

CONTRIBUTORS

Qing Li

Director
Global Research & Design
qing.li@spglobal.com

Michael Ashton, CFA

Managing Principal
Enduring Investments LLC
m.ashton@enduringinvestments.com

Jodie Gunzberg, CFA

Getting Smarter About Saving for College: Introducing the S&P Target Tuition Inflation Index

INTRODUCTION

“It’s 2018 and Americans are more burdened by student loan debt than ever. In fact, the average student loan debt for Class of 2017 graduates was \$39,400, up six percent from the previous year... Americans owe over \$1.48 trillion in student loan debt, spread out among about 44 million borrowers. That’s about \$620 billion more than the total U.S. credit card debt.”¹

As reported by the College Board,² education costs have risen at an alarming rate in the past three decades, with an increase of 129% for private nonprofit four-year institutions and an increase of 213% for public four-year institutions. From 1987-1988 until 2017-2018, tuition rose from USD 15,160 to USD 34,740 per year for private nonprofit four-year institutions, and in the same time period public four-year institution tuition rose from USD 3,190 to USD 9,970 per year, adjusted to reflect 2017 U.S. dollars.

As CNBC tried to put that into perspective, they pointed out in an article that a 1988 graduate of Harvard University would have spent USD 17,100 on tuition during their senior year. Now, in their 50s, they would have to pay USD 44,990 in tuition for their child to attend Harvard today. That makes the current cost of tuition more than 2.5 times as much as it was in 1988—a markup of 163%.³

Also to keep track of college tuition and fees, the U.S. Bureau of Labor Statistics publishes a college tuition and fees item as part of the Consumer Price Index (CPI). This item is a component of the tuition, other school fees, and childcare index, and it is included in the education and

¹ Student Loan Hero. A Look at the Shocking Student Loan Debt Statistics for 2018. <https://studentloanhero.com/student-loan-debt-statistics/>. May 1, 2018.

² College Board. Trends in Higher Education Series: Trends in College Pricing 2017. https://trends.collegeboard.org/sites/default/files/2017-trends-in-college-pricing_0.pdf. October 2017. pp. 12.

³ CNBC. Here’s how much more expensive it is for you to go to college than it was for your parents. Martin, Emmie. <https://www.cnbc.com/2017/11/29/how-much-college-tuition-has-increased-from-1988-to-2018.html>. Nov. 29, 2017.

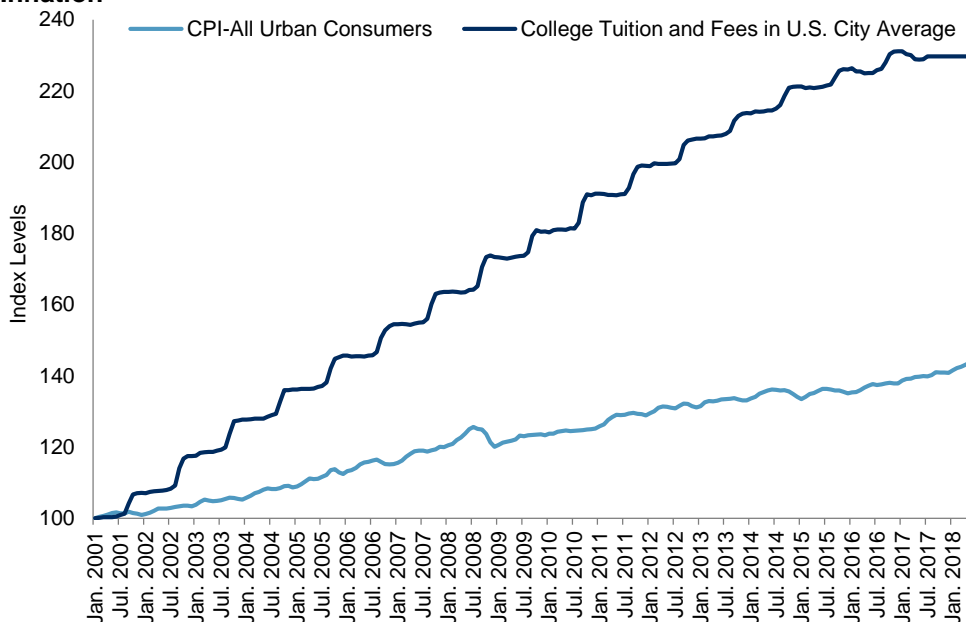
communication group of the CPI. The college tuition and fixed fees item accounts for about 55% of the weight of the tuition and other school fees index and is the largest component of this index.⁴

The base period weight for each CPI item group is the out-of-pocket expenditures households incurred for that item. The weight for college tuition reflects annual consumer expenditures for undergraduate and post-graduate studies at two- and four-year colleges, major universities, and professional schools (law, dental, medical, etc.). The CPI sample of colleges and universities prices was selected proportional to expenditures for students as reported by households located in the 87 areas sampled by the CPI. Because students may choose to attend colleges that are outside of the 87 pricing areas, colleges included in the sample are located throughout the U.S. (which is unlike the samples for most other CPI items).

Costs associated with college tuition and fees, as measured by the U.S. Bureau of Labor Statistics, have far outpaced general U.S. inflation as measured by CPI (5.9% versus 2.6%, annualized from January 1987 to June 2018; see Exhibit 1). So for individuals saving for college, growing assets on pace with tuition inflation is possibly challenging without a college inflation protection security.

Costs associated with college tuition and fees, as measured by the U.S. Bureau of Labor Statistics, have far outpaced general U.S. inflation as measured by CPI (5.9% versus 2.6%, annualized from January 1987 to June 2018).

Exhibit 1: College Tuition Inflation Has Grown Faster Than General U.S. Inflation



Source: U.S. Bureau of Labor Statistics. Data from Jan. 1, 2001, to June 1, 2018. Chart is provided for illustrative purposes.

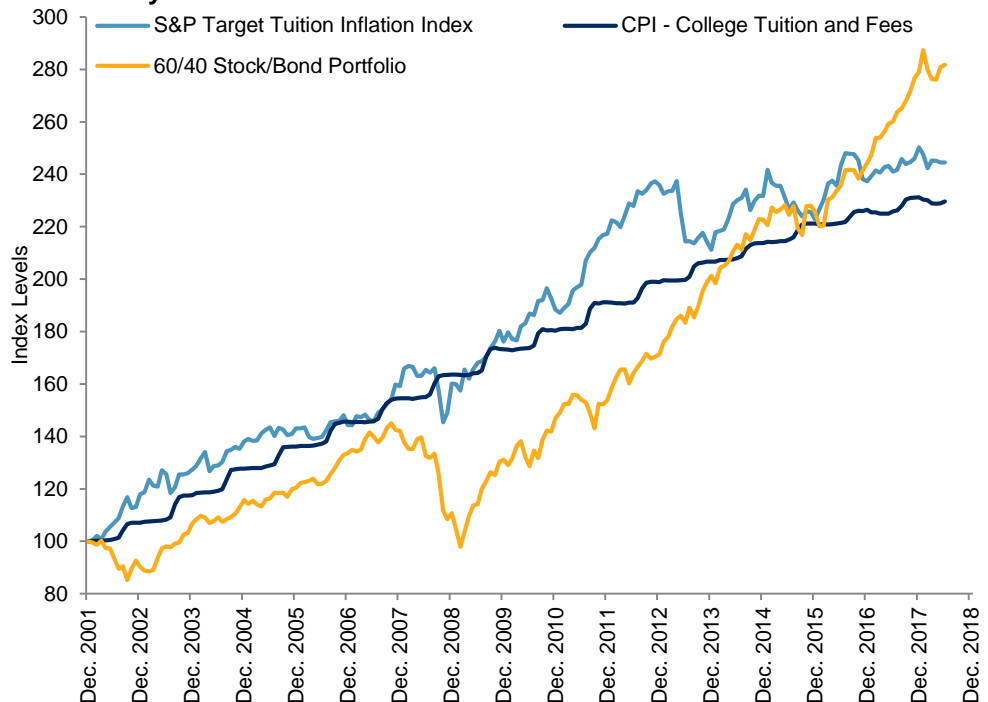
⁴ U.S. Department of Labor, Bureau of Labor Statistics. CPI-All Urban Consumers (Current Series) Original Data Value, Series Id: CUUR0000SA0, Not Seasonally Adjusted, Series Title: All items in U.S. city average, all urban consumers, not seasonally adjusted, Area: U.S. city average, Item: All items, Base Period: 1982-84=100, Years: 1987 to 2018.
 U.S. Department of Labor, Bureau of Labor Statistics. CPI-All Urban Consumers (Current Series) Original Data Value, Series Id: CUUR0000SEEB01, Not Seasonally Adjusted, Series Title: College tuition and fees in U.S. city average, all urban consumers, not seasonally adjusted, Area: U.S. city average, Item: College tuition and fees, Base Period: 1982-84=100, Years: 1987 to 2018, <https://data.bls.gov/pdq/SurveyOutputServlet>.

Unfortunately, most market participants saving for college only have some combination of the available investments today, perhaps in a 529 plan or “qualified tuition plan” that are made up of just traditional stock and bond funds.⁵

S&P Dow Jones Indices developed the S&P Target Tuition Inflation Index in partnership with Enduring Investments.

In response to this, S&P Dow Jones Indices partnered with Enduring Investments to develop the [S&P Target Tuition Inflation Index](#), which comprises underlying inflation bond, corporate bond, and equity indices and is designed to reflect changes in college tuition and fees over long-term periods.

Exhibit 2: The S&P Target Tuition Inflation Index Kept Pace More Consistently With Tuition Inflation Than a 60/40 Stock/Bond Portfolio



The 60/40 stock/bond portfolio is a hypothetical portfolio. Source: Enduring Investments, S&P Dow Jones Indices LLC, U.S. Bureau of Labor Statistics, Bloomberg. Data from Dec. 31, 2001, to June 30, 2018. The 60/40 stock/bond portfolio is represented by 60% S&P 500® blended with 40% Bloomberg Barclays U.S. Aggregate Bond Index. Past performance is no guarantee of future results. Chart is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

Over longer time periods, the likelihood of tracking tuition inflation with the S&P Target Tuition Inflation Index increased. For example, when two-year periods were measured, the index only tracked the College Tuition and Fees U.S. City Average CPI within 2% during 43.7% of the period studied. When the time periods were lengthened to over eight years, the index tracked within 2% of tuition inflation nearly 100% of the time. This was a

⁵ U.S. Securities and Exchange Commission. An Introduction to 529 Plans. <https://www.sec.gov/reportspubs/investor-publications/investorpubsintro529htm.html>. May 29, 2018. Examples are found at Vanguard and Fidelity: <https://investor.vanguard.com/529-plan/list/#/529-plan/asset-class/month-end-returns> <https://www.fidelity.com/529-plans/investment-options>

significant improvement over a typical 60/40 stock/bond mix that is usually intended to provide better risk-adjusted returns. Since most of the contribution to risk in the traditional 60/40 stock/bond allocation comes from equities, its tuition inflation matching capability was comparatively volatile.

Exhibit 3: How Often Were Average Annual Returns Within 2.0% of College Tuition CAGR? (%)

PERIODS	S&P TARGET TUITION INFLATION INDEX	60/40 STOCK/BOND PORTFOLIO
2-Year	43.7	23.0
4-Year	60.0	17.3
6-Year	77.8	37.3
8-Year	99.0	65.7
10-Year	100.0	78.2
12-Year	100.0	66.7

The 60/40 stock/bond portfolio is a hypothetical portfolio. Source: S&P Dow Jones Indices LLC, U.S. Bureau of Labor Statistics, Bloomberg Enduring Investments. Data from December 2001 to June 2018. Assumes no management fees for either strategy. The 60/40 stock/bond portfolio is represented by 60% S&P 500 blended with 40% Bloomberg Barclays U.S. Aggregate Bond Index. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

Not only will the traditional mix by definition decline with falling equities, but an acceleration of general inflation may adversely affect the performance of equities and bonds.

Not only will the traditional mix by definition decline with falling equities, but an acceleration of general inflation may adversely affect the performance of equities and bonds. Also, in a declining equity environment, tuition inflation will likely accelerate, partly driven by rising general inflation plus demand growth for education, as well as endowment and appropriation underperformance.

THE THEORY BEHIND THE INDEX CONSTRUCTION

The first step in designing an index to track college tuition inflation over time is to understand how college tuition is set. Colleges are producing a product just like any other business, but the product is education. Just as in any business, they have expenses and revenues, so understanding what is driving those expenses and revenues is an important part of understanding how to build such an index.

On the expense side, colleges have mostly labor costs, but they have a number of other things that go into creating the educational product. According to American Institutes for Research (AIR), “More than one-half of total average spending by private research universities was dedicated to E&R [education and related spending] functions, and at private non-research colleges, E&R accounted for approximately 80 percent of total expenditures.”⁶ Collectively, those costs rise with general inflation, for example, the report shows that in 2013, E&R spending per full-time

⁶ Desrochers, Donna M. and Steven Hurlburt, American Institutes for Research, Delta Cost Project. Trends in College Spending: 2003-2013 – Where Does the Money Come From? Where Does It Go? What Does It Buy? January 2016. pp. 9. <https://www.air.org/system/files/downloads/report/Delta-Cost-Trends-in-College%20Spending-January-2016.pdf>

equivalent student increased an average of 2%-3% at public four-year institutions in 2013.

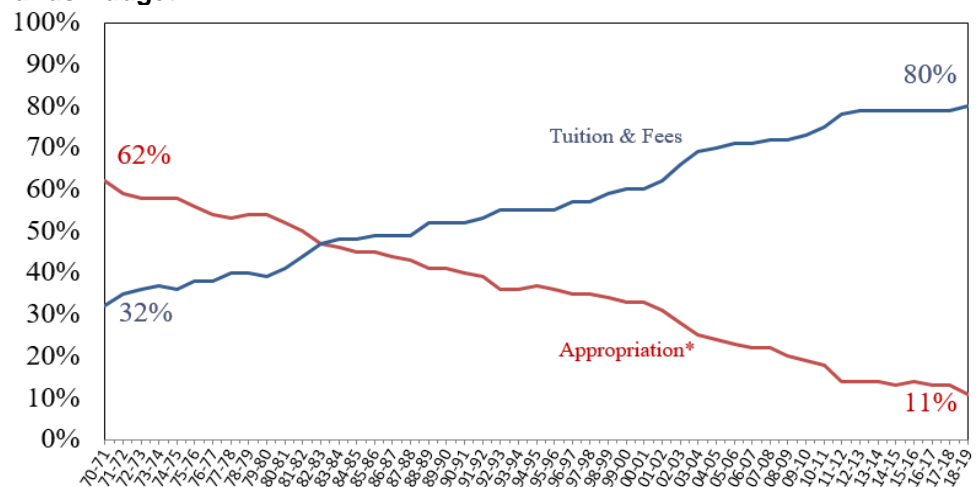
On the revenue side, colleges basically have two types—internal revenues and external revenues. The internal revenues are government appropriations for public universities, or the endowment returns for private universities. The external revenues come from college tuition. As noted in the Delta Cost Project, colleges and universities typically receive revenues to fund their educational mission from tuition, state and local appropriations, and income from endowments or investment returns.⁷ So understanding how college tuition varies depending on how the appropriations or the endowment returns behave is the key to constructing the S&P Target Tuition Inflation Index.

Generally, there is an inverse relationship between tuition increases and funding by appropriations and endowments, where the health of the latter may be driven by investment performance.

Generally, there is an inverse relationship between tuition increases and funding by appropriations and endowments, where the health of the latter may be driven by investment performance. “Endowments are managed for the long-term to strike a balance between the competing demands of funding current operations and preserving purchasing power to fund future operations.... However, endowments are not immune from market risks. During the Great Recession, endowments lost an average of 3.0 percent from 2007-08 and 18.7 percent from 2008-09.”⁸

One example of the long-term relationship between tuition and appropriation as a percentage of the budget comes from Penn State in Exhibit 4.

Exhibit 4: Appropriation Versus Tuition and Fees as a Percent of the General Funds Budget



*Includes Federal Stimulus Funds for 2009-10 and 2010-11. Beginning in 2018-19, budget information is total budget, including temporary as well as permanent budget.

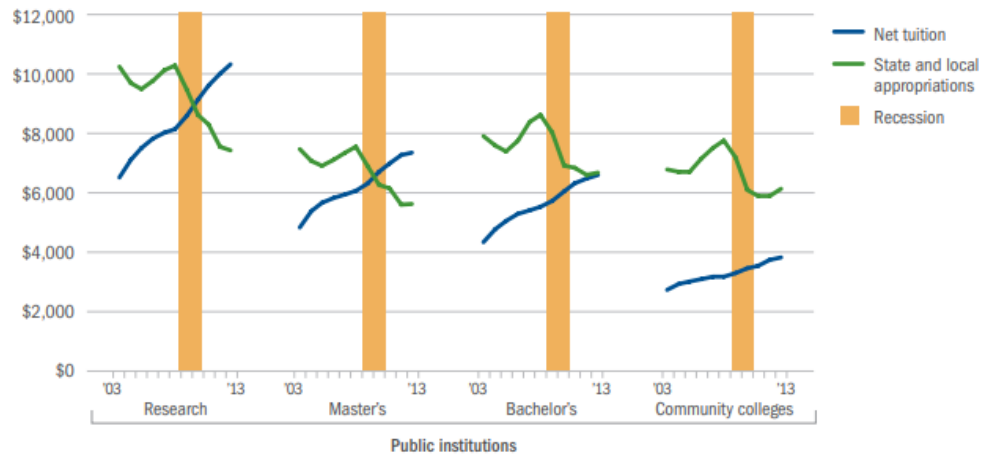
Source: [Penn State University](https://www.pennstate.edu/budget). Data from 1970 to 2018. Chart is provided for illustrative purposes.

⁷ AIR (pp. 3-4).

⁸ Council for Advancement and Support of Education, American Council on Education, Association of American Universities, Association of Public and Land-grant Universities, National Association of Independent Colleges and Universities, among others. Facts About College and University Endowments. January 2017. https://www.case.org/Documents/PublicPolicy/Endowments_Facts_Jan2017.pdf

Additionally, the Economics of Education Review found that for every USD 1,000 cut from per-student state and local appropriations, the average student could be expected to pay USD 257 more per year in tuition and fees. Tuition increases can be traced to state budget cuts, has more than doubled since 1987, and remains at its highest level in the post-recession era.⁹ These severe and sustained losses of public funding contributed to the rapid increase in net tuition revenue observed since the recession.¹⁰

Exhibit 5: Net Tuition Revenue and State and Local Appropriations at Public Institutions per Full-Time Equivalent Student,



Source: AIR, Delta Cost Project IPEDS Database 1987-2013 (11-year matched set). [Trends in College Spending: 2003-2013](#) (pp. 7). Data from 2003 to 2013 in 2013 U.S. dollars. Chart is provided for illustrative purposes.

When the stock market declines, endowments and appropriations suffer, and tuition inflation generally increases to cover the shortfall.

Understanding tuition inflation as a function of general inflation as measured by CPI plus a spread is the beginning of the S&P Target Tuition Inflation Index construction. The spread is a flexible combination of short stocks, long corporate bonds, and cash, based on stock market performance since there is an inverse relationship between endowment and appropriation performance and tuition inflation. Though allocations varied to U.S. equities of endowments surveyed by the 2017 NACUBO-Commonfund Study of Endowments, and the U.S.-dollar-weighted average was 16%, the smaller endowments allocated over 40% to U.S. equities. While the U.S. equities allocations were smaller in the largest plans, allocations of up to 20% in alternative strategies including long/short equity and 130/30 may also carry a significant amount of equity market risk.¹¹ From these relatively large exposures to equities, endowment (and appropriation) performance was largely driven by equity returns. So when

⁹ Webber, Douglas A., Economics of Education Review, State divestment and tuition at public institutions, Volume 60, Oct. 2017. pp 1-4. SN - 0272-7757. <https://doi.org/10.1016/j.econedurev.2017.07.007>
<http://www.sciencedirect.com/science/article/pii/S0272775717303618>

¹⁰ Desrochers, Donna M. and Steven Hurlburt, American Institutes for Research, Delta Cost Project. Trends in College Spending: 2003-2013 Where Does the Money Come From? Where Does It Go? What Does It Buy? January 2016. pp. 7. <https://www.air.org/system/files/downloads/report/Delta-Cost-Trends-in-College%20Spending-January-2016.pdf>

¹¹ National Association of College and University Business Officers. 2017 NACUBO-Commonfund Study of Endowments. <http://products.nacubo.org/index.php/nacubo-research/2017-nacubo-commonfund-study-of-endowments.html>

the stock market declines, endowments and appropriations suffer, and tuition inflation generally increases to cover the shortfall.

THE INDEX MODEL DEVELOPMENT

In observing that $CPI_{\text{tuition}} = CPI_{\text{overall}} + (CPI_{\text{tuition}} - CPI_{\text{overall}})$, CPI_{overall} is represented by U.S. Treasury Inflation-Protected Securities (TIPS) over time. The basis, $CPI_{\text{tuition}} - CPI_{\text{overall}}$, is measured theoretically by the inverse relationship between tuition inflation and appropriation or endowment performance, driven largely by the stock market.

The relationship between tuition inflation and CPI is not stable, but it is unstable in a predictable way because tuition inflation is not random, but rather it is the result of a decision-making process that is stable, and the underlying relationship makes causal sense. It is based on an understanding of how colleges set tuition.

Since endowments are often long corporate bonds and long equities, the S&P Target Tuition Inflation Index is short these assets in small amounts. The purpose of the long side of the S&P Target Tuition Inflation Index, in addition to TIPS, is partly to add some spread and partly to stabilize the effect of the changing equity risk premium and the connection between the risk premium and inflation surprises.

The starting point of the model development to track tuition inflation¹² is such that in the real return space, if:

r is the real return earned on TIPS;

r_{bond} is the real return earned on aggregate bonds; and

r_{equity} is the real return earned on equities,

when we take the expected inflation (π^e), inflation (π), credit spread (CS), and equity risk premium (ERP) into consideration, the real return on aggregate bonds and equities can be written as:

$$r_{\text{bond}} = r + \pi^e + \text{CS} - \pi \quad (1)$$

$$r_{\text{equity}} = r + \pi^e + \text{CS} + \text{ERP} - \pi \quad (2)$$

Notice that $(r + \pi^e + \text{CS})$ represents the nominal return on bonds and $(r + \pi^e + \text{CS} + \text{ERP})$ represents the nominal return on equities.

The relationship between tuition inflation and CPI is not stable, but it is unstable in a predictable way.

¹² U.S. Bureau of Labor Statistics. CPI College Tuition and Fees U.S. City Average (series ID CUUR0000SEEB01).

Based on a regression analysis, the coefficients of r , r_{bond} , and r_{equity} are 0.8, 0.25, 0.05, respectively. Thus we have:

$$\begin{aligned} \text{CPI}_{\text{tuition}} &= 0.8r + 0.25r_{\text{bond}} - 0.05r_{\text{equity}} \\ &= 0.8r + 0.25(r + \pi^e + \text{CS} - \pi) - 0.05(r + \pi^e + \text{CS} + \text{ERP} - \pi) \\ &= r + 0.2\text{CS} + 0.2(\pi^e - \pi) - 0.05\text{ERP} \end{aligned} \quad (3)$$

Equation 3 returns actual headline inflation plus a spread, the breakeven inflation, and equity risk premium, which are the two terms $0.2(\pi^e - \pi) - 0.05\text{ERP}$ in the equation that effectively stabilize the equation because when realized inflation is higher than a prior expected inflation, stocks tend to decline and vice versa.

In other words, the short position in stocks represents the non-linearity of the endowment contribution all by itself. However, an adjustment can be made for scaling the weight of the short stocks to add extra return in a declining market. For example, in the S&P Target Tuition Inflation Index, if the starting weight is rounded to 80% TIPS, stock weight is scaled short between 0% to -10%, and corporate bond weight is the long plug, but theoretically net long.

The short position in stocks represents the non-linearity of the endowment contribution all by itself.

- If the stocks are at -5%, the corporate bond is 25% net or implicitly short -3.33% and long 28.33% by a 60/40 split.
- If the stocks are at -10%, the invisible short is still -3.33% because it is $-5\% / -3.33\% + -5\%$ additional short equities. The long position is $33.33\% - 3.33\% = 30\%$ net.
- If the stocks are at 0%, the invisible short is still -3.33% because it is $-5\% / -3.33\% + 5\%$ long equities netting to zero. Thus the long corporate position is $23.33\% - 3.33\% = 20\%$ net.

Another way to view this is as a fixed inflation plus spread with a variable size on the out of the money (OTM) straddle. In our model, credit spread is the spread between corporate bonds and Treasuries, and equity risk premium is the spread between equities and corporate bonds, but technically, the equities minus corporate bond spread is not exactly the equity risk premium, since the equity risk premium is defined as equities minus Treasuries. The corporate bonds minus equities is rather a kind of capital structure arbitrage, a relationship as described by Merton,¹³ where the model is selling a put on the assets of the firm (long corporate bonds) and selling a call on the assets of the firm (short equity). Theoretically, both options are struck at zero equity, so the spread acts like a deep OTM short straddle on firm assets. In those terms, the capital structure arbitrage

¹³ Merton, Robert C., On the Pricing of Corporate Debt: The Risk Structure of Interest Rates. May 1974. <https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1540-6261.1974.tb03058.x>

spread (equity risk premium in Equations 2 and 3) is a moderately short volatility strategy, which has positive carry. Usually, this type of strategy does well in moderate market moves, performs more strongly in market declines, and does poorly in strong rallies—which is observed in the model.

After the basic regression was run, model adjustments needed to be made to add more return, despite a high R-squared. Adding the (longer duration) [S&P U.S. Treasury TIPS 15+ Year Index](#) for extra spread to the [S&P U.S. Treasury TIPS 1-10 Year Index](#), which tracks tuition inflation more closely, helped. While many combinations were tested, the even split of 80% total TIPS weight happened to track most closely to tuition inflation, without being overfitted. The corporate bonds were also added for spread, but as a plug to the TIPS and short equities.

Also, a mechanism for adjusting the spread oppositely and dynamically with stock market performance was added to better target the tuition inflation. In the theme of keeping it simple and investable, the biggest short weight was set to 10%, with the magnitude determined by the three-year return on the [S&P 500](#). The three-year return was the logical choice for better stability than the one-year return and for more flexibility than the five-year return, and to reflect moves with average recession times lasting roughly two years.¹⁴

Lastly, the numbers were rounded for ease and simplicity in creating the methodology.

The R-squared was 0.96 of back-tested monthly index levels from January 2001-June 2017 of the S&P Target Tuition Inflation Index model compared with the CPI College Tuition and Fees U.S. City Average.

THE INDEX METHODOLOGY

Based on the back-tested analysis, we constructed the S&P Target Tuition Inflation Index, which is designed to reflect changes in college tuition and fees over long-term periods. For shorter-term periods, the index performance may not be indicative of changes in college tuition and fees. The index may experience periods of negative returns based on the performance of the underlying constituents, whereas the cost of tuition and fees generally did not decline.

The S&P Target Tuition Inflation Index consists of allocations to a group of indices covering U.S. TIPS, U.S. corporate bonds, and a short overlay of U.S. equities. The universe of eligible asset classes and the indices used to represent each are listed in Exhibit 6.

The S&P Target Tuition Inflation Index consists of allocations to a group of indices covering U.S. TIPS, U.S. corporate bonds, and a short overlay of U.S. equities.

¹⁴ National Bureau of Economic Research. US Business Cycle Expansions and Contractions. July 31, 2018. <http://www.nber.org/cycles.html>.

Exhibit 6: S&P Target Tuition Inflation Index Asset Class Eligibility

ASSET CLASS	INDEX
Inflation-Linked Bonds	S&P U.S. Treasury TIPS 1-10 Year Index
	S&P U.S. Treasury TIPS 15+ Year Index
Corporate Bonds	S&P 500 Bond Index
Equities	S&P 500

Source: S&P Dow Jones Indices LLC, [S&P Target Tuition Inflation Index Methodology](#). Table is provided for illustrative purposes.

At each rebalancing, the weight of inflation-linked bonds is set at 80%, equally weighting the S&P U.S. Treasury TIPS 1-10 Year Index and S&P U.S. Treasury TIPS 15+ Year Index at 40% each.

The weights of the S&P 500, S&P 500 Bond Index, and cash are determined on a monthly basis. The weight of the S&P 500 is derived via an interpolation based on the three-year return of the S&P 500 as described below.

- If the three-year return of the S&P 500 is negative, the weight is interpolated between -5% (when the S&P 500 three-year return is at 0%) and -10% (when the S&P 500 three-year return is at -100%).
- If the three-year return of the S&P 500 is positive but less than 50%, the weight is interpolated between 0% (when the S&P 500 three-year return is at 50%) and -5% (when the S&P 500 three-year return is at 0%).
- If the three-year return is positive and greater than 50%, the weight is set at 0%.

At each rebalancing, the weight of inflation-linked bonds is set at 80%, equally weighting the S&P U.S. Treasury TIPS 1-10 Year Index and S&P U.S. Treasury TIPS 15+ Year Index at 40% each.

The weights of the S&P 500 Bond Index are based on the determined equity weight, as follows.

- If the weight of the S&P 500 is less than -5%, the weight is set at 25%.
- If the weight of the S&P 500 is greater than or equal to -5%, the weight is set at 1 minus the sum of the weights of the equity and inflation-linked bond weights.

The weight of cash is based on the determined equity weight, as follows.

- If the weight of the S&P 500 is less than -5%, the weight is set at 1 minus the sum of the weights of the equity, bond, and inflation-linked bond weights.
- If the weight of the S&P 500 is greater than or equal to -5%, the weight is set at 0%.

Exhibit 7: The S&P Target Tuition Inflation Index Model Weights

BENCHMARK INDEX	WEIGHT
S&P U.S. Treasury TIPS 1-10 Year Index	40%
S&P U.S. Treasury TIPS 15+ Year Index	40%
S&P 500 Bond Index	Weight varies depending on the short position in equities.
S&P 500	Short on equities and weight is reset monthly via interpolation according to the three-year return of the S&P 500. The weight varies between -10% and 0%.
S&P U.S. Treasury Bill 0-3 Month Index	Weight varies depending on the short position in equities and is between 0% and 5%.

Source: S&P Dow Jones Indices LLC, [S&P Target Tuition Inflation Index Methodology](#). Data as of Aug. 31, 2017. Table is provided for illustrative purposes.

The S&P Target Tuition Inflation Index constituent weights are rebalanced monthly, effective after the close of the last business day of the month. The rebalancing reference date is the fifth business day before the last business day of the month.

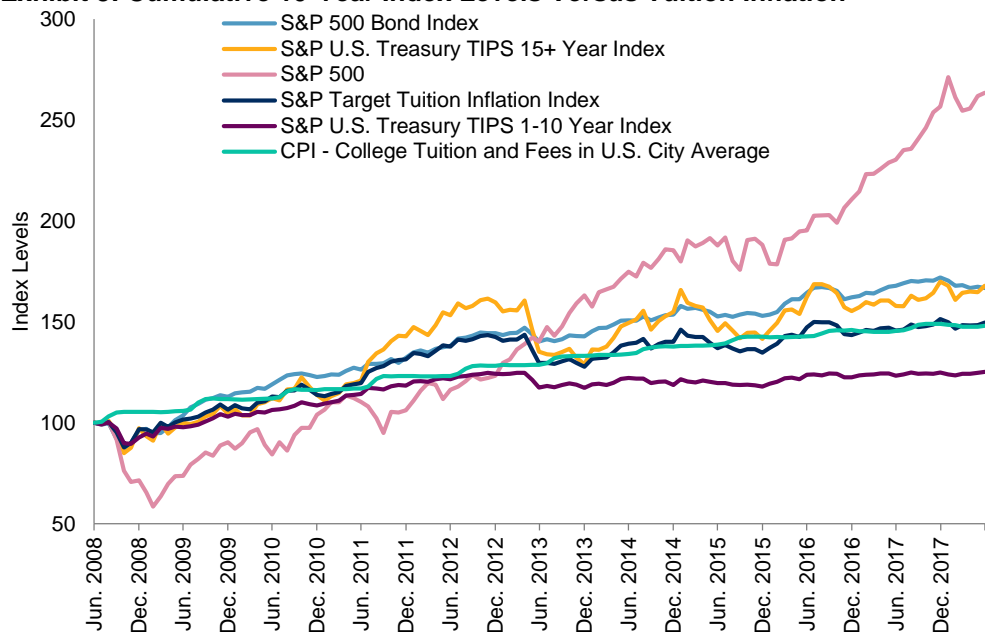
INDEX PERFORMANCE RESULTS

In reviewing the performance, it is helpful to examine the individual components of the S&P Target Tuition Inflation Index alongside the tuition inflation to understand the relationship between tuition inflation, TIPS, stocks, and corporate bonds, since they underpin the index methodology. In Exhibit 8, notice that the S&P U.S. Treasury TIPS 1-10 Year Index moved in-line with the tuition inflation—however, with a significant deficit in return. The S&P U.S. Treasury TIPS 15+ Year Index helped keep that inflation relationship, but added some spread from the longer duration.

Also, while correlation is not the best measure of the relationship between TIPS and tuition inflation, since tuition inflation is an economic index printed monthly with most of its variance in the two months when school prices are reset, there was still a slightly negative correlation between the S&P 500 and tuition inflation that was supported by the investment performance of endowments and appropriations. However, the S&P 500 Bond Index was much more stable, with moderately positive correlation to the tuition inflation, so it served as a solid addition to the short stock position.

The S&P U.S. Treasury TIPS 1-10 Year Index moved in-line with the tuition inflation—however, with a significant deficit in return. The S&P U.S. Treasury TIPS 15+ Year Index helped keep that inflation relationship, but added some spread from the longer duration.

Exhibit 8: Cumulative 10-Year Index Levels Versus Tuition Inflation



Source: S&P Dow Jones Indices LLC, U.S. Bureau of Labor Statistics. Data from June 30, 2008, to July 27, 2018. Past performance is no guarantee of future results. Chart is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

A better way to measure success of the S&P Target Tuition Inflation Index than by constituent performance or typical metrics like correlation, standard deviation, or tracking error is to check failure rates, through which there was a shortfall as compared with the tuition inflation (see Exhibit 9). The biggest difference was seen between the 6-8-year marks, during which there was a far lower chance of the S&P Target Tuition Inflation Index failing to keep pace with tuition inflation than for stocks, bonds, or cash (that usually fails except in the immediate time frames).

The biggest difference was seen between the 6-8-year marks, during which there was a far lower chance of the S&P Target Tuition Inflation Index failing to keep pace with tuition inflation than for stocks, bonds, or cash.

Exhibit 9: How Often Did Individual Assets Fail to Return Within 1% Below the Compounded Rate of Tuition Inflation? (%)

PERIOD	S&P TARGET TUITION INFLATION INDEX	STOCKS ALONE (S&P 500)	BONDS ALONE (S&P 500 BOND INDEX)	60/40 STOCK/BOND PORTFOLIO	CASH (S&P U.S. TREASURY BILL 3-MONTH INDEX)
2-Year	42.0	21.3	45.4	23.0	98.9
4-Year	37.3	36.7	43.3	36.0	100.0
6-Year	19.0	51.6	26.2	37.3	100.0
8-Year	2.0	24.5	20.6	16.7	100.0
10-Year	0.0	9.0	24.4	7.7	100.0
12-Year	0.0	0.0	40.7	0.0	100.0

The 60/40 stock/bond portfolio is a hypothetical portfolio. Source: S&P Dow Jones Indices LLC, U.S. Bureau of Labor Statistics, Bloomberg. Data from December 2001, to June 2018. Calculated by enduring investments. The 60/40 stock/bond portfolio is represented by 60% S&P 500 blended with 40% Bloomberg Barclays U.S. Aggregate Bond Index. Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

Still, the traditional metrics like risk and return are interesting and likely needed for completeness. Exhibit 10 shows how comparatively close the returns of the S&P Target Tuition Inflation Index were to tuition inflation, though there was more volatility that may have been expected given the difference in the data collection methods.

Exhibit 10: Annualized Risk and Returns of Tuition CPI and S&P Target Tuition Inflation Index With Constituents

PERIOD	S&P 500 BOND INDEX	S&P U.S. TREASURY TIPS 15+ YEAR INDEX	S&P 500	S&P U.S. TREASURY TIPS 1-10 YEAR INDEX	S&P TARGET TUITION INFLATION INDEX	CPI - COLLEGE TUITION AND FEES IN U.S. CITY AVERAGE
ANNUALIZED RETURN (%)						
1-Year	-0.7	6.3	14.4	1.5	2.7	1.7
3-Year	3.0	4.9	11.9	1.5	3.0	2.2
5-Year	3.5	4.4	13.4	1.3	2.9	2.8
10-Year	5.3	5.3	10.2	2.3	4.1	4.0
ANNUALIZED VOLATILITY (%)						
1-Year	2.6	7.4	8.6	1.7	3.9	1.5
3-Year	3.3	8.0	10.2	2.3	4.5	1.4
5-Year	3.4	9.2	9.8	2.8	5.2	1.5
10-Year	5.6	11.5	14.7	4.6	7.0	2.3

Source: S&P Dow Jones Indices LLC U.S. Bureau of Labor Statistics. Data as of June 2018. Past performance is no guarantee of future results. Table is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

CONCLUSION

The S&P Target Tuition Inflation Index aims to provide a college tuition TIPS-like solution for savers seeking to preserve their purchasing power for college tuition.

Given that the pace of rising costs of college has far exceeded general inflation, paying for it has now become a major concern. Though some tools have been introduced to help college savings, such as 529 plans, the investment offerings still largely consist of traditional investments not necessarily designed for college tuition liabilities. The S&P Target Tuition Inflation Index aims to provide a college tuition TIPS-like solution for savers seeking to preserve their purchasing power for college tuition.

Suppose an investor has USD 3,500 today, enough to pay for 10% of tuition and fees at a private college that now costs nearly USD 35,000. A hypothetical investment into a fund tracking this index (excluding fees) should theoretically be able to keep pace with tuition inflation over a long period, so that in eight or more years, that investor may still pay for 10% of college. This strategy may be able to be mixed with higher growth investments for longer time periods for extra gains with risky asset reduction as the college liability approaches, much like inflation bonds are used in glide paths for retirement where retirees aim to preserve purchasing power for their retirement liabilities.

While traditional measures like return and standard deviation for risk may be important, perhaps the most meaningful metric is the shortfall—the risk of not having enough to pay for college tuition. Based on the work presented here, the S&P Target Tuition Inflation Index has the potential to reduce that risk, as we have demonstrated here using live data and historical back-tests. In turn, this innovation may serve a niche need in the marketplace for investors looking to save for college tuition, and it conceivably may reduce debt created by shortfalls.

S&P DJI RESEARCH CONTRIBUTORS		
Charles Mounts	Global Head	charles.mounts@spglobal.com
Jake Vukelic	Business Manager	jake.vukelic@spglobal.com
GLOBAL RESEARCH & DESIGN		
AMERICAS		
Aye M. Soe, CFA	Americas Head	aye.soe@spglobal.com
Phillip Brzenk, CFA	Director	phillip.brzenk@spglobal.com
Smita Chirputkar	Director	smitta.chirputkar@spglobal.com
Rachel Du	Senior Analyst	rachel.du@spglobal.com
Bill Hao	Director	wenli.hao@spglobal.com
Qing Li	Director	qing.li@spglobal.com
Berlinda Liu, CFA	Director	berlinda.liu@spglobal.com
Maria Sanchez	Associate Director	maria.sanchez@spglobal.com
Kelly Tang, CFA	Director	kelly.tang@spglobal.com
Hong Xie, CFA	Director	hong.xie@spglobal.com
APAC		
Priscilla Luk	APAC Head	priscilla.luk@spglobal.com
Utkarsh Agrawal, CFA	Associate Director	utkarsh.agrawal@spglobal.com
Akash Jain	Associate Director	akash.jain@spglobal.com
Liyu Zeng, CFA	Director	liyu.zeng@spglobal.com
EMEA		
Sunjiv Mainie, CFA, CQF	EMEA Head	sunjiv.mainie@spglobal.com
Leonardo Cabrer, PhD	Senior Analyst	leonardo.cabrer@spglobal.com
Andrew Cairns	Senior Analyst	andrew.cairns@spglobal.com
Andrew Innes	Associate Director	andrew.innes@spglobal.com
INDEX INVESTMENT STRATEGY		
Craig J. Lazzara, CFA	Global Head	craig.lazzara@spglobal.com
Fei Mei Chan	Director	feimei.chan@spglobal.com
Tim Edwards, PhD	Managing Director	tim.edwards@spglobal.com
Anu R. Ganti, CFA	Director	anu.ganti@spglobal.com
Hamish Preston	Senior Associate	hamish.preston@spglobal.com
Howard Silverblatt	Senior Index Analyst	howard.silverblatt@spglobal.com

PERFORMANCE DISCLOSURE

The S&P Target Tuition Inflation Index was launched on August 31, 2017. All information presented prior to an index's Launch Date is hypothetical (back-tested), not actual performance. The back-test calculations are based on the same methodology that was in effect on the index Launch Date. Complete index methodology details are available at www.spdji.com.

S&P Dow Jones Indices defines various dates to assist our clients in providing transparency. The First Value Date is the first day for which there is a calculated value (either live or back-tested) for a given index. The Base Date is the date at which the Index is set at a fixed value for calculation purposes. The Launch Date designates the date upon which the values of an index are first considered live: index values provided for any date or time period prior to the index's Launch Date are considered back-tested. S&P Dow Jones Indices defines the Launch Date as the date by which the values of an index are known to have been released to the public, for example via the company's public website or its datafeed to external parties. For Dow Jones-branded indices introduced prior to May 31, 2013, the Launch Date (which prior to May 31, 2013, was termed "Date of introduction") is set at a date upon which no further changes were permitted to be made to the index methodology, but that may have been prior to the Index's public release date.

Past performance of the Index is not an indication of future results. Prospective application of the methodology used to construct the Index may not result in performance commensurate with the back-test returns shown. The back-test period does not necessarily correspond to the entire available history of the Index. Please refer to the methodology paper for the Index, available at www.spdji.com for more details about the index, including the manner in which it is rebalanced, the timing of such rebalancing, criteria for additions and deletions, as well as all index calculations.

Another limitation of using back-tested information is that the back-tested calculation is generally prepared with the benefit of hindsight. Back-tested information reflects the application of the index methodology and selection of index constituents in hindsight. No hypothetical record can completely account for the impact of financial risk in actual trading. For example, there are numerous factors related to the equities, fixed income, or commodities markets in general which cannot be, and have not been accounted for in the preparation of the index information set forth, all of which can affect actual performance.

The Index returns shown do not represent the results of actual trading of investable assets/securities. S&P Dow Jones Indices LLC maintains the Index and calculates the Index levels and performance shown or discussed, but does not manage actual assets. Index returns do not reflect payment of any sales charges or fees an investor may pay to purchase the securities underlying the Index or investment funds that are intended to track the performance of the Index. The imposition of these fees and charges would cause actual and back-tested performance of the securities/fund to be lower than the Index performance shown. As a simple example, if an index returned 10% on a US \$100,000 investment for a 12-month period (or US \$10,000) and an actual asset-based fee of 1.5% was imposed at the end of the period on the investment plus accrued interest (or US \$1,650), the net return would be 8.35% (or US \$8,350) for the year. Over a three year period, an annual 1.5% fee taken at year end with an assumed 10% return per year would result in a cumulative gross return of 33.10%, a total fee of US \$5,375, and a cumulative net return of 27.2% (or US \$27,200).

GENERAL DISCLAIMER

Copyright © 2018 by S&P Dow Jones Indices LLC. All rights reserved. Standard & Poor's®, S&P 500® and S&P® are registered trademarks of Standard & Poor's Financial Services LLC ("S&P"), a subsidiary of S&P Global. Dow Jones® is a registered trademark of Dow Jones Trademark Holdings LLC ("Dow Jones"). Trademarks have been licensed to S&P Dow Jones Indices LLC. Redistribution, reproduction and/or photocopying in whole or in part are prohibited without written permission. This document does not constitute an offer of services in jurisdictions where S&P Dow Jones Indices LLC, Dow Jones, S&P or their respective affiliates (collectively "S&P Dow Jones Indices") do not have the necessary licenses. All information provided by S&P Dow Jones Indices is impersonal and not tailored to the needs of any person, entity or group of persons. S&P Dow Jones Indices receives compensation in connection with licensing its indices to third parties. Past performance of an index is not a guarantee of future results.

It is not possible to invest directly in an index. Exposure to an asset class represented by an index is available through investable instruments based on that index. S&P Dow Jones Indices does not sponsor, endorse, sell, promote or manage any investment fund or other investment vehicle that is offered by third parties and that seeks to provide an investment return based on the performance of any index. S&P Dow Jones Indices makes no assurance that investment products based on the index will accurately track index performance or provide positive investment returns. S&P Dow Jones Indices LLC is not an investment advisor, and S&P Dow Jones Indices makes no representation regarding the advisability of investing in any such investment fund or other investment vehicle. A decision to invest in any such investment fund or other investment vehicle should not be made in reliance on any of the statements set forth in this document. Prospective investors are advised to make an investment in any such fund or other vehicle only after carefully considering the risks associated with investing in such funds, as detailed in an offering memorandum or similar document that is prepared by or on behalf of the issuer of the investment fund or other vehicle. Inclusion of a security within an index is not a recommendation by S&P Dow Jones Indices to buy, sell, or hold such security, nor is it considered to be investment advice.

These materials have been prepared solely for informational purposes based upon information generally available to the public and from sources believed to be reliable. No content contained in these materials (including index data, ratings, credit-related analyses and data, research, valuations, model, software or other application or output therefrom) or any part thereof (Content) may be modified, reverse-engineered, reproduced or distributed in any form or by any means, or stored in a database or retrieval system, without the prior written permission of S&P Dow Jones Indices. The Content shall not be used for any unlawful or unauthorized purposes. S&P Dow Jones Indices and its third-party data providers and licensors (collectively "S&P Dow Jones Indices Parties") do not guarantee the accuracy, completeness, timeliness or availability of the Content. S&P Dow Jones Indices Parties are not responsible for any errors or omissions, regardless of the cause, for the results obtained from the use of the Content. THE CONTENT IS PROVIDED ON AN "AS IS" BASIS. S&P DOW JONES INDICES PARTIES DISCLAIM ANY AND ALL EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USE, FREEDOM FROM BUGS, SOFTWARE ERRORS OR DEFECTS, THAT THE CONTENT'S FUNCTIONING WILL BE UNINTERRUPTED OR THAT THE CONTENT WILL OPERATE WITH ANY SOFTWARE OR HARDWARE CONFIGURATION. In no event shall S&P Dow Jones Indices Parties be liable to any party for any direct, indirect, incidental, exemplary, compensatory, punitive, special or consequential damages, costs, expenses, legal fees, or losses (including, without limitation, lost income or lost profits and opportunity costs) in connection with any use of the Content even if advised of the possibility of such damages.

S&P Dow Jones Indices keeps certain activities of its business units separate from each other in order to preserve the independence and objectivity of their respective activities. As a result, certain business units of S&P Dow Jones Indices may have information that is not available to other business units. S&P Dow Jones Indices has established policies and procedures to maintain the confidentiality of certain non-public information received in connection with each analytical process.

In addition, S&P Dow Jones Indices provides a wide range of services to, or relating to, many organizations, including issuers of securities, investment advisers, broker-dealers, investment banks, other financial institutions and financial intermediaries, and accordingly may receive fees or other economic benefits from those organizations, including organizations whose securities or services they may recommend, rate, include in model portfolios, evaluate or otherwise address.