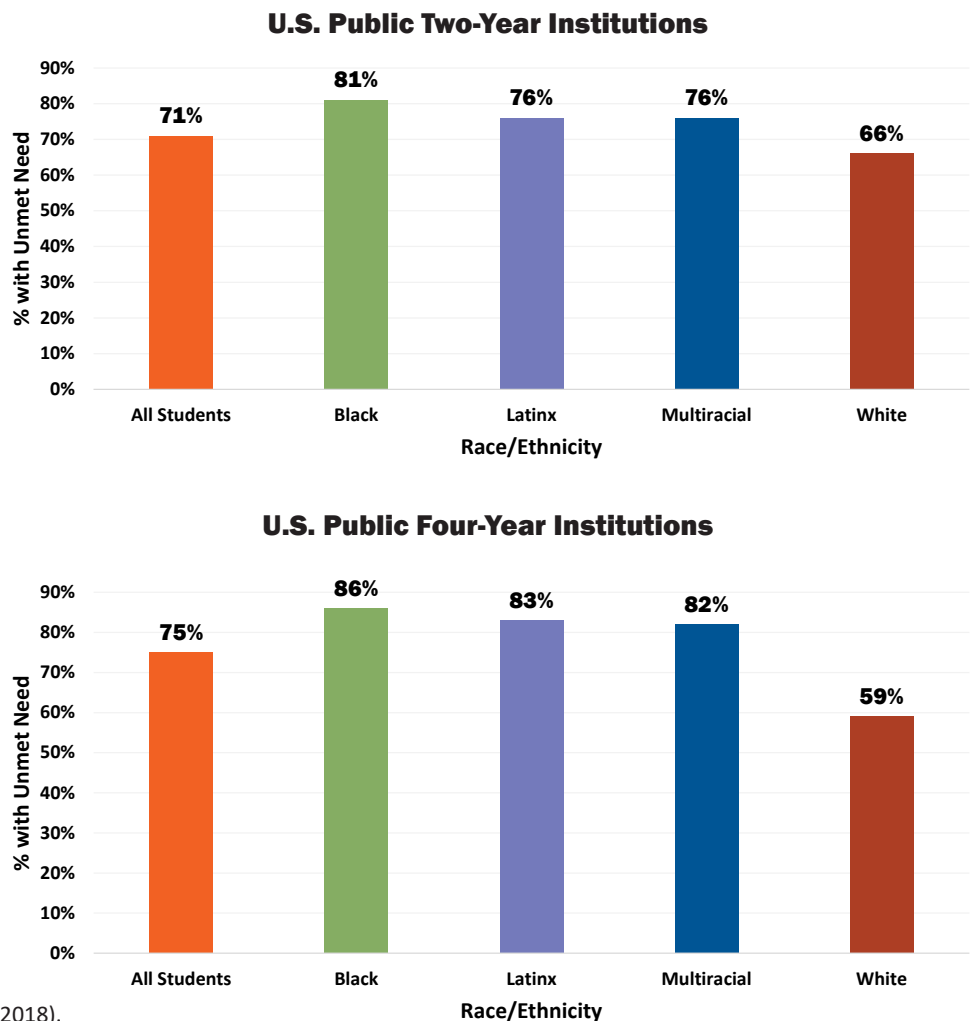
At both the two-year and four-year sectors, underrepresented minority students, especially black students, are more likely to have unmet need than white students or students overall.
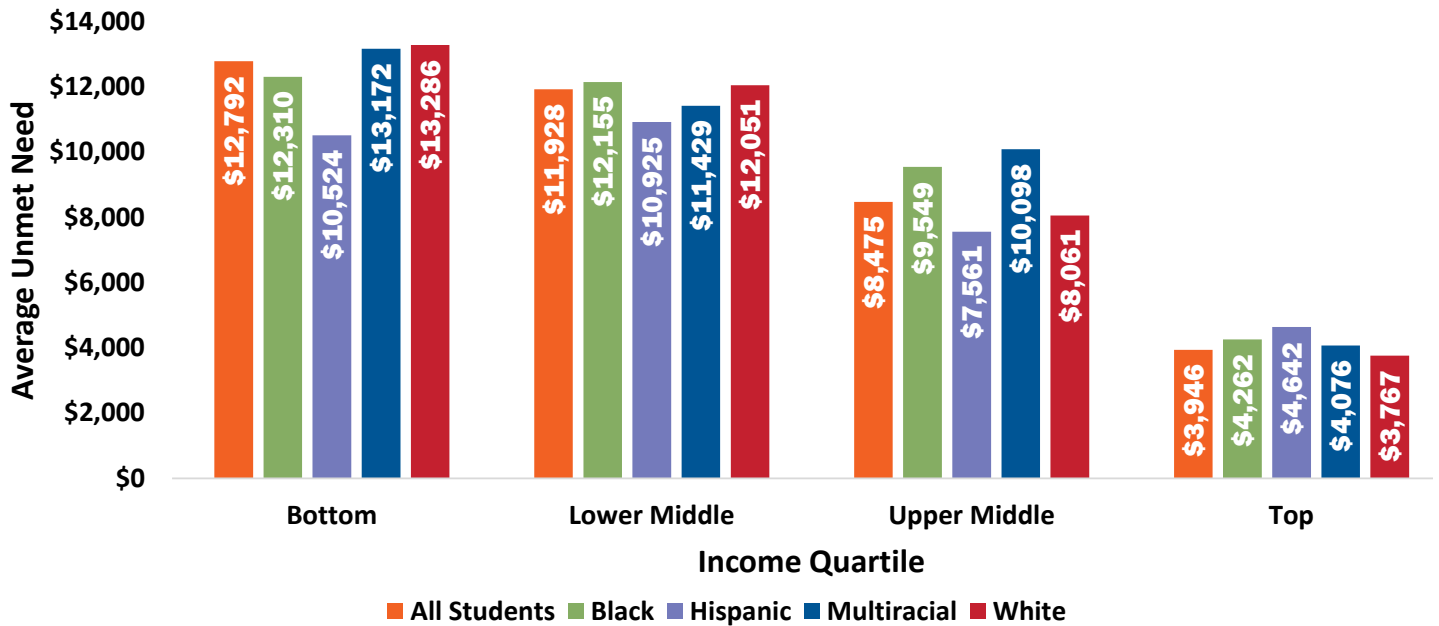
U.S. Public Four-Year Institutions

Note: These figures use data from Walizer (2018).

Figure 4. Average Unmet Need by Income Quartile and Race/Ethnicity

U.S. Public Two-Year Institutions

Bottom:
- All Students: $6,903
- Black: $6,174
- Hispanic: $6,833
- Multiracial: $6,666
- White: $6,748

Lower Middle:
- All Students: $6,315
- Black: $6,856
- Hispanic: $6,293
- Multiracial: $5,770
- White: $6,082

Upper Middle:
- All Students: $3,967
- Black: $4,892
- Hispanic: $3,861
- Multiracial: $4,254
- White: $3,614

Top:
- All Students: $1,920
- Black: $2,789
- Hispanic: $2,098
- Multiracial: $3,204
- White: $1,711

Average Unmet Need (Y-axis) vs Income Quartile (X-axis)

Legend: All Students, Black, Hispanic, Multiracial, White

U.S. Public Four-Year Institutions

Bottom:
- All Students: $12,792
- Black: $12,310
- Hispanic: $10,524
- Multiracial: $13,172
- White: $13,286

Lower Middle:
- All Students: $11,928
- Black: $12,155
- Hispanic: $10,925
- Multiracial: $11,429
- White: $12,051

Upper Middle:
- All Students: $8,475
- Black: $9,549
- Hispanic: $7,561
- Multiracial: $10,098
- White: $8,061

Top:
- All Students: $3,946
- Black: $4,262
- Hispanic: $4,642
- Multiracial: $4,076
- White: $3,767

Average Unmet Need (Y-axis) vs Income Quartile (X-axis)

Legend: All Students, Black, Hispanic, Multiracial, White

Note: These figures use data from Walizer (2018).

The pervasiveness of unmet financial need has negative implications for postsecondary student outcomes. The U.S. Department of Education suggests that high amounts of unmet need drive students to work long hours to cover college costs (U.S. Department of Education 2014; Walizer 2015). Assuming a student with high unmet need stays enrolled, working excessively can threaten their academic performance and lengthen time to a credential (Bound et al. 2012; Scott-Clayton 2012; Walizer 2015). Greater amounts of unmet need also are linked to decreased degree aspirations or "cooling out" (Sublett and Taylor 2021); decreased retention likelihood (Bresciani and Carson 2002; Benson 2018); and lower levels of completion (Benson 2018). From an alternate perspective, DesJardins and McCall (2010) conduct enrollment simulations using data from a large research university. They find that strategic injections of grant aid reduce stop-outs, increase reenrollments after stop-outs, and increase graduation rates.

Hypotheses About the Impact of Unmet Need on First-Time Students

Based on our review of existing research, we expect unmet financial need will impact retention of first-time Kentucky students in a variety of ways. First, widespread evidence suggests that minoritized and low-income students are more likely than their peers to have unmet need, and in greater amounts. At both U.S. community colleges and public universities, proportions of URM students who have unmet need are 10% to 17% higher than the share of white students with unmet need. Further, across institutional sectors, lower income students tend to have much higher unmet need, and URM students generally have more average unmet need than non-URM students across income quartiles. These empirical insights lead to our first theory:

> *Vulnerable Population Hypothesis: Among first-time, degree-seeking Kentucky students, unmet financial need is more prevalent among and costly to URM and low-income students as compared to their counterparts.*

Second, we surmise that unmet financial need is associated with a range of negative student outcomes. For example, majorities of students across the nation express concern about college affordability and report that it influences their enrollment decisions. Unmet need also is correlated with a long list of behaviors that impact retention likelihood, such as increased work hours, higher rates of indebtedness, and cooling out. Furthermore, unmet need lowers the likelihood of retention and graduation. Cumulatively, these insights lead to our second hypothesis:

> *Retention Impact Hypothesis: Among first-time, degree-seeking Kentucky students, unmet financial need has a negative impact on first-year to second-year retention.*

Finally, research shows that unmet financial need, in terms of both frequency and cost, disproportionately affects students from vulnerable populations. We expect that this inequity creates further inequitable outcomes in student retention, which leads to our third hypothesis:

> *Vulnerable Population Impact Hypothesis: Among first-time, degree-seeking Kentucky students, unmet financial need exerts a substantively stronger impact on retention among URM and low-income students than on their counterparts.*

Part Two:
Research Design & Findings for KY Public Postsecondary Sectors

Research Design

This study uses a variety of research data and methods to test these hypotheses, beginning with the vulnerable population hypothesis. We investigate our expectations by constructing affordability indicators of unmet need, cost of attendance, and various types of grant aid from an original dataset containing academic and biodemographic information about resident students enrolled at public institutions in Kentucky since 2011. The dataset is useful for tracking affordability trends, as it includes a large sample of first-time, degree-seeking students (N = 171,270) enrolled across time and institutional sectors. This rich variance enables accurate inferences about how unmet need varies across academic and biodemographic circumstances.

It is important to note here that we describe measures of central tendency for each indicator with the full sample, as well as a subsample of students having unmet financial need ≥ $1. We do this to permit intuitive comparisons, as our sample of first-time, degree-seeking students includes a large proportion of students (29.7%) with zero unmet need. These students greatly skew and reduce measures of central tendency on college affordability indicators.

Aggregate Affordability Measures (Table 1)

Median unmet financial need is an aggregate measure based on individual need calculations for each student in each academic year in the sample. For each student, unmet financial need is computed as: Cost of Attendance – (EFC + Financial Aid). Across all observations, median unmet financial need is $4,846. From 2011-12 to 2020-21, median unmet financial need decreased -23.5%, from $5,466 to $4,182. However, across students with unmet financial need ≥ $1, median unmet financial need is much higher at $7,853. From 2011-12 to 2020-21, median unmet need increased 1.3%, from $7,800 to $7,900.

Median cost of attendance derives from the cost of attendance amounts reported by Kentucky institutions in each academic year. Across all observations, median cost of attendance is $20,177. From 2011-12 to 2020-21, median cost of attendance increased 26.7%, from $18,438 to $23,364. Across students with unmet financial need ≥ $1, median cost of attendance is $19,593. From 2011-12 to 2020-21, it increased 31.0%, from $17,694 to $23,176.

Median state aid is an aggregate measure based on individual state aid, such as the Kentucky College Access Program (CAP) grant awarded to financially needy students, the KEES scholarship, the Work Ready Kentucky Scholarship, and others. Across all observations, median state aid is $2,096. From 2011-12 to 2020-21, median state aid increased 22.6%, from $1,864 to $2,286. Across students with unmet financial need ≥ $1, median state aid is $2,121. From 2011-12 to 2020-21, median state aid increased 33.1%, from $1,782 to $2,371.

Median federal aid is a collective measure of individual federal grant awards, such as the Pell grant, for each academic year. Across all observations, median federal aid is $963. Between 2011-12 and 2020-21, median federal aid decreased from $1,613 to $0. Across students with unmet financial need ≥ $1, median federal grant aid is $3,065. From 2011-12 to 2020-21, median federal grant aid increased 4.9%, from $3,025 to $3,173.

Median institutional aid is an aggregate measure that derives from institutional awards to each student in each academic year. Across all observations, median institutional aid is $0. From 2011-12 to 2020-21, median institutional grant aid increased from $0 to $1,568. Across students with unmet financial need ≥ $1, median institutional grant aid is $0. Between 2011-12 and 2020-21, median institutional grant aid increased from $0 to $714.

Individual-Level Biodemographic Measures

URM student is a dichotomous indicator that measures whether a student identifies as part of an underrepresented minority racial or ethnic group. This variable is a key component of several interaction terms used to test the vulnerable population and vulnerable population impact hypotheses. Our sample of 171,270 students includes 29,223 URM students (17.1%) and 142,047 non-URM students (82.9%).[8]

Income is a continuous indicator that measures household income as reported from institutional financial aid. This indicator also is key to our investigation of the vulnerable population hypothesis. Reported income in Kentucky ranges from $0 to $10,400,000. In our analysis, we use a categorical measure of income based on quartiles to investigate differences in unmet financial need across advantaged and disadvantaged students. The lowest income quartile ends at $28,418; the low-middle income quartile ends at $63,352; the upper-middle income quartile ends at $107,757; and the upper-income quartile ends at $10,400,000.

Trend and Demographic Analysis

Median Cost of Attendance

In large part, Kentucky trend data mirror college affordability patterns from around the country. The cost of attendance for first-time, degree-seeking Kentucky students has increased signficantly over the past decade:

- At four-year public research institutions, median cost of attendance increased from $22,300 to $31,614, or 41.8%, between 2011-12 and 2020-21 (see Figure 5).

- At four-year public comprehensive institutions, median cost of attendance rose from $17,990 to $24,064, or 33.8%, between 2011-12 and 2020-21 (see Figure 6 on page 16).

- At KCTCS, median cost of attendance remained essentially flat over the last decade, declining from $13,946 to $13,852 (see Figure 7 on page 16).

Median Unmet Need

Our Kentucky dataset also reveals that unmet financial need trends are nuanced and complex. Examining unmet financial need among all first-time, degree-

Table 1. Descriptive Statistics for Aggregate College Affordability Indicators						
Affordability Indicator	**All Students in Sample (includes those with unmet need = $0)**			**Students with Unmet Need ≥ $1**		
	Overall	**2011-12**	**2020-21**	**Overall**	**2011-12**	**2020-21**
Median Unmet Financial Need	$4,846	$5,466	$4,182	$7,853	$7,800	$7,900
Median Cost of Attendance	$20,177	$18,438	$23,364	$19,593	$17,694	$23,176
Median State Aid	$2,096	$1,864	$2,286	$2,121	$1,782	$2,371
Median Federal Aid	$963	$1,613	$0	$3,065	$3,025	$3,173
Median Institutional Aid	$0	$0	$1,568	$0	$0	$714
Observations	171,270	15,033	16,917	120,422	11,120	11,163

seeking students leads to different conclusions than just examining those with unmet financial need. Depending on the research question, either could be an acceptable approach. However, our goal is to paint a more complete picture of the magnitude and direction of unmet financial need patterns; therefore, trends for both groups are investigated. Across all students in our sample, median unmet financial need:

- increased from $3,646 to $4,524, or 24.1% at four-year public research institutions (Figure 5).

- decreased from $6,756 to $5,536, or -18.1% at four-year public comprehensive institutions (Figure 6).

- decreased from $7,614 to $4,904, or -35.6% at two-year public institutions (Figure 7).

Some of these findings may seem surprising, even contradictory, in light of steep increases in costs of attendance. However, it is important to remember that the full sample includes a large plurality (29.7%) of students with zero unmet financial need. These students greatly skew and reduce measures of central tendency.

Interestingly, our data also suggest that institutional grant awards have been effective at reducing and even eliminating costs for four-year students with low need. At two-year institutions, state aid such as the College Access

Program (CAP) grant for low-income students has had a similar effect on unmet financial need. Table 2 reveals some evidence of these patterns, as the share of all students with zero unmet need has increased by 11.1%, while the proportion of students with increasing levels of unmet need has generally declined.[9]

We also can surmise that grant aid efforts do little to help students with high unmet need. Since 2011-12, the number of students with $15,000 or more in unmet need increased by nearly 1,700 students or 6.8%.

When removing the nearly 30% of students with zero unmet financial need, these data tell a much different story about trends over time. Between 2011-12 and 2020-21, median unmet financial need:

- increased from $9,323 to $11,714, or 25.1% at four-year research institutions (Figure 5).

- increased from $8,880 to $9,770, or 10.0% at four-year comprehensive institutions (Figure 6).

- decreased from $8,031 to $6,391, or -20.4% at KCTCS (Figure 7).

Table 2. Distribution Across Increments of Unmet Need in AY 2011-12 and AY 2020-21

Unmet Need Amount	AY 2011-12		AY 2020-21	
	Number	Percent	Number	Percent
$0	5,357	20.6%	7,978	31.7%
$1 to $2,499	1,826	7.0%	1,600	6.3%
$2,500 to $4,999	2.666	10.2%	2,717	10.8%
$5,000 to $7,499	3,504	13.5%	2,779	11.0%
$7,500 to $9,999	5,081	19.5%	2,705	10.7%
$10,000 to $12,499	3,557	13.7%	2,242	8.9%
$12,500 to $14,999	2,061	7.9%	1,530	6.1%
$15,000 or more	1,996	7.7%	3,652	14.5%
Observations	26,048	100.0%	25,203	100.0%

Unmet Need across Race/Ethnicity and Income

URM Students

Findings from the demographic analysis also align with existing scholarship on unmet financial need. We consistently find, across institutional sectors, that unmet financial need is more costly to and prevalent among URM students compared to their counterparts (see Figure 8 on page 17).

- At four-year public research institutions, median unmet need is substantively larger among students who identify as Black ($6,750), Hispanic ($7,503), or as two or more races ($6,041), compared to those who identify as Asian ($6,540) or White ($3,926).

- At four-year public comprehensive institutions, median unmet need is much larger among students who identify as Black ($10,804), Hispanic ($8,312), or as two or more races ($8,981), compared to those who identify as Asian ($5,275) or white ($4,862).

- At two-year public institutions, the song remains the same: Median unmet need among students who identify

as Black ($6,835), Hispanic ($5,375), or as two or more races ($5,469) outpaces median unmet need among those who identify as Asian ($4,719) or White ($3,896).

As a secondary test of the relationship between unmet financial need and URM status, we cross-tabulate URM status with a seven-point categorical measure of unmet financial need based on practical $2,500 increments. These findings further corroborate the inequity caused by unmet financial need (see Table 3 page 18). Across sectors, larger proportions of URM students appear in each of the four highest brackets of unmet financial need compared to non-URM students:

- At public research institutions, 47.5% of URM students had $7,500 or greater unmet financial need compared to 41.0% of non-URM students.

- At public comprehensive institutions, 64.2% of URM students had $7,500 or greater unmet financial need compared to just 39.4% of non-URM students.

- Across KCTCS, 37.6% of URM students had $7,500 or greater unmet financial need compared to just 21.2% of non-URM students.

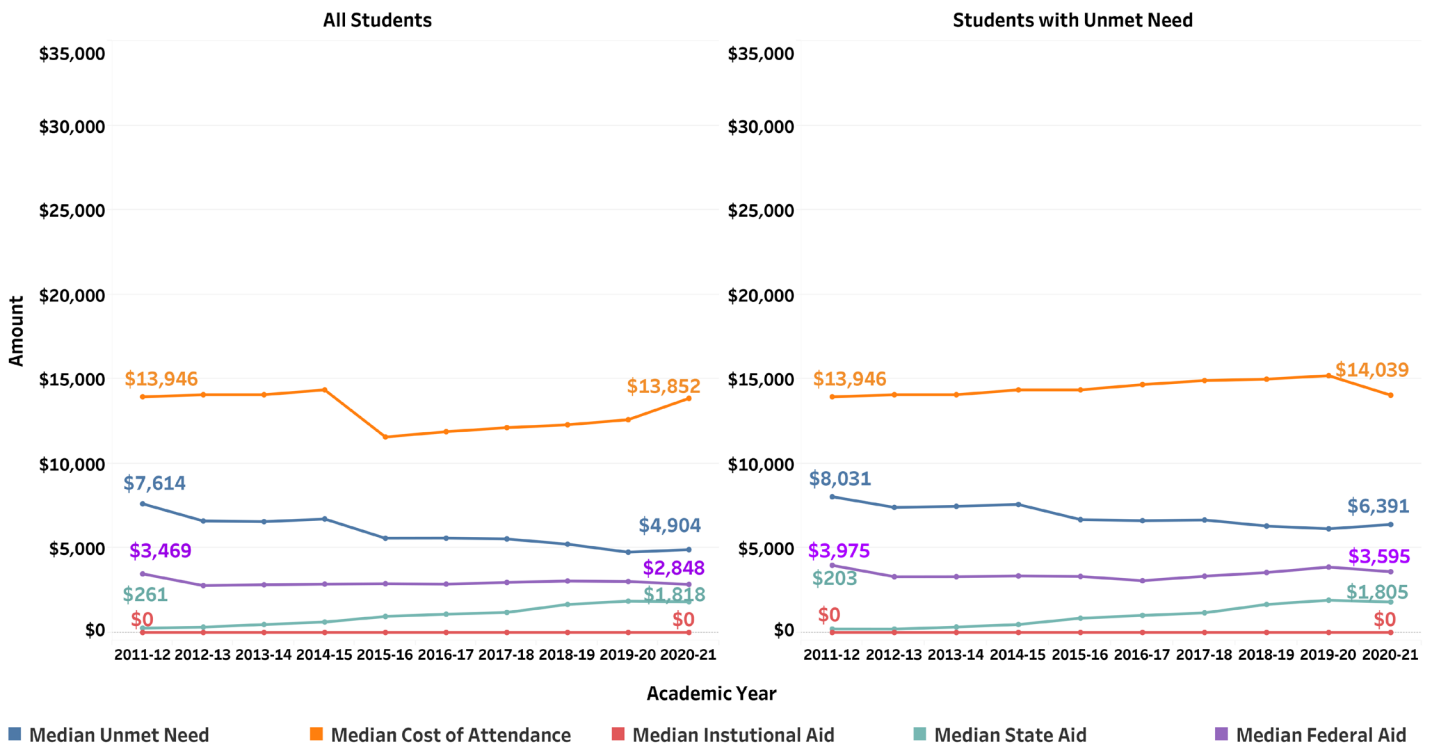## Figure 5. Trends in Unmet Need, COA & Grant Aid at Four-Year Research Institutions
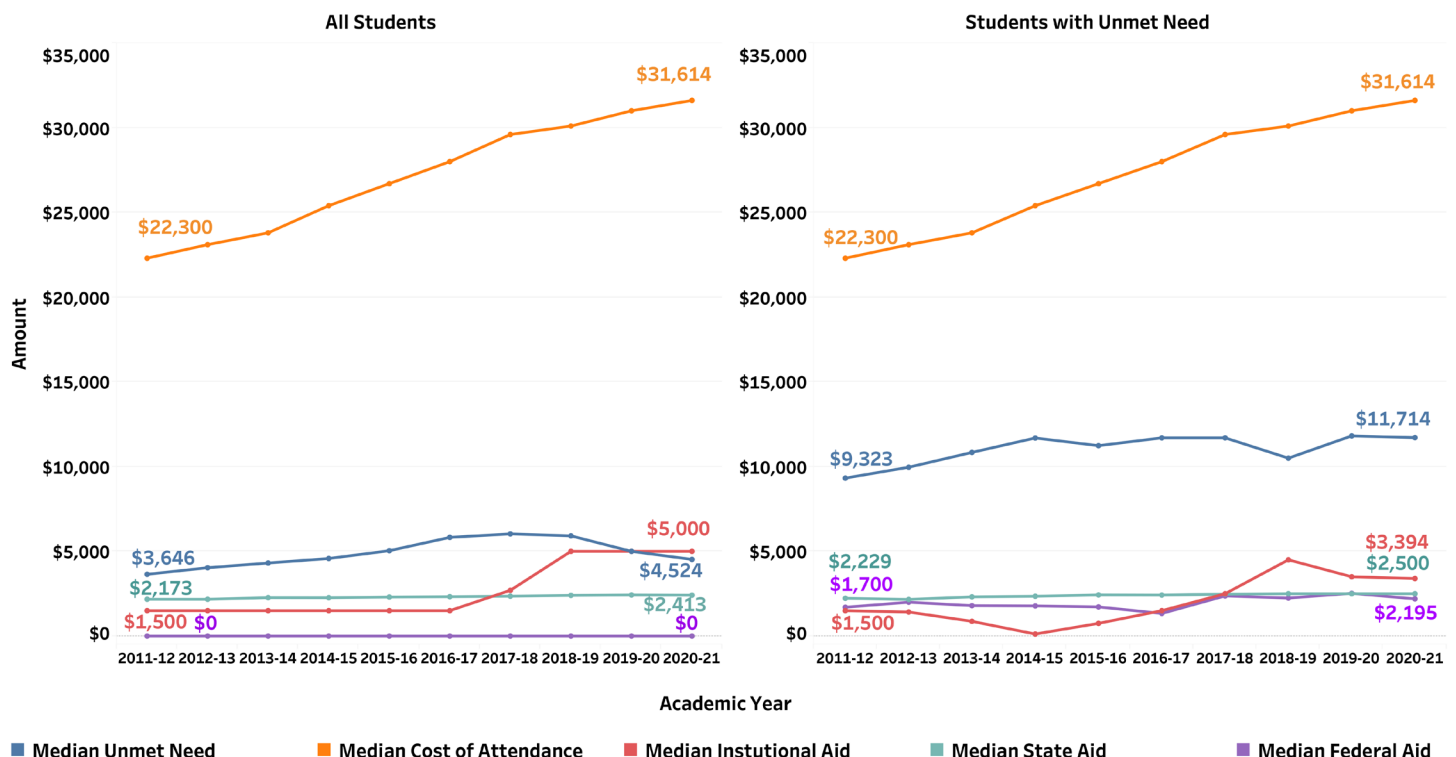
Note: In the left figure, the sample includes all first-time, degree-seeking, in-state students who filed a FAFSA and enrolled in a public, 4-yr. research institution in KY. The right figure restricts the sample to students with unmet need greater than or equal to $1.

Figure 6. Trends in Unmet Need, COA & Grant Aid at KY Four-Year Comprehensive Institutions
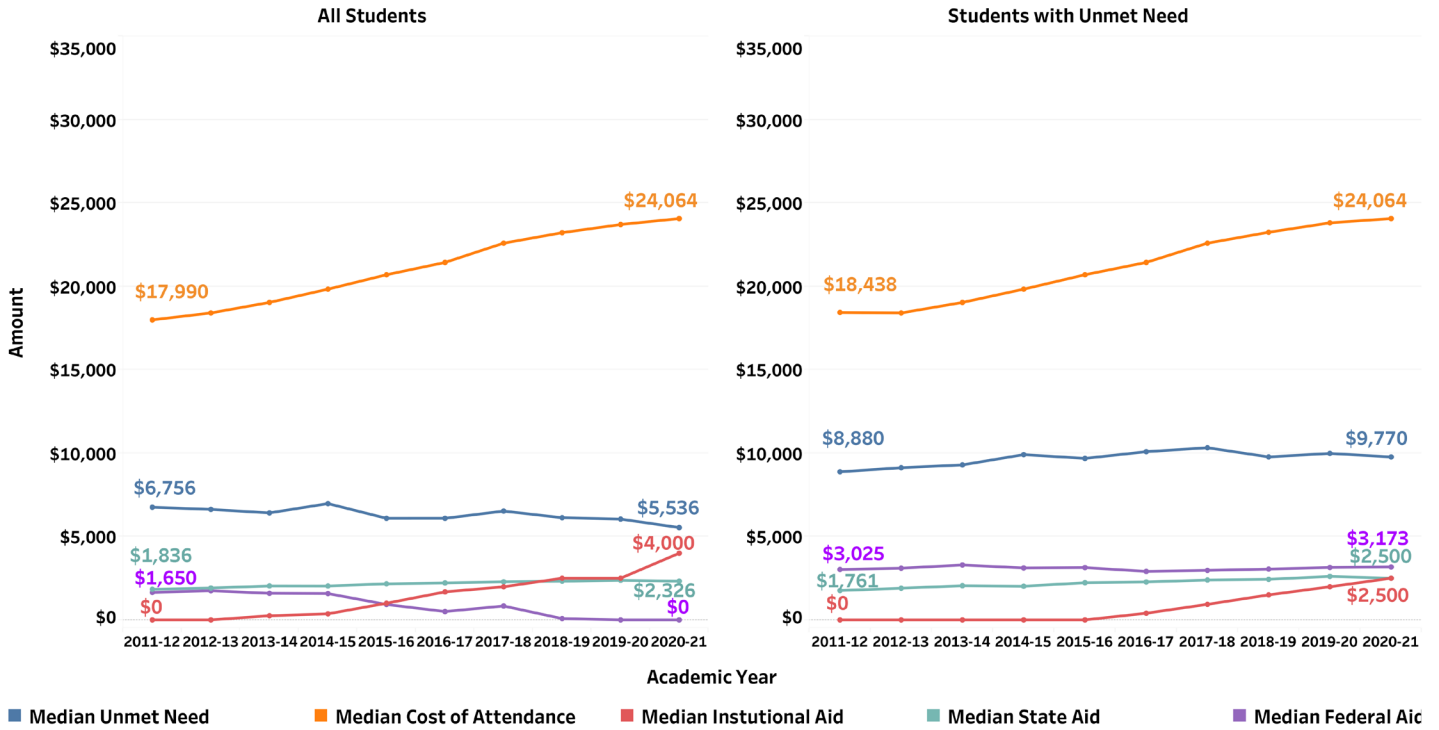
Note: In the left figure, the sample includes all first-time, degree-seeking, in-state students who filed a FAFSA and enrolled in a public, comprehensive institution in KY. The right figure restricts the sample to students with unmet need greater than or equal to $1.

Figure 7. Trends in Unmet Need, COA & Grant Aid at KY Two-Year Institutions

Note: In the left figure, the sample includes all first-time, degree-seeking, in-state students who filed a FAFSA and enrolled in a public, KCTCS institution in KY. The right figure restricts the sample to students with unmet need greater than or equal to $1.

Cumulatively, these findings offer the first piece of supporting evidence for the vulnerable population hypothesis.

Low-Income Students

We also find unmet financial need is more prevalent and costly to low-income students across sectors (see Figure 9 on page 19).

- At four-year research institutions, students in the lowest income quartile have a median unmet financial need of $12,177, compared to $10,517, $134, and $0 as we move across higher income quartiles.

- At four-year comprehensive institutions, median unmet financial need is $10,467 among students in the lowest income quartile, compared to $9,355, $3,253, and $0 in subsequently higher income quartiles.

- Across KCTCS institutions, median unmet financial need is $6,670, $5,594, $4,139, and $0 moving from the lowest income quartile to the highest.

This evidence also supports the vulnerable population hypothesis.

SEM Model: Data and Methods

To test the retention impact and vulnerable population impact hypotheses, we use structural equation modeling (SEM). SEM is an ideal statistical modeling tool for understanding how multiple interrelated factors, particularly unmet financial need, operate together to structure retention (Hoyle 1995; Kline 1998; de Carvahlo and Chima 2014). For example, students' demographic backgrounds are likely to influence their retention. However, this relationship is probably moderated at several steps along the way: demographic background likely influences college preparedness and success in high school, which later influences first-year college success and access to financial aid. Cumulatively, all these factors influence the student's likelihood of retention.

Whereas a parsimonious regression model would assume that all indicators operate on retention independently (see Figure 10 on page 19), potentially causing signs and significance to flip, SEM was designed to help map out the complex and structural ways academic, financial, and demographic factors shape retention (see Figure 11 on page 20).

Figure 8. Median Unmet Need by Race/Ethnicity & Sector, AY 2011-12 to AY 2020-21
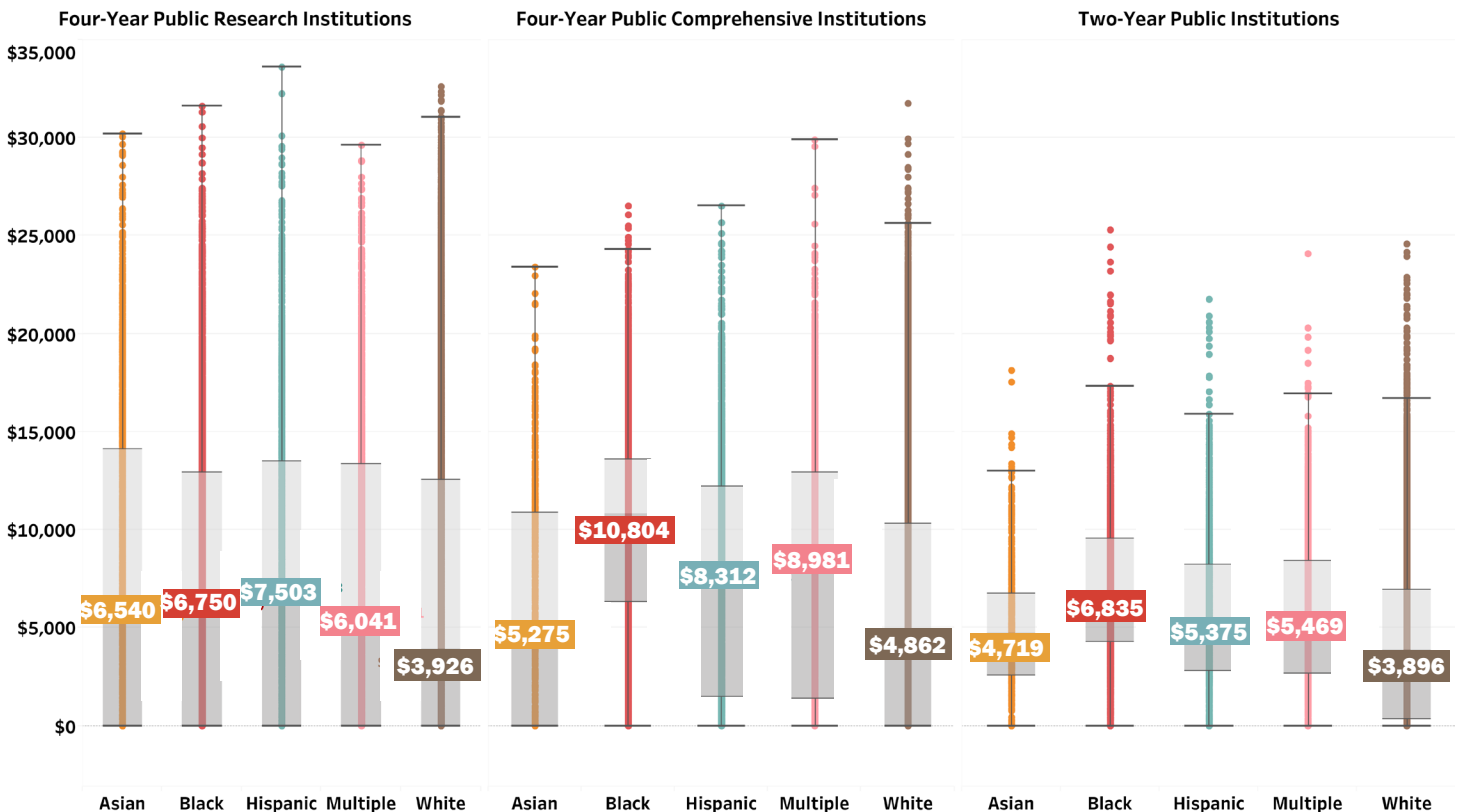
Dependent Variable

Second-year retention is a dichotomous indicator that measures whether students are enrolled in the fall term a year after enrolling as a first-time, degree-seeking student. As we proceed with our investigation, we estimate how several factors, including unmet financial need, influence the probability of second-year retention. In our sample of 171,270 students, 118,860 (69.4%) returned for a second year; 52,410 (30.6%) did not return.

Primary Independent Variable

Unmet financial need is a continuous indicator that measures the amount of unmet financial need for each first-time, degree-seeking student. Again, unmet financial need is calculated for each student as: Cost of Attendance – (Expected Family Contribution + Financial Aid). We do not include loans that need to be repaid because, in most cases, students take out loans to cover unmet need. Therefore, including loans in the calculation would underestimate the burden of unmet financial need. For the entire sample, unmet financial need ranges from $0 to $55,252. The median is $4,846, and the mean is $5,925. This indicator directly tests the retention impact hypothesis.

Covariates

URM student is a dichotomous indicator that measures whether a student identifies as a member of an underrepresented minority racial or ethnic group. Our sample of 171,270 students includes 29,223 URM students (17.1%) and 142,047 non-URM students (82.9%). We interact this variable with unmet financial need to test the vulnerable population impact hypothesis.
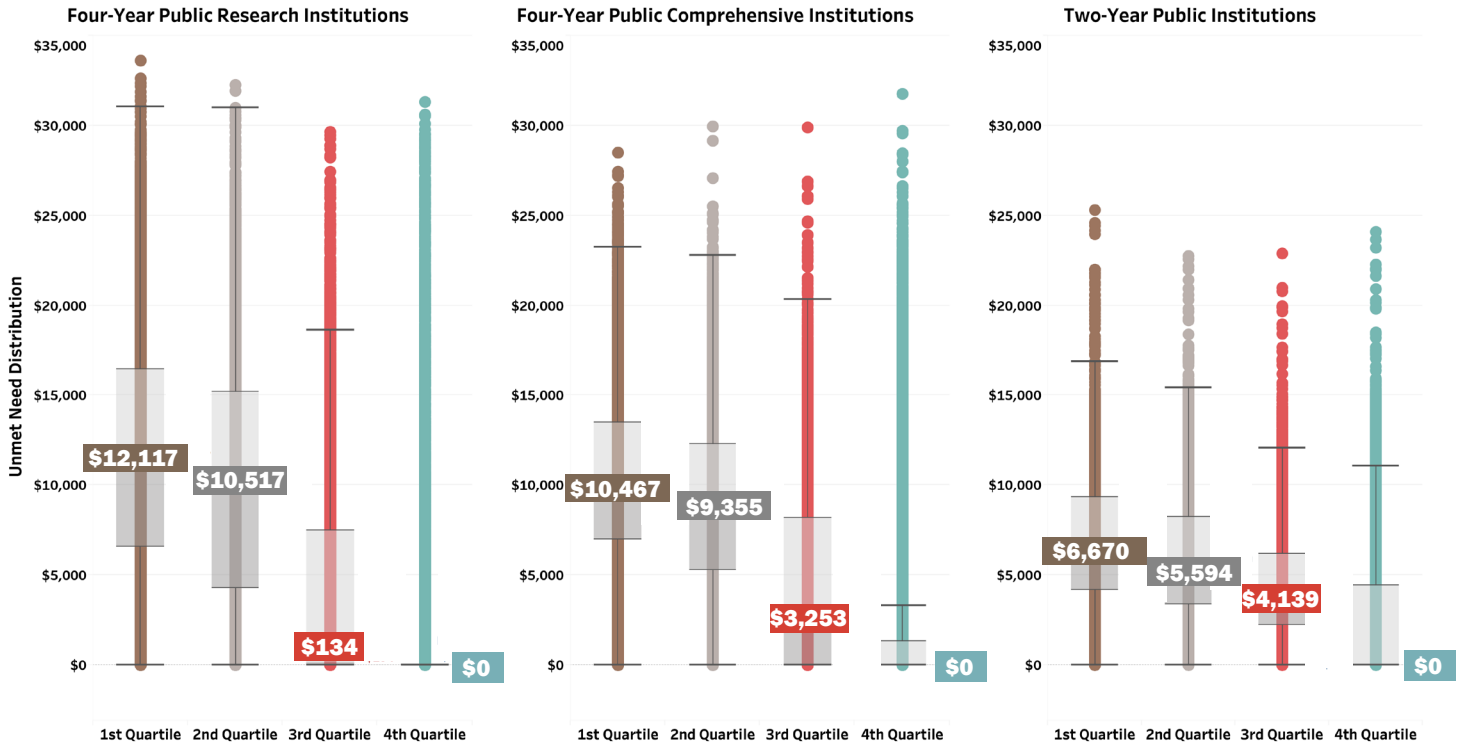
Female is a three-point categorical measure of gender that indicates whether an individual is defined on their student record as gender unknown (0), male (1) or female (2). This indicator is included to account for the likelihood that females are retained at higher rates compared to their counterparts (Kentucky Council on Postsecondary Education 2021). Our sample of 171,270 students includes 210 students whose gender is unknown (0.1%), 71,920 males (42.0%), and 99,140 females (57.9%).

Eastern Kentucky student is a dichotomous indicator that measures whether a student comes from the eastern region of the state, which generally experiences higher poverty levels and lower college-going rates. We include this measure to account for the likelihood that underserved Eastern Kentucky students are retained at lower rates than their counterparts in other regions.[10]
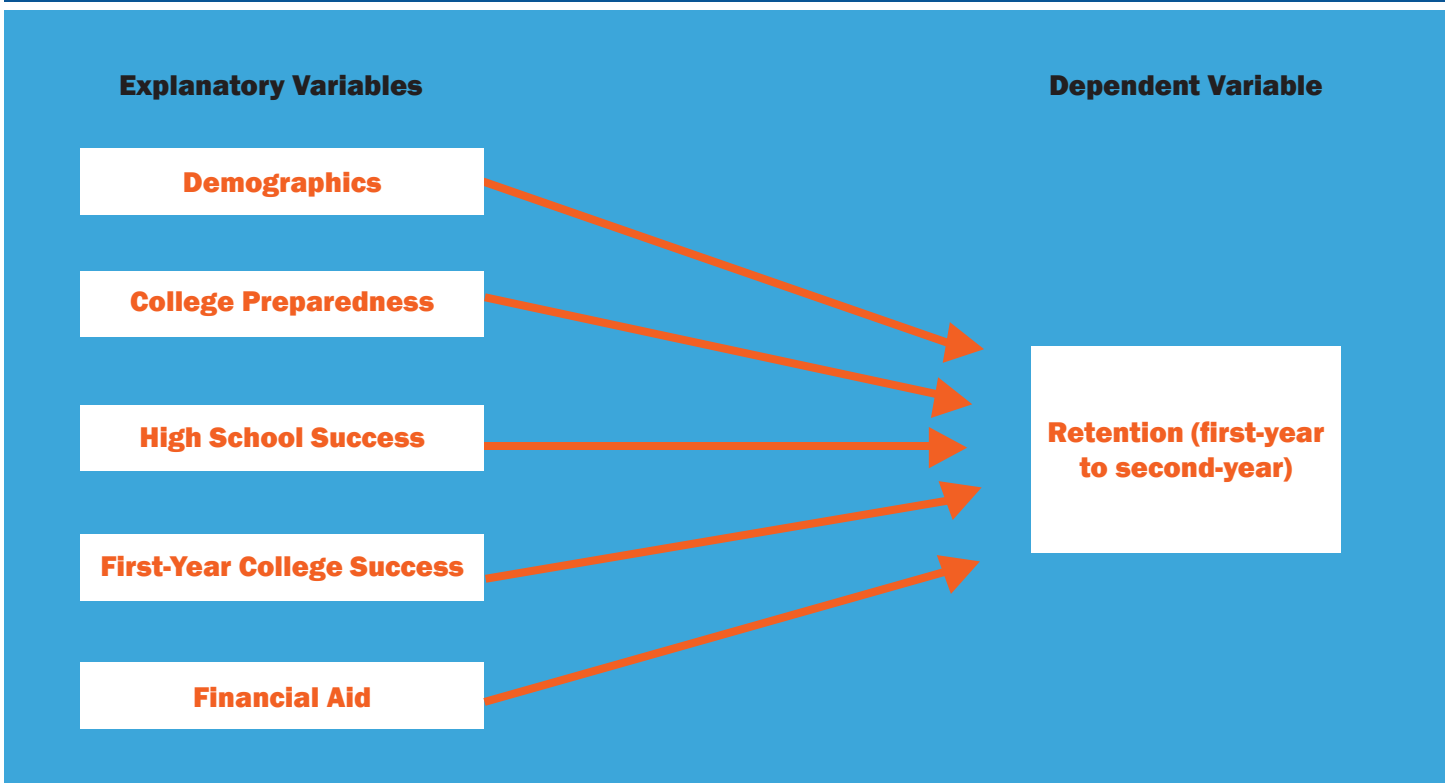
Table 3. Distribution of Unmet Financial Need by URM Status, AY 2011-12 to 2020-21

Unmet Need Amount	4-Year Public Research		4-Year Public Comp.		2-Year Public	
	URM	Non-URM	URM	Non-URM	URM	Non-URM
$0	27.5%	40.3%	15.0%	33.8%	9.7%	23.7%
$1 to $2,499	7.8%	5.7%	5.6%	7.6%	8.4%	13.5%
$2,500 to $4,999	8.4%	6.6%	7.1%	9.0%	20.3%	22.3%
$5,000 to $7,499	8.7%	6.5%	8.1%	10.3%	24.0%	19.4%
$7,500 to $9,999	9.4%	7.5%	13.3%	12.6%	19.7%	12.1%
$10,000 to $12,499	10.4%	8.2%	20.8%	12.2%	12.4%	6.7%
$12,500 to $14,999	9.4%	8.7%	16.0%	8.0%	4.5%	2.1%
$15,000 or more	18.3%	16.6%	14.1%	6.6%	1.0%	0.3%
Observations	9,085	36,888	10,663	60,281	9,475	44,878

Figure 9. Median Unmet Need by Income & Sector, AY 2011-12 to AY 2020-21

Four-Year Public Research Institutions

Unmet Need Distribution

1st Quartile: $12,117
2nd Quartile: $10,517
3rd Quartile: $134
4th Quartile: $0

Four-Year Public Comprehensive Institutions

1st Quartile: $10,467
2nd Quartile: $9,355
3rd Quartile: $3,253
4th Quartile: $0

Two-Year Public Institutions

1st Quartile: $6,670
2nd Quartile: $5,594
3rd Quartile: $4,139
4th Quartile: $0

Figure 10. Example of OLS Regression Retention Model

Explanatory Variables

- Demographics
- College Preparedness
- High School Success
- First-Year College Success
- Financial Aid

Dependent Variable

- Retention (first-year to second-year)

Figure 11. Example of Proposed SEM Retention Model
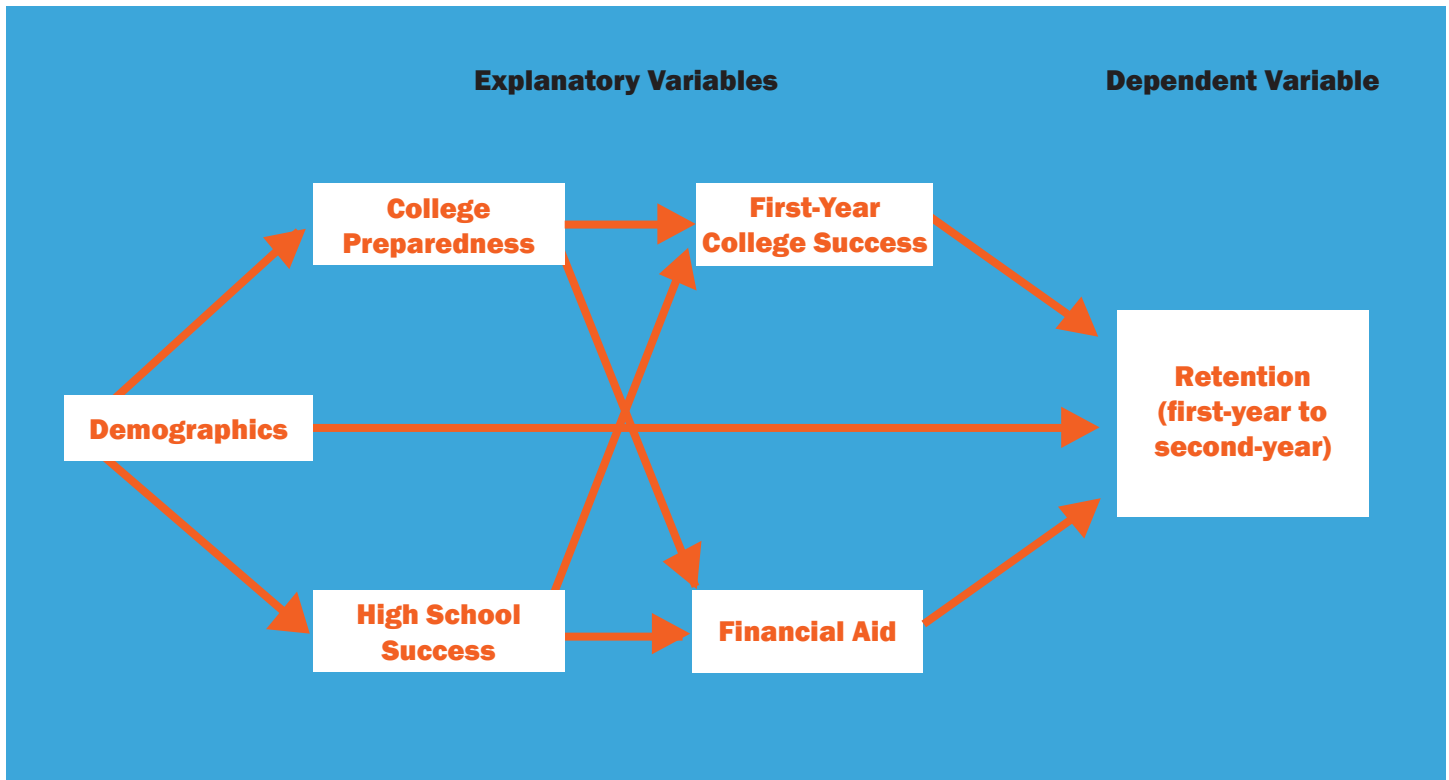
As a reminder, our sample only includes in-state students. Out of 171,270 students, 26,408 (10.0%) are from Eastern Kentucky; 154,862 (90.0%) are from other Kentucky regions.

Dual credit student is a binary indicator that measures whether a student was enrolled in dual credit courses prior to enrolling as a first-time freshman in college. Our sample of 171,270 students includes 83,427 (48.7%) who took dual credit courses and 87,843 students (51.3%) who did not. We include this measure to account for the likelihood that dual credit students will experience higher rates of first-year success and retention (Kentucky Council on Postsecondary Education 2021).

Underprepared student is a dichotomous indicator that measures whether a student falls below established benchmarks of college readiness. Our sample of 171,270 students includes 46,408 underprepared students (27.1%) and 124,756 students not identified as underprepared (72.9%). This measure is included to account for the likelihood that underprepared students are less likely to be retained.

Full-time student is a dichotomous indicator that measures whether a student was enrolled full-time or part-time during their first academic year. The sample of 171,270 students includes 157,517 full-time students (92.0%) and 13,753 part-time students (8.0%). We include this measure to control for the probability that full-time students are more likely to return for their second year.

Sector is a three-point categorical indicator that measures the institutional context in which a student was enrolled. Accounting for student enrollment across sectors enables us to understand how enrollment at a research university (1), comprehensive university (2), or two-year community college (3) influences retention. In our sample of 171,270 students, 45,973 students (26.8%) were enrolled at research universities, 70,944 (41.4%) at four-year comprehensive institutions, and 54,353 (31.7%) at two-year community and technical colleges.[11]

SEM Analysis Findings

Results from the SEM model offer strong evidence in support of our hypotheses.[12] However, the model also helps us understand the antecedent factors that structure unmet need amounts across the student sample; accordingly, we begin our discussion of the model estimates there.[13] Figure 12 illustrates our model variables at three levels, based on their temporal order, to help guide the discussion. From level one to level two, our model estimates that:

- URM students have a lower likelihood of previous dual credit experience and a higher likelihood of being underprepared than non-URM students. All else constant, the likelihood that URM students have dual credit experience while in high school is 36.2%, compared to 51.3% for non-URM students. The likelihood that URM students are underprepared for college is 44.7%, compared to 23.4% for non-URM students.

- Compared to males, female students are much more likely to enroll in dual credit courses and are far less likely to enter college underprepared. All else constant, females have a 51.8% likelihood of enrolling in dual credit classes, compared to a 25.3% likelihood for males. Females have a 28.1% likelihood of being underprepared, compared to a 51.1% likelihood for males.

- Although Eastern Kentucky students are moderately more likely than students from other regions to have dual credit experience in high school (60.9% versus 47.3%), they have a 36.3% likelihood of being underprepared for postsecondary education, compared to a 25.5% likelihood among non-Eastern Kentucky students.

Moving from level two to level three, our model estimates that students who took dual credit classes in high school are more likely to be successful academically, enroll full-time, and have less unmet need in their first postsecondary year than those who did not participate in dual enrollment. All else constant:

- Dual credit students are likely to have a 0.25-point higher GPA in their first year compared to non-dual credit students.

- Dual credit students are likely to have $837 less in unmet financial need compared to non-dual credit students. They also are slightly more likely to enroll full-time (94.7% versus 92.3%).

- Underprepared students are likely to have first-year GPAs that are 0.75 point lower than those not identified as underprepared. Additionally, underprepared students are less likely to enroll full-time (84.1% versus 95.5% for prepared students), and they average $1,563 more in unmet financial need compared to their counterparts.

Moving from the third level to the outcome variable, we find that students with higher GPAs are more likely to return for their second year compared to those with lower GPAs. For simplicity's sake, we explore this relationship by

Figure 12. Factors that Structure Retention of First-Time, Degree-Seeking KY Students
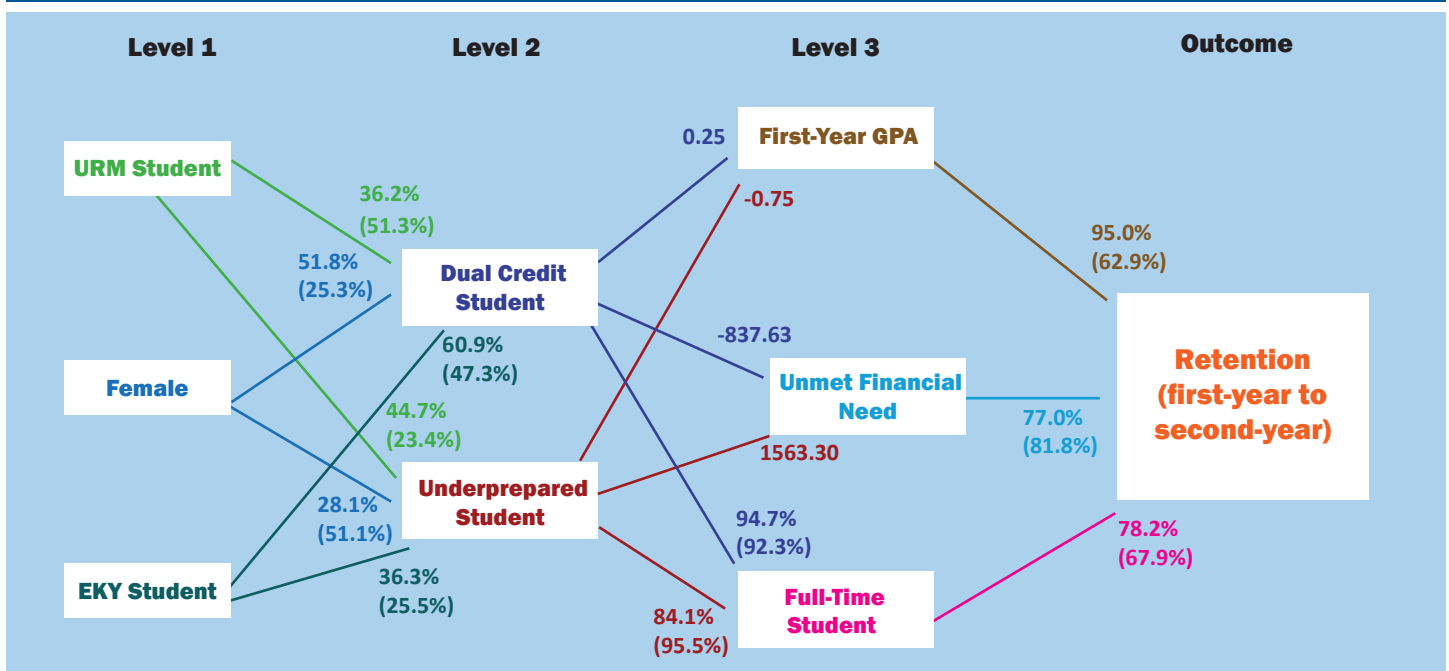
Note: At each stage, where the outcome variable is dichotomous, we provide the predicted probabilities' "success" on the outcome variable for the listed predictor and a reference group in parentheses. For example, all else constant, a student from Eastern Kentucky (EKY student) has a 36.3% probability of being underprepared, compared to a 25.5% probability for non-EKY students. Where the outcome variable is continous, we report regression coefficients for simple interpretation. For example, on average, underprepared students are likely to have a 0.75-point lower GPA than students who are not underprepared. Each relationship in the model is significant at the p < .01 level.

comparing the probability of retention for students with 4.0 GPAs to that of students with 2.0 GPAs. Our model estimates that students with a 4.0 GPA are 95.0% likely to return for their second year, compared to just a 62.9% likelihood for students with a 2.0 GPA. Our model also estimates that full-time students are moderately more likely to be retained for a second year than part-time students. Full-time students are 78.2% likely to return for a second year, while part-time students are just 67.9% likely to return. Finally, we find that students with higher levels of unmet financial need are less likely to return for their second year.

For a quick interpretation of this relationship, we compare predicted probabilities of retention for students with $0 and $5,000 in need. Our model estimates that students with $5,000 in unmet final need have a 77.0% likelihood of returning for their second year, whereas students with $0 in unmet financial need have an 81.8% likelihood of returning.

From this quick comparison, we observe that each $1,000 increase in unmet financial need decreases the likelihood of retention by about 1.0%.

This evidence strongly supports the retention impact hypothesis.

In summary, working through the structural relationships in our SEM model helps illustrate the negative consequences unmet financial need has for retention, as well as the antecedent factors that make some students more likely to have unmet need. Ultimately, this process suggests how we might leverage live data in the future to target initiatives that help improve retention among students most likely to stop-out due to financial barriers.

For example, our model estimates that there are direct relationships between unmet need and coming from a low-income, URM, and/or Eastern Kentucky background (not pictured); however, we also can see how these life circumstances predict lower likelihoods of prior high school success and preparedness, which moderate and intensify the likelihood of having unmet need. As we continue to unpack our SEM model and investigate the relationship between unmet need and retention across institutional sectors and time, we pay close attention to these demographic inferences.

Unmet Need and Retention across Sectors, Years, and Demographics

In this section, we estimate and present predicted probabilities of retention as a function of unmet financial need across institutional sector, time, and demographics. To guide this discussion, Figures 13, 14, and 15 plot second-year retention likelihood at four-year public research institutions, four-year public comprehensive institutions, and two-year public institutions at each $1,000 increment of unmet financial need. (For institution-level analysis, visit the CPE website.)
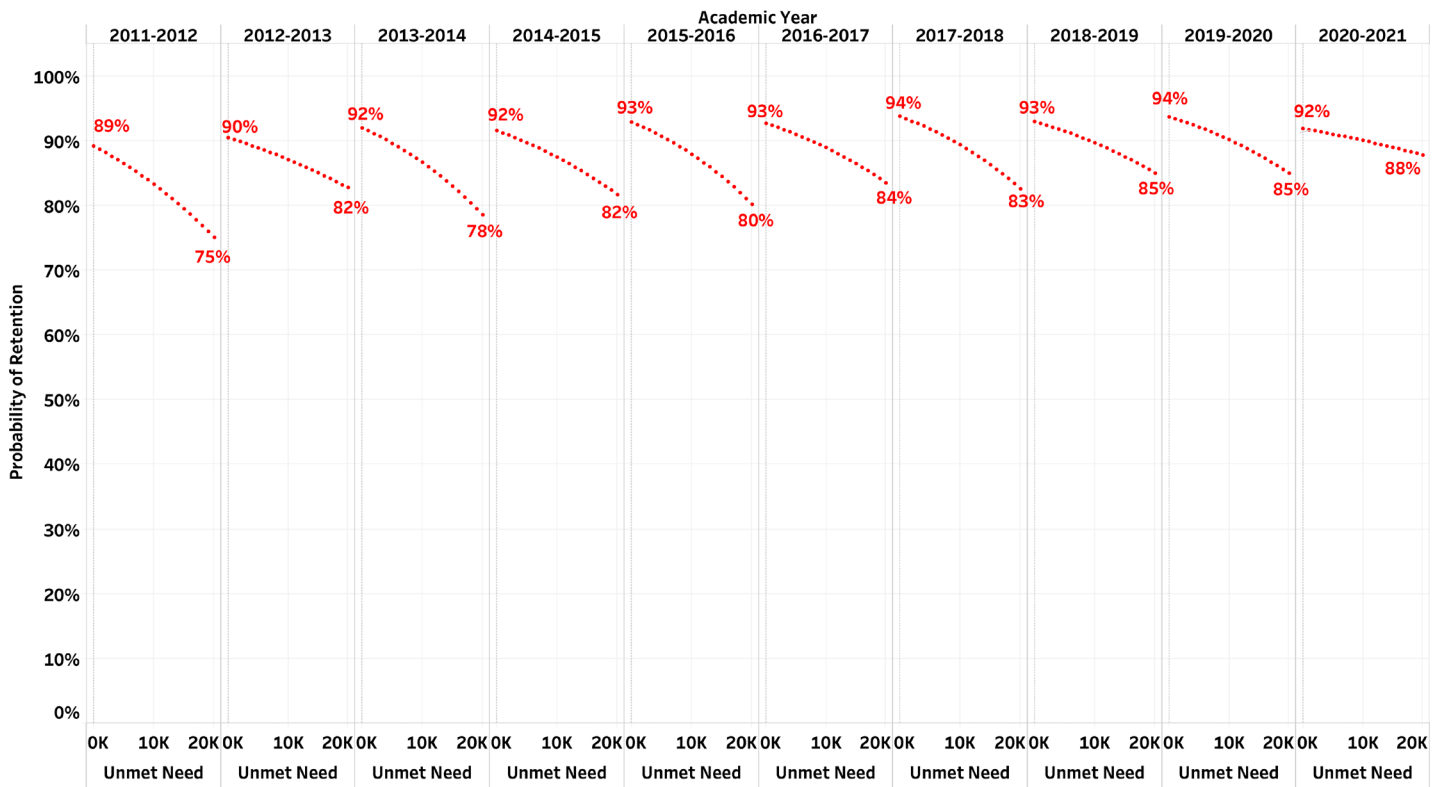
The predicted probability plots provide unambiguous evidence of the negative effect unmet financial need has on the retention of first-time, degree-seeking Kentucky students. For example, in 2011-12, students who were enrolled at research institutions and had no unmet need had an 89% likelihood of returning for a second year, compared to an 87% retention likelihood at $5,000 of unmet need, an 83% likelihood at $10,000 of unmet need, a 79% likelihood at $15,000 of unmet need, and a 75% likelihood at $20,000 of unmet need.

Over time, this impact has flattened due to programs like UK LEADS, implemented in 2016-17, that provide grants to students most likely to return when their unmet financial need is reduced (see note 4). By 2020-21, students with no unmet financial need were 92% likely to return, compared to a 91% likelihood at $5,000 of unmet need, a 90% likelihood at $10,000 of unmet need, a 89% likelihood at $15,000 of unmet need, and an 87% likelihood at $20,000 of unmet need.
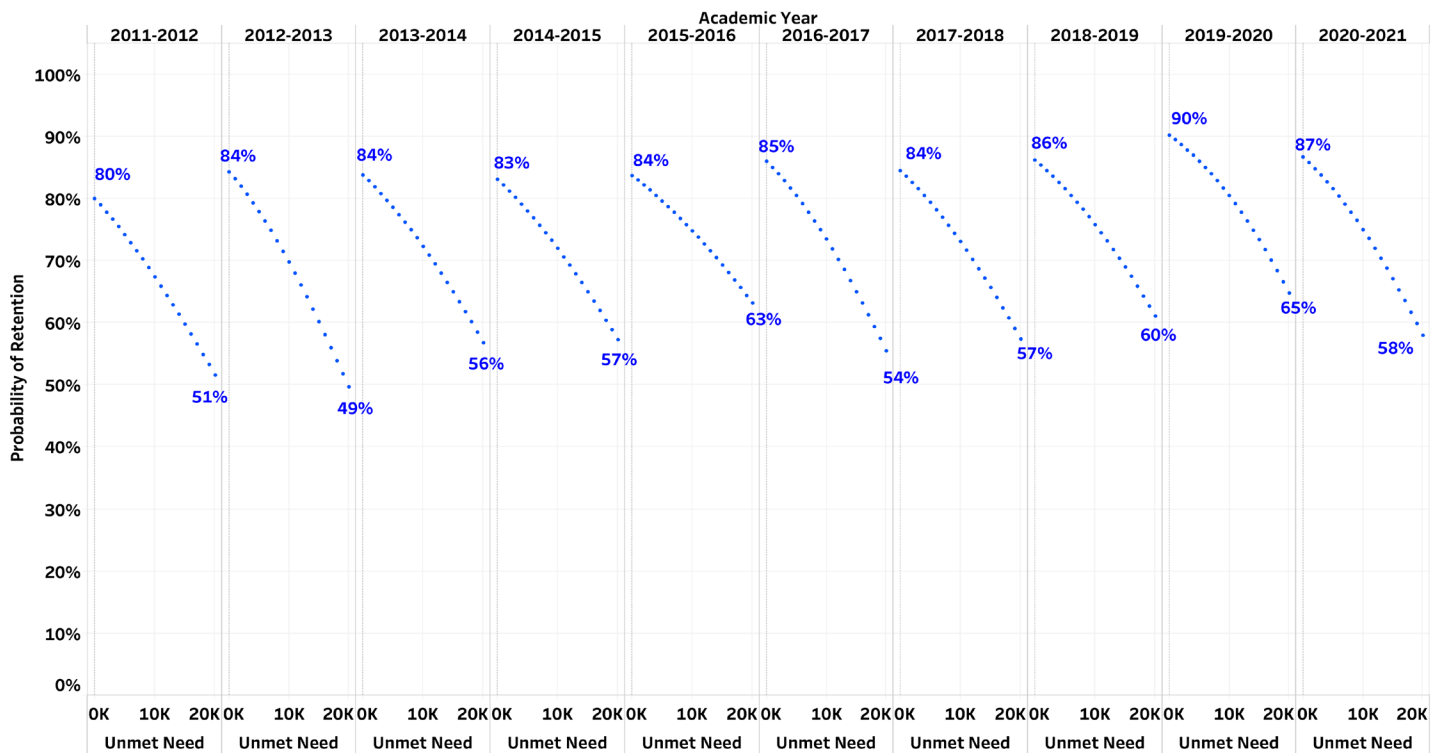
We compared these two sets of predictions to those for URM and low-income students and found similar results (not pictured): In 2011-12, unmet financial need exerted a strong and negative influence on retention among vulnerable students, but due to the positive impact of programs like UK LEADS, students from these populations were statistically indiscernible from the full sample by 2020-21.

The negative consequences of unmet financial need are far more pronounced for first-time, degree-seeking students enrolled at four-year comprehensive institutions (Figure 14). For example, in 2020-21, students with no unmet financial need had an 87% likelihood of returning for a second year, compared to an 82% likelihood at $5,000 of unmet need, a 75% likelihood at $10,000 of unmet need, a 67% likelihood at $15,000 of unmet need, and a 58% likelihood at $20,000 of unmet need.

Figure 13. Unmet Need Diminishes Retention Likelihood for First-Time KY Students at 4-Yr. Public Research Institutions

Academic Year

Probability of Retention

Year	High	Low
2011-2012	89%	75%
2012-2013	90%	82%
2013-2014	92%	78%
2014-2015	92%	82%
2015-2016	93%	80%
2016-2017	93%	84%
2017-2018	94%	83%
2018-2019	93%	85%
2019-2020	94%	85%
2020-2021	92%	88%

Unmet Need (0K, 10K, 20K)

Figure 14. Unmet Need Diminishes Retention Likelihood for First-Time KY Students at 4-Yr. Public Comprehensive Institutions

Academic Year

Probability of Retention

Year	High	Low
2011-2012	80%	51%
2012-2013	84%	49%
2013-2014	84%	56%
2014-2015	83%	57%
2015-2016	84%	63%
2016-2017	85%	54%
2017-2018	84%	57%
2018-2019	86%	60%
2019-2020	90%	65%
2020-2021	87%	58%

Unmet Need (0K, 10K, 20K)

Figure 15. Unmet Need Diminishes Retention Likelihood for First-Time KY Students at 2-Yr. Public Institutions
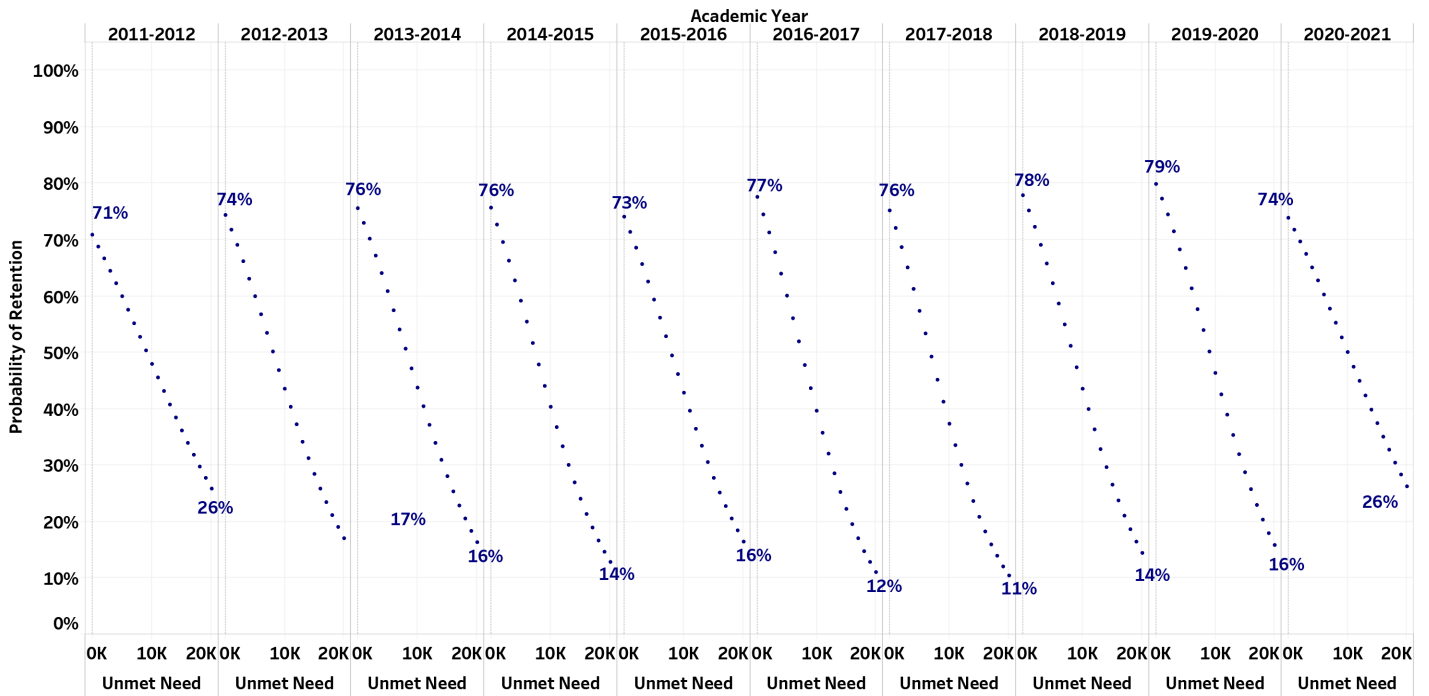
Table 4. Unmet Need Endangers Retention of Students from Vulnerable Populations

Unmet Need Amount	Retention Likelihood: 4-Yr. Comps, AY 2020-21			Retention Likelihood: 2-Yr. Institutions, AY 2020-21		
	All Students	URM	Low-Income	All Students	URM	Low-Income
Zero Unmet Need	87%	87%	92%	74%	73%	82%
$5,000 Unmet Need	82%	79%	85%	63%	59%	65%
$10,000 Unmet Need	75%	69%	75%	50%	42%	44%
$15,000 Unmet Need	67%	57%	62%	38%	28%	25%
$20,000 Unmet Need	58%	43%	46%	26%	17%	12%

Comparing these predictions to those for URM and low-income students, we find that the impact of unmet financial need on retention is much stronger across students from these vulnerable populations (see Table 4 on page 24). In 2020-21:

- URM students with no unmet financial need were 87% likely to return for a second year, compared to a 79% likelihood at $5,000 of unmet need, a 69% likelihood at $10,000 of unmet need, a 57% at $15,000 of unmet need, and a 43% likelihood at $20,000 of unmet need.

- Low-income students with no unmet financial need had a 92% likelihood of being retained, compared to an 85% likelihood at $5,000 of unmet need, a 75% likelihood at $10,000 of unmet need, a 62% likelihood at $15,000 of unmet need, and a 46% likelihood at $20,000 of unmet need.

When thinking about the steep consequences of unmet financial need on the retention of URM and low-income students,

an equally powerful inference is that students from these vulnerable populations are just as likely as their peers to return for a second year when their financial burden is zero (see Table 4).

Finally, unmet financial need has the strongest influence on retention of first-time, degree-seeking students enrolled at KCTCS (see Figure 15). In 2020-21, students with no unmet financial need were 74% likely to return for a second year, compared to a 63% likelihood at $5,000 of unmet need, a 50% likelihood at $10,000 of unmet need, a 38% likelihood at $15,000 of unmet need, and a 26% likelihood at $20,000 of unmet need. The impact of unmet financial need on retention also is much stronger across students identified as URM and low-income (see Table 4). In 2020-21:

- URM students with no unmet financial need had a 73% likelihood of being retained, compared to a 59% likelihood at $5,000 of unmet need, a 42% likelihood at $10,000 of unmet need, a 28% likelihood at $15,000 of unmet need, and a 17% likelihood at $20,000 of unmet need.

- Low-income students with no unmet financial need had an 82% likelihood of being retained, compared to a 65% likelihood at $5,000 of unmet need, a 44% likelihood at $10,000 of unmet need, a 25% likelihood at $15,000 of unmet need, and a 12% likelihood at $20,000 of unmet need.

Just as we observed in the student data from four-year comprehensive institutions, as unmet financial need increases, it becomes a larger barrier to the retention of minoritized and low-income KCTCS students (see Table 4). Equally telling, this equity gap in retention between students from vulnerable populations and their peers dissipates when unmet financial need is zero. Altogether, these findings provide incontrovertible evidence in support of the retention impact hypothesis and vulnerable population impact hypotheses.

Part Three:
Conclusion & Next Steps

The purpose of this study is to analyze levels of unmet financial need for first-time, degree-seeking Kentucky students, as well as to identify the consequences of unmet financial need on the second-year retention of these students. In the broadest sense, this nuanced approach contributes important theoretical and empirical perspectives on unmet financial need. Whereas most prior research has described unmet need in certain institutions or sectors, we take a comprehensive approach and use structural equation modeling to investigate unmet financial need across sector, time, and demographics. Then, we directly model its consequences for retention.

Our approach contributes an appropriate and replicable strategy that others can use to investigate unmet need in their state or institution. We hope that researchers and policy makers will continue to investigate the implications of unmet financial need and continue to collaborate around the best ideas to help financially needy students.

Our findings also offer substantive contributions to the growing body of research on unmet financial need. Briefly, we find strong evidence in support of our hypotheses that unmet financial need is more prevalent among and costly to URM and low-income students, that unmet need lessens retention likelihood, and that the relationship between unmet financial need and retention is stronger among students from vulnerable populations. Equally important, these trends cut across time and institutional context. However, and perhaps most importantly, we find that when unmet financial need is zero and/or initiatives are in place to help financially needy students, inequities that arise from unmet financial need are effectively nullified.

A follow-up report on the CPE website adds more knowledge about how unmet financial need impacts the retention of first-time Kentucky students at specific institutions and relative to those institutions' performance

Next Steps

- In conjunction with public institutions, CPE will develop a predictive learning model to enable Kentucky institutions to identify at-risk students or those most likely to be retained with targeted financial assistance.

- CPE will bring institutional and policy partners together to discuss the implications of this research and share best practices.

- CPE will disseminate this research to national postsecondary education partners to add to the body of research on unmet financial need.

goals. In doing so, we contribute actionable business intelligence that will empower institutional leaders and lawmakers to design strategies aimed at increasing affordability for the next class of Kentucky students.

At research institutions, unmet financial need has become less likely to diminish the likelihood of retention below institutional goals for substantive amounts of students. This is due to targeted financial aid programs around unmet need, such as the UK LEADS initiative.

Generally, we observe that Kentucky's four-year comprehensive institutions have retention goals around 75-80%, and in the most recent academic year, the probability of second-year retention typically drops below those goals at around $8,000 of unmet financial need. In

2020-21, approximately 40% (2,550 out of 6,607 in our sample) of first-time, degree-seeking students enrolled at comprehensive institutions had unmet need greater than $8,000.

For 2020-21 KCTCS students, $5,000 in unmet financial need is about the threshold where retention likelihood falls below the institution's 58.5% second-year retention performance goal. Approximately 40% (2,263 out of 5,734 in our sample) of first-time students in 2020-21 had unmet financial need greater than that $5,000 threshold.

Identifying students at comprehensive universities and KCTCS in these two risk groups is the ideal starting point for any brainstorming on initiatives to help Kentucky students struggling with affordability barriers.

Part Four:
Appendices

Appendix A: Notes

1. Expected Family Contribution (EFC) is an index used to determine a student's eligibility for federal financial aid. This figure results from financial information provided by the applicant in the Free Application for Federal Student Aid (FAFSA) form.

2. URM students are those who identify as American Indian or Alaska Native, Black, Hispanic or Latinx, Native Hawaiian or Pacific Islander, or as two or more races. Non-URM includes Asian and White students.

3. Research institutions include the University of Kentucky and the University of Louisville. Comprehensive institutions include Eastern Kentucky University, Kentucky State University, Morehead State University, Murray State University, Northern Kentucky University, and Western Kentucky University. Two-year institutions include the 16 colleges of the Kentucky Community and Technical College System.

4. The UK LEADS (Leveraging Economic Affordability for Developing Success) initiative targets aid to first-time students for whom unmet financial need is likely the largest barrier to success. UK LEADS provides one-time grants to these students based on data analysis and predictive modeling.

5. These statistics come from an analysis conducted by the Center on Budget and Policy Priorities using SHEEO (State Higher Education Executive Officers) State Higher Education Finance Report data.

6. *U.S. News and World Report* counts Ph.D.-granting institutions as national universities.

7. Although this report frames the importance of college affordability around workforce and financial outcomes, it is worth noting that the benefits of postsecondary attainment are not limited to dollars and cents. Countless empirical studies link degree attainment to many non-financial indices measuring quality of life, including better health, lower rates of morbidity and mortality, and higher civic participation (Attewell and Lavin 2007; Carnevale et al. 2011; Tamborini et al. 2015; Buckles et al. 2016).

8. We include as URM students those who identify as American Indian or Alaska Native (N = 328), Black (N = 15,283), Hispanic or Latinx (N = 6,632), Native Hawaiian or Other Pacific Islander (N = 148), or as two or more races (N = 6,832). Non-URM students include those who identify as Asian (N = 2,972) or White (N = 137,299).

9. This pattern also is evident in Figures 5, 6, and 7, where rises in institutional grant aid at four-year institutions and state grant aid at two-year institutions correspond to inverse changes in unmet financial need.

10. We identify regions in which students live using Local Workforce Development Areas defined by the Kentucky Career Center. Eastern Kentucky students (N = 16,408) are identified as those living in the Eastern Kentucky Concentrated Employment Program area. Non-Eastern Kentucky students (N = 154,862) are identified as those from the Barren River (N = 11,479), Bluegrass (N = 29,846), Cumberlands (N = 10,566), Green River (N = 9,097), KentuckianaWorks (N = 35,761), Lincoln Trail (N = 11,710), Northern Kentucky (N = 20,197), TenCo (N = 8,442), and West Kentucky (N = 16,883) areas or whose region is unknown (N = 881).

11. Research institutions include the University of Kentucky (N = 26,528) and the University of Louisville (N = 19,445). Comprehensive institutions include Eastern Kentucky University (N = 18,422), Kentucky State University (N = 1,178), Morehead State University (N = 10,647), Murray State University (8,339), Northern Kentucky University (N = 11,614), and Western Kentucky University (N = 20,744). Two-year institutions include the 16 colleges of the Kentucky Community and Technical College System (N = 54,353).

12. After estimating the model, we scrutinized it by consulting diagnostic tests of the comparative fit index and the standardized root mean square residual, each of which capture model fit and assess whether the model is appropriately specified. The comparative fit index (CFI) compares the fit of the SEM to the fit of a null model (Bentler 1990). The standard threshold for a properly fit SEM is a CFI statistic ≥ .90, and our model reports a CFI of 1.00. The standardized root mean square residual (SRMR) measures the square-root of the difference between the residuals of the sample covariance matrix and the hypothesized model (Mueller and Hancock 2008). The standard threshold for a properly fit SEM is an SRMR statistic < .08, and our model reports a SRMR of .06.

13. A full table of coefficients for the model is provided in a supplementary report, which can be found on CPE's website.

Appendix B: References

Association of Public and Land-Grant Universities. 2022. "How does a college degree improve graduates' employment and earnings potential?" https://www.aplu.org/our-work/4-policy-and-advocacy/publicuvalues/employment-earnings.html (Accessed October 4, 2022).

Attewell, Paul, and David Lavin. 2007. *Passing the Torch: Does Higher Education for the Disadvantaged Pay Off Across the Generations?* New York, NY: Russell Sage Publishers.

Benson, Gary. 2018. "Unmet Need among Financially Needy College Students in the State of Washington." *Education Research and Data Center.*

Bentler, Peter M. 1990. "Comparative Fit Indices in Structural Models." *Psychological Bulletin* 107(2): 238-246.

Bettinger, Eric, Oded Gurantz, Laura Kawano, and Bruce Sacerdote. 2019. "The Long-Run Impacts of Financial Aid: Evidence from California's Cal Grant." *American Economic Journal* 11(1): 64-94.

Bound, John, Michael F. Lovenheim, and Sarah Turner. 2012. "Increasing Time to Baccalaureate Degree in the United States." *Education Finance and Policy* 7(4): 375-424.

Bresciani, Marilee J., and Lewis Carson. 2002. "A Study of Undergraduate Persistence by Unmet Need and Percentage of Gift Aid." *Journal of Student Affairs Research and Practice* 40(1): 104-123.

Buckles, Kasey, Andreas Hagemann, Ofer Malamud, Melinda Morrill, and Abigail Wozniak. 2016. "The effect of college education on mortality." *Journal of Health Economics* 50: 99–114.

The Burning Glass Institute. 2022. "The Emerging Degree Reset: How the Shift to Skills-Based Hiring Holds the Keys to Growing the U.S. Workforce at a Time of Talent Shortage." https://static1.squarespacecom/static/6197797102be715f55c0e0a1/t/6202bda7f1ceee7b0e9b7e2f/1644346798760/The+Emerging+Degree+Reset+%2822.02%29Final.pdf (Accessed January 2, 2023).

Carnevale, Anthony, Stephen J. Rose, and Ban Cheah. 2011. "The College Payoff: Education, Occupations, Lifetime Earnings." *Georgetown University Center on Education and the Workforce*. https://cew.georgetown.edu/cew-reports/the-college-payoff/ (Accessed October 4, 2022).

Carvahlo, Jackson de, and Felix O. Chima. 2014. "Applications of Structural Equation Modeling in Social Sciences Research." *American International Journal of Contemporary Research* 4(1): 6-11.

Choitz, Vickie, and Patrick Reimharr. 2013. "Mind the Gap: Unmet Financial Need Threatens Persistence and Completion for Low-Income Community College Students." *Center for Postsecondary and Economic Success at CLASP*. https://www.clasp.org/sites/default/files/public/resources-and-publications/files/CLASP-Unmet-Need-Brief-041213-final-ab-2.pdf (Accessed October 4, 2022).

Citizens Financial Group. 2021. "Citizens Survey Shows That Affordability Concerns Remain Top of Mind for Students and Families." https://investor.citizensbank.com/about-us/newsroom/latest-news/2021/2021-08-04-130526976.aspx (Accessed October 4, 2022).

Denning, Jeffrey T., Benjamin M. Marx, and Lesley J. Turner. 2019. "ProPelled: The Effects of Grants on Graduation, Earnings, and Welfare." *American Economic Journal: Applied Economics* 11(3): 193–224.

Dynarski, Susan M. 2003. "Does aid matter? Measuring the effect of student aid on college attendance and completion." *American Economic Review* 93(1): 279-288.

Dynarski, Susan M. 2005. "High-Income Families Benefit Most from New Education Savings Incentives." *Urban-Brookings Tax Policy Center* (9).

Dynarski, Susan M., and Judith E. Scott-Clayton. 2008. "Complexity and Targeting in Federal Student Aid: A Quantitative Analysis." *Tax Policy and the Economy* 22(1): 109-150.

Harvard Business School. 2017. "Dismissed by Degrees: How degree inflation is undermining U.S. competitiveness and hurting America's middle class." https://www.hbs.edu/managing-the-future-of-work/Documents/dismissed-by-degrees.pdf (Accessed December 26, 2022).

Hoyle, Rick H. 1995. "The Structural Equation Modeling Approach: Basic Concepts and Fundamental Issues." In *Structural Equation Modeling: Concepts, Issues, and Applications*, ed. Rick H. Hoyle. Thousand Oaks, CA: Sage Publications: 1-15.

Kentucky Center for Statistics. 2022. "Economic Mobility in Kentucky from 2010 to 2019." https://kystats.ky.gov/Content/Reports/WP-LF_Update_October_2022.pdf?v=20221028023145 (Accessed December 26, 2022).

Kentucky Council on Postsecondary Education. 2021. "Early Economic Return on Higher Education Investment: Evidence from the Kentucky High School Class of 2011." http://cpe.ky.gov/data/reports/2021roireport.pdf (Accessed October 4, 2022).

Kentucky Council on Postsecondary Education. 2022. "Higher Education Matters: A Statewide Strategic Agenda for Kentucky Postsecondary Education, 2022-2030." http://cpe.ky.gov/ourwork/documents/2022-30strategicagenda.pdf (Accessed October 4, 2022).

Kerr, Emma, and Sarah Wood. 2022. "A Look at College Tuition Growth Over 20 Years: Tuition at ranked National Universities has risen significantly since the 2003 edition of the Best Colleges rankings." *U.S. News and World Report*. 13, September. https://www.usnews.com/education/best-colleges/paying-for-college/articles/see-20-years-of-tuition-growth-at-national-universities (Accessed January 2, 2023).

Kline, Rex B. 1998. *Principles and Practice of Structural Equation Modeling*. New York: The Guilford Press.

Long, Bridget Terry. 2008. "What is Known about the Impact of Financial Aid? Implications for Policy." *National Center for Postsecondary Research*: 1-52.

Ma, Jennifer, Matea Pender, and Meredith Welch. 2016. "Education Pays 2016: The Benefits of Higher Education for Individuals and Society." *Trends in Higher Education Series*. College Board.

Mitchell, Michael, Michael Leachman, and Kathleen Masterson. 2017. "A Lost Decade in Higher Education Funding: State Cuts Have Driven Up Tuition and Reduced Quality." *Center on Budget and Policy Priorities*. 23, August. https://www.cbpp.org/research/state-budget-and-tax/a-lost-decade-in-higher-education-funding (Accessed December 4, 2022).

Mitchell, Michael, Michael Leachman, and Matt Saenz. 2019. "State Higher Education Funding Cuts Have Pushed Costs to Students, Worsened Inequality." *Center on Budget and Policy Priorities*. 24, October. https://www.cbpp.org/research/state-budget-and-tax/state-higher-education-funding-cuts-have-pushed-costs-to-students (Accessed January 2, 2023).

Mortenson, Thomas G. 1999. "Unmet and Overmet Financial Need of Undergraduate Students." *Postsecondary Education Opportunity* 88: 1-10.

Mueller, Ralph O., and Gregory R. Hancock. 2008. "Best Practices in Structural Equation Modeling." In *Best Practices in Quantitative Methods*, ed. Jason W. Osborne. Thousand Oaks, CA: Sage Press: 488-508.

National Education Association. 2022. "The Higher Ed Funding Rollercoaster: State Funding of Higher Education During Financial Crises." *National Education Association*. https://www.nea.org/he_funding_report (Accessed December 26, 2022).

Scott-Clayton, Judith. 2012. "What Explains Trends in Labor Supply among U.S. Undergraduates?" *National Ta Journal* 65(1): 181-210.

Seftor, Neil S., and Sarah E. Turner. 2002. "Back to School: Federal Student Aid Policy and Adult College Enrollment." *Journal of Human Resources*: 336-352.

State Higher Education Executive Officers Association. 2021. "New Report Finds Despite Eight Years of Increases in State Support, Public Colleges Entered the 2020 Recession with Historically Low Funding. *State Higher Education Executive Officers Association*. 26, May. https://sheeo.org/new-report-finds-despite-eight-years-of-increases-in-state-support-public-colleges-entered-the-2020-recession-with-historically-low-funding/ (Accessed December 26, 2022).

Sublett, Cameron, and Jason Taylor. 2021. "Net Tuition, Unmet Financial Need, and Cooling Out: A National Study of Degree Aspirations Among First-Time Community College Students." *Community College Review* 49(4): 389-412

Tamborini, Christopher R., ChangHwan Kim, and Arthur Sakamoto. 2015. "Education and Lifetime Earnings in the United States." *Demography* 52(4): 1383-1407.

Walizer, Lauren. 2015. "Barriers to Success: High Unmet Financial Need Continues to Endanger Higher Education Opportunities for Low-Income Students." *Center for Postsecondary and Economic Success*. https://www.clasp.org/wp-content/uploads/2022/01/Barriers-to-Success-High-Unmet-Financial-Need-Continues-to-Endanger-Higher-Education-Opportunities.pdf (Accessed January 3, 2023).

Walizer, Lauren. 2018. "When Financial Aid Falls Short: New Data Reveal Students Face Thousands in Unmet Need." *Center for Law and Social Policy*. https://www.clasp.org/wp-content/uploads/2022/01/2018whenfinancialaidfallsshort.pdf (Accessed January 3, 2023).

CPE