

PIONEER MUNICIPAL HIGH INCOME ADVANTAGE TRUST

Form N-CSRS

November 29, 2018

UNITED STATES  
SECURITIES AND EXCHANGE COMMISSION  
Washington, D.C. 20549

FORM N-CSR

CERTIFIED SHAREHOLDER REPORT OF REGISTERED  
MANAGEMENT INVESTMENT COMPANIES

Investment Company Act file number 811-21409

Pioneer Municipal High Income Advantage Trust  
(Exact name of registrant as specified in charter)

60 State Street, Boston, MA 02109  
(Address of principal executive offices) (ZIP code)

Terrence J. Cullen, Amundi Pioneer Asset Management, Inc.,  
60 State Street, Boston, MA 02109  
(Name and address of agent for service)

Registrant's telephone number, including area code: (617) 742-7825

Date of fiscal year end: March 31

Date of reporting period: April 1, 2017 through September 30, 2018

Form N-CSR is to be used by management investment companies to file reports with the Commission not later than 10 days after the transmission to stockholders of any report that is required to be transmitted to stockholders under Rule 30e-1 under the Investment Company Act of 1940 (17 CFR 270.30e-1). The Commission may use the information provided on Form N-CSR in its regulatory, disclosure review, inspection, and policymaking roles.

A registrant is required to disclose the information specified by Form N-CSR, and the Commission will make this information public. A registrant is not required to respond to the collection of information contained in Form N-CSR unless the Form displays a currently valid Office of Management and Budget ("OMB") control number. Please direct comments concerning the accuracy of the information collection burden estimate and any suggestions for reducing the burden to Secretary, Securities and Exchange Commission, 450 Fifth Street, NW, Washington, DC 20549-0609. The OMB has reviewed this collection of information under the clearance requirements of 44 U.S.C. ss. 3507.

ITEM 1. REPORTS TO STOCKHOLDERS.

# Edgar Filing: PIONEER MUNICIPAL HIGH INCOME ADVANTAGE TRUST - Form N-CSRS

Pioneer Municipal High  
Income Advantage Trust

-----  
Semiannual Report | September 30, 2018  
-----

Ticker Symbol: MAV

[LOGO] Amundi Pioneer  
=====

ASSET MANAGEMENT

visit us: [www.amundipioneer.com](http://www.amundipioneer.com)

## Table of Contents

|   |    |
|---|----|
| President's Letter                          | 2  |
| Portfolio Management Discussion             | 4  |
| Portfolio Summary                           | 10 |
| Prices and Distributions                    | 11 |
| Performance Update                          | 12 |
| Schedule of Investments                     | 13 |
| Financial Statements                        | 23 |
| Notes to Financial Statements               | 28 |
| Additional Information                      | 38 |
| Approval of Investment Management Agreement | 41 |
| Trustees, Officers and Service Providers    | 46 |

Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18 1

## President's Letter

Through the third quarter of 2018, the U.S. stock market, as measured by the Standard & Poor's 500 Index (the S&P 500), has returned more than 10%, while bond markets, as measured by the Bloomberg Barclays U.S. Aggregate Bond Index, have been negative, returning -1.6%.

The momentum in the equity market has been driven by several factors, including overall positive corporate earnings reports and a strong U.S. economy. U.S. gross domestic product (GDP) growth exceeded 4% in the second quarter of 2018

## Edgar Filing: PIONEER MUNICIPAL HIGH INCOME ADVANTAGE TRUST - Form N-CSRS

and was expected to top 3% once again in the third quarter. The low unemployment rate has continued, with initial jobless claims hitting a multi-decade low and consumer and small-business confidence achieving levels not seen in many years.

Despite the good economic news, and even though wages have been rising, inflation expectations have not risen significantly. For its part, the U.S. Federal Reserve System (the Fed) continued with its tightening of monetary policy by raising interest rates in September, the third such increase during this calendar year, and has been moving forward with the tapering of its balance sheet, a process which began in October 2017.

Across the fixed-income space, rising interest rates have helped drive down the returns of some asset classes, such as U.S. Treasuries. However, strong corporate earnings and higher oil prices have propelled high-yield bonds well into positive territory through the first nine months of the year. In addition, higher rates have contributed to positive year-to-date returns for floating-rate instruments such as bank loans, while structured sectors, including asset-backed securities (ABS) and mortgage-backed securities (MBS), have generally outperformed Treasuries. Agency MBS, in particular, have performed well as the housing market has continued to show strength, even with both interest rates and home prices moving upward.

Despite the generally positive returns, market volatility has increased this year compared with 2017. The aforementioned rising interest rates have been one reason, while the uncertainty surrounding U.S. trade policy has, at times, also led to unsettled markets. Of course, in today's global economy, risk factors extend well beyond U.S. borders, and investors have grappled with various issues on the international front in recent months, including a lack of progress in the United Kingdom's Brexit negotiations, concerns about the budgetary policies of the populist Italian government, and the potential impact of Turkey's economic challenges on European banks. Moreover, while trade tensions between the U.S. and Europe have moderated, proposed higher tariffs on Chinese imports could have a negative impact on that country's economy and, by extension, on its Asian trade partners.

2 Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18

As we enter the final quarter of 2018, however, we remain cautious on the equity markets. While we are constructive on our view of U.S. stocks and the overall economy, the previously mentioned risk factors and increased volatility are concerns that may overtake that constructive view.

In fixed income, we have taken a more cautious approach in our core portfolios with regard to credit-sensitive debt, as those investments appear more susceptible to what we believe could be a less-benign credit environment going forward, due in part to increased leverage within the investment-grade and bank-loan market segments. We believe that structured credit sectors, including agency MBS, non-agency MBS, and ABS, may offer investors more attractive relative value, given solid U.S. housing market and consumer fundamentals. Agency MBS and high-quality, non-agency MBS may also offer lower downside volatility and stronger credit protections relative to their quality ratings. In addition, as interest rates have risen, we find that short- and intermediate-term Treasuries have become more attractive.

We believe this year's market fluctuations as well as increased risk factors within the global economy have served to remind investors of the importance of active management. Since 1928, active management has been the foundation of Amundi Pioneer's investment approach. We believe active management is especially important during periods of volatility, and that our shareowners can

## Edgar Filing: PIONEER MUNICIPAL HIGH INCOME ADVANTAGE TRUST - Form N-CSRS

benefit from the experience and tenure of our investment teams, who work collaboratively to make active and informed decisions across our funds.

As always, and particularly during times of market uncertainty, we encourage you to work with your financial advisor to develop an overall investment plan that addresses both your short- and long-term goals, and to implement such a plan in a disciplined manner.

We greatly appreciate the trust you have placed in us and look forward to continuing to serve you in the future.

Sincerely,

/s/ Lisa M. Jones

Lisa M. Jones  
Head of the Americas, President and CEO of U.S.  
Amundi Pioneer Asset Management USA, Inc.  
September 30, 2018

Any information in this shareowner report regarding market or economic trends or the factors influencing the Trust's historical or future performance are statements of opinion as of the date of this report. Past performance is no guarantee of future results.

Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18 3

Portfolio Management Discussion | 9/30/18

The municipal bond market generated positive results over the six-month period ended September 30, 2018, with high-yield municipals once again outperforming investment-grade municipals. In the following interview, David Eurkus and Jonathan Chirunga discuss the factors that influenced the performance of Pioneer Municipal High Income Advantage Trust during the six-month period. Mr. Eurkus, Managing Director, Director of Municipals, U.S., and a portfolio manager at Amundi Pioneer Asset Management, Inc. ("Amundi Pioneer"), and Mr. Chirunga, a senior vice president and a portfolio manager at Amundi Pioneer, are responsible for the day-to-day management of the Trust.

Q How did Pioneer Municipal High Income Advantage Trust perform during the six-month period ended September 30, 2018?

A Pioneer Municipal High Income Advantage Trust returned 1.13% at net asset value (NAV) and 2.33% at market price during the six-month period ended September 30, 2018. During the same six-month period, the Trust's benchmarks, the Bloomberg Barclays U.S. Municipal High Yield Bond Index and the Bloomberg Barclays Municipal Bond Index, returned 3.84% and 0.72% at NAV, respectively. The Bloomberg Barclays U.S. Municipal High Yield Bond Index is an unmanaged measure of the performance of lower-rated municipal bonds, while the Bloomberg Barclays Municipal Bond Index is an unmanaged measure of the performance of investment-grade municipal bonds. Unlike the Trust, the two indices do not use leverage. While use of leverage increases investment opportunity, it also increases investment risk.

During the same six-month period, the average return at NAV of the 14 closed-end funds in Morningstar's High Yield Municipal Debt Closed End Funds category (which may or may not be leveraged) was 1.44%, and the average return (at market price) of the 14 closed-end funds in the same Morningstar category was 2.05%.

## Edgar Filing: PIONEER MUNICIPAL HIGH INCOME ADVANTAGE TRUST - Form N-CSRS

The shares of the Trust were selling at a 6.4% discount to NAV on September 30, 2018. Comparatively, the shares of the Trust were selling at a 7.5% discount to NAV on March 31, 2018.

On September 30, 2018, the standardized 30-day SEC yield of the Trust's shares was 4.36%\*.

- \* The 30-day SEC yield is a standardized formula that is based on the hypothetical annualized earning.

4 Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18

Q How would you describe the investment environment in the municipal bond market during the six-month period ended September 30, 2018?

A During the past six months, the municipal bond market performed well in the wake of tax reform legislation passed in the U.S. last December, which continues to loom large. The law's revisions to the federal tax code included the fact that, within the municipal market, advance refunding bonds would no longer be tax exempt as of January 1, 2018. (An advance refunding bond is issued to pay off, or refund, another outstanding bond more than 90 days in advance of its call date.)

Advance refunding bonds have traditionally been issued by municipalities to refinance debt at lower rates and to delay repayment of principal. In December 2017, a host of municipal entities rushed to issue advance refunding bonds before the new tax bill took effect. The spike in supply was well received by the market, but in January 2018, the municipal market experienced significantly reduced demand, as many large investors who would have typically purchased bonds in January had already done so in December in advance of the new law's effective date. Due to the sudden decrease in demand, the tax-free bond market underwent a correction, and yields rose sharply. However, the municipal market then stabilized.

Later in the period, the high-yield municipal market was temporarily disrupted when some large exchange-traded funds (ETFs) began to liquidate a significant volume of tobacco settlement bonds in order to cover redemptions. However, the heavily discounted bonds began to find buyers by period-end, and tobacco settlement bonds specifically -- and high-yield municipals more generally -- gradually recovered in price. Municipal bonds ended the six-month period at valuations that were very attractive compared with Treasury bonds of similar maturity. Meanwhile, investor demand for tax-exempt bonds continued to outpace supply, leading to favorable market conditions.

Elsewhere, the U.S. economy continued to perform well despite increasing trade tensions between the United States and a number of other countries, and the U.S. Federal Reserve System (the Fed) continued to remove monetary accommodation from the U.S. economy by raising short-term rates in June and September, and continuing to taper its balance sheet, a process that began in October 2017. In addition, the Treasury yield curve continued to flatten over the period, as long-term Treasury rates rose slightly while short-term rates increased more significantly.

Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18 5

## Edgar Filing: PIONEER MUNICIPAL HIGH INCOME ADVANTAGE TRUST - Form N-CSRS

Q What factors affected the Trust's performance relative to the Bloomberg Barclays municipal bond indices during the six-month period ended September 30, 2018?

A During the period, we maintained a well-diversified\*\* portfolio, with exposures to both investment-grade and high-yield municipal bonds. The diversification helped the Trust outperform the Bloomberg Barclays Municipal Bond Index, which tracks investment-grade municipals, even as it trailed the return of the Bloomberg Barclays U.S. Municipal High Yield Bond Index.

The portfolio's holdings of certain tobacco bonds funded by Master Settlement Agreements between the tobacco industry and individual states, as well as higher education bonds issued by the City of Philippi, West Virginia, contributed positively to the Trust's performance during the period. The bonds funded several projects at a small college in rural West Virginia that have not been additive to the school's bottom line. However, the Trust is currently receiving payments from the issuer under the terms of a forbearance agreement we negotiated. The forbearance agreement, originally due to expire in October, has been extended and will now expire in December 2018. By the time the forbearance agreement expires, the Trust is expected to receive \$2.9 million in total payments. Prior to the forbearance agreement, the Trust was realizing no income from the City of Philippi bond.

Detractors from the Trust's benchmark-relative returns during the period included portfolio holdings of underperforming Maryland Health & Higher Education bonds, and Maine Turnpike Authority revenue bonds.

Q Did the Trust's distributions\*\*\* to shareholders change during the six-month period ended September 30, 2018?

A No, the Trust's distribution level remained consistent over the six-month period.

Q Did the level of leverage in the Trust change during the six-month period ended September 30, 2018?

A At the end of the six-month period on September 30, 2018, 37.0% of the Trust's total managed assets were financed by leverage obtained through the issuance of preferred shares, compared with 36.6% of the Trust's total managed assets financed by leverage at the start of the period on April 1, 2018.

\*\* Diversification does not assure a profit nor protect against loss.

\*\*\* Distributions are not guaranteed.

6 Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18

The Trust historically employed leverage through the issuance of Auction Preferred Shares ("APS"). The Trust redeemed all of its outstanding APS on February 20, 2018. The Trust refinanced the APS, and increased the amount of leverage employed by the Trust, through the issuance of Variable Rate Muni Fund Term Preferred Shares ("VMTP Shares"). VMTP Shares are issued via private placement and are not publicly available. The further increase in leverage as a percentage of the Trust's total managed assets during the six-month period was the result of depreciation in the values of the Trust's holdings.

## Edgar Filing: PIONEER MUNICIPAL HIGH INCOME ADVANTAGE TRUST - Form N-CSRS

Q Did the Trust invest in any derivative securities during the six-month period ended September 30, 2018?

A No, the Trust's portfolio held no derivative securities during the period.

Q What is your investment outlook?

A Our outlook for the municipal market remains positive. We believe that healthy demand from both traditional and non-traditional investors drawn to the market by the attractive value and generous yields of municipal bonds -- as compared with taxable debt -- can continue to outstrip limited new-issue supply and help to support the prices of municipals. At the same time, we think that the U.S. economy can continue to grow at a stable and modest pace without an accompanying acceleration in inflation. Given such an economic scenario, we believe solidly-performing municipal bonds should continue to experience steady credit improvement. We also believe that the Fed will continue to act deliberately and cautiously as it gradually raises short-term rates. However, escalating trade disputes and other geopolitical events could spur additional volatility within financial markets in the coming months.

Consistent with our investment discipline in managing the Trust, we intend to focus on intensive, fundamental research when selecting individual bond issues, while maintaining a close watch on any economic factors that could influence the municipal market. We do not anticipate any significant changes to either the portfolio's positioning or structure in the near future.

Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18 7

Please refer to the Schedule of Investments on pages 13-22 for a full listing of Trust securities.

All investments are subject to risk, including the possible loss of principal. In the past several years, financial markets have experienced increased volatility, depressed valuations, decreased liquidity and heightened uncertainty. These conditions may continue, recur, worsen or spread.

Investments in high-yield or lower-rated securities are subject to greater-than-average risk.

The Trust may invest in securities of issuers that are in default or that are in bankruptcy.

A portion of income may be subject to state, federal, and/or alternative minimum tax. Capital gains, if any, are subject to a capital gains tax.

When interest rates rise, the prices of fixed-income securities in the Trust will generally fall. Conversely, when interest rates fall, the prices of fixed-income securities in the Trust will generally rise.

By concentrating in municipal securities, the portfolio is more susceptible to adverse economic, political or regulatory developments than is a portfolio that invests more broadly.

Investments in the Trust are subject to possible loss due to the financial failure of the issuers of the underlying securities and the issuers' inability to meet their debt obligations.

The Trust currently uses leverage through the issuance of preferred shares.

## Edgar Filing: PIONEER MUNICIPAL HIGH INCOME ADVANTAGE TRUST - Form N-CSRS

Leverage creates significant risks, including the risk that the Trust's incremental income or capital appreciation for investments purchased with the proceeds of leverage will not be sufficient to cover the cost of leverage, which may adversely affect the return for the holders of common shares.

8 Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18

The Trust is required to meet certain regulatory and rating agency asset coverage requirements in connection with its outstanding preferred shares. In order to maintain required asset coverage levels, the Trust may be required to alter the composition of its investment portfolio or take other actions, such as redeeming preferred shares with the proceeds from portfolio transactions, at what might be inopportune times in the market. Such actions could reduce the net earnings or returns to holders of the Trust's common shares over time, which is likely to result in a decrease in the market value of the Trust's shares.

These risks may increase share price volatility.

Any information in this shareowner report regarding market or economic trends or the factors influencing the Trust's historical or future performance are statements of opinion as of the date of this report. Past performance is no guarantee of future results.

Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18 9

Portfolio Summary | 9/30/18

Portfolio Diversification

-----  
(As a percentage of total investments)\*

[THE FOLLOWING DATA WAS REPRESENTED AS A PIE CHART IN THE PRINTED MATERIAL]

|                              |       |
|------------------------------|-------|
| Insured:                     | 11.9% |
| Revenue Bonds: Other Revenue | 37.7% |
| Education Revenue            | 12.5% |
| Health Revenue               | 12.2% |
| Tobacco Revenue              | 8.7%  |
| Development Revenue          | 5.4%  |
| Facilities Revenue           | 5.1%  |
| Water Revenue                | 2.7%  |
| Pollution Control Revenue    | 1.7%  |
| Transportation Revenue       | 1.5%  |
| Airport Revenue              | 0.6%  |

Portfolio Maturity

-----  
(As a percentage of total investments)\*

[THE FOLLOWING DATA WAS REPRESENTED AS A PIE CHART IN THE PRINTED MATERIAL]



# Edgar Filing: PIONEER MUNICIPAL HIGH INCOME ADVANTAGE TRUST - Form N-CSRS

|             |       |
|-------------|-------|
| 20+ years   | 51.8% |
| 10-20 years | 34.3% |
| 7-10 years  | 11.3% |
| 5 -7 years  | 1.6%  |
| 0-5 years   | 1.0%  |

## 10 Largest Holdings

(As a percentage of total investments)\*

1. New Jersey Transportation Trust Fund Authority, 12/15/27 (BHAC-CR MBIA Insured)
2. Massachusetts Development Finance Agency, WGBH Foundation, Series A, 5.75%, 1/1/42 (AMBAC Insured)
3. Buckeye Tobacco Settlement Financing Authority, Asset-Backed, Series A-2, 6.5%, 6/1/47
4. Private Colleges & Universities Authority, Emory University, Series A, 5.0%, 10/1/43
5. New York State Dormitory Authority, Series C, 5.0%, 3/15/39
6. New Jersey Economic Development Authority, Continental Airlines, 5.75%, 9/15/27
7. New York State Dormitory Authority, Series A, 4.0%, 7/1/37
8. State of Connecticut, Series E, 4.0%, 9/1/30
9. State of Florida, Capital Outlay, Series A, 4.0%, 6/1/38
10. District of Columbia Tobacco Settlement Financing Corp., Asset-Backed, 6.75%, 5/15/40

\* Excludes temporary cash investments and all derivative contracts except for options purchased. The Trust is actively managed, and current holdings may be different. The holdings listed should not be considered recommendations to buy or sell any securities listed.

10 Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18

Prices and Distributions | 9/30/18

Share Prices and Distributions

Market Value per Common Share^

9/30/18

3/31/18

## Edgar Filing: PIONEER MUNICIPAL HIGH INCOME ADVANTAGE TRUST - Form N-CSRS

|              |         |         |
|--------------|---------|---------|
| Market Value | \$10.66 | \$10.72 |
| Discount     | (6.4)%  | (7.5)%  |

Net Asset Value per Common Share<sup>^</sup>

|                 |         |         |
|-----------------|---------|---------|
|                 | 9/30/18 | 3/31/18 |
| Net Asset Value | \$11.39 | \$11.59 |

Distributions per Common Share: 4/1/18 - 9/30/18

| Net Investment Income | Short-Term Capital Gains | Long-Term Capital Gains |
|-----------------------|--------------------------|-------------------------|
| \$0.3150              | \$--                     | \$--                    |

Yields

|                  |         |         |
|------------------|---------|---------|
|                  | 9/30/18 | 3/31/18 |
| 30-Day SEC Yield | 4.36%   | 4.10%   |

The data shown above represents past performance, which is no guarantee of future results.

<sup>^</sup> Net asset value and market value are published in Barron's on Saturday, The Wall Street Journal on Monday and The New York Times on Monday and Saturday. Net asset value and market value are published daily on the Trust's website at [www.amundipioneer.com](http://www.amundipioneer.com).

Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18 11

Performance Update | 9/30/18

Investment Returns

## Edgar Filing: PIONEER MUNICIPAL HIGH INCOME ADVANTAGE TRUST - Form N-CSRS

The mountain chart on the right shows the change in market value, including reinvestment of dividends and distributions, of a \$10,000 investment made in common shares of Pioneer Municipal High Income Advantage Trust during the periods shown, compared to that of the Bloomberg Barclays Municipal Bond Index and the Bloomberg Barclays U.S. Municipal High Yield Bond Index.

Average Annual Total Returns  
(As of September 30, 2018)

| Period   | Net Asset Value (NAV) | Market Price | Bloomberg Barclays Municipal Bond Index | Bloomberg Barclays U.S. Municipal High Yield Bond Index |
|----------|-----------------------|--------------|---|---|
| 10 years | 7.95%                 | 8.38%        | 4.75%                                   | 6.51%   |
| 5 years  | 5.98                  | 2.17         | 3.54                                    | 6.36  |
| 1 year   | 1.04                  | -2.32        | 0.35                                    | 6.36  |

[THE FOLLOWING DATA WAS REPRESENTED AS A MOUNTAIN CHART IN THE PRINTED MATERIAL]

Value of \$10,000 Investment

|      | Pioneer Municipal High Income Advantage Trust | Bloomberg Barclays Municipal Bond Index | Bloomberg Barclays U.S. Municipal High Yield Bond Index |
|------|---|---|---|
| 9/08 | \$10,000                                      | \$10,000                                | \$10,000  |
| 9/09 | \$12,969                                      | \$11,485                                | \$10,455  |
| 9/10 | \$16,216                                      | \$12,152                                | \$11,724  |
| 9/11 | \$17,426                                      | \$12,624                                | \$12,214  |
| 9/12 | \$22,075                                      | \$13,674                                | \$14,020  |
| 9/13 | \$20,088                                      | \$13,371                                | \$13,804  |
| 9/14 | \$24,627                                      | \$14,431                                | \$15,455  |
| 9/15 | \$22,578                                      | \$14,887                                | \$15,647  |
| 9/16 | \$24,580                                      | \$15,718                                | \$17,418  |
| 9/17 | \$22,896                                      | \$15,855                                | \$17,668  |
| 9/18 | \$22,365                                      | \$15,911                                | \$18,792  |

Call 1-800-225-6292 or visit [www.amundipioneer.com](http://www.amundipioneer.com) for the most recent month-end performance results. Current performance may be lower or higher than the performance data quoted.

Performance data shown represents past performance. Past performance is no guarantee of future results. Investment return and market price will fluctuate, and your shares may trade below NAV due to such factors as interest rate changes and the perceived credit quality of borrowers.

Total investment return does not reflect broker sales charges or commissions. All performance is for common shares of the Trust.

Shares of closed-end funds, unlike open-end funds, are not continuously

## Edgar Filing: PIONEER MUNICIPAL HIGH INCOME ADVANTAGE TRUST - Form N-CSRS

offered. There is a one-time public offering and, once issued, shares of closed-end funds are bought and sold in the open market through a stock exchange, and frequently trade at prices lower than their NAV. NAV per common share is total assets less total liabilities, which include preferred shares, divided by the number of common shares outstanding.

When NAV is lower than market price, dividends are assumed to be reinvested at the greater of NAV or 95% of the market price. When NAV is higher, dividends are assumed to be reinvested at prices obtained through open-market purchases under the Trust's dividend reinvestment plan.

The performance table and graph do not reflect the deduction of fees and taxes that a shareowner would pay on Trust distributions or the sale of Trust shares. Had these fees and taxes been reflected, performance would have been lower.

The Bloomberg Barclays Municipal Bond Index is an unmanaged, broad measure of the municipal bond market. The Bloomberg Barclays U.S. Municipal High Yield Bond Index is unmanaged, totals over \$26 billion in market value and maintains over 1,300 securities. Municipal bonds in this index have the following requirements: maturities of one year or greater, sub investment grade (below Baa or non-rated), fixed coupon rate, issue date later than 12/31/90, deal size over \$20 million, maturity size of at least \$3 million. Index returns are calculated monthly, assume reinvestment of dividends and, unlike Trust returns, do not reflect any fees, expenses or sales charges. The indices do not employ leverage. You cannot invest directly in the indices.

12 Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18

Schedule of Investments | 9/30/18 (unaudited)

-----  
Principal  
Amount  
USD (\$)  
-----

|           |   |
|-----------|---|
|           | UNAFFILIATED ISSUERS -- 157.4%  |
|           | DEBTOR IN POSSESSION FINANCING --                                       |
|           | 1.6% of Net Assets  |
| 4,432,000 | Texas Pellets, Inc. / German Pellets Texas LLC, 8.0%,<br>9/30/18 (144A) |

-----  
TOTAL DEBTOR IN POSSESSION FINANCING  
(Cost \$4,432,000)  
-----

|           |  |
|-----------|--|
|           | TAX EXEMPT OBLIGATIONS --  |
|           | 155.8% of Net Assets (a)   |
|           | Alabama -- 1.6%  |
| 2,500,000 | Alabama Industrial Development Authority, Pine City Fiber Co.,<br>6.45%, 12/1/23                                   |
| 2,500,000 | Huntsville-Redstone Village Special Care Facilities Financing<br>Authority, Redstone Village Project, 5.5%, 1/1/43 |

-----  
Arizona -- 2.5%  
-----

## Edgar Filing: PIONEER MUNICIPAL HIGH INCOME ADVANTAGE TRUST - Form N-CSRS

|               |   |
|---------------|---|
| 4,000,000 (b) | City of Phoenix, 5.0%, 7/1/27   |
| 2,000,000     | City of Phoenix, Industrial Development Authority, 3rd & Indian School Assisted Living Project, 5.4%, 10/1/36 |
| 27,000        | County of Pima, Industrial Development Authority, Arizona Charter Schools Project, Series C, 6.75%, 7/1/31    |

---

|                |  |
|----------------|--|
| 6,990,000      | California -- 13.9%  |
| 38,610,000 (c) | California County Tobacco Securitization Agency, Asset-Backed, Gold County Funding Corp., 5.25%, 6/1/46                  |
| 1,845,000      | California County Tobacco Securitization Agency, Capital Appreciation, Stanislaus County, Subordinated, Series A, 6/1/46 |
| 1,550,000      | California Educational Facilities Authority, Stanford University, 5.25%, 4/1/40  |
| 5,000,000      | California Enterprise Development Authority, Sunpower Corp., 8.5%, 4/1/31  |
| 2,975,000 (d)  | California Pollution Control Financing Authority, 5.0%, 7/1/37 (144A)  |
| 1,875,000      | California School Finance Authority, Classical Academies Project, Series A, 7.375%, 10/1/43                              |
| 757,342 (e)    | California Statewide Communities Development Authority, Lancer Plaza Project, 5.875%, 11/1/43                            |
| 1,500,000 (d)  | California Statewide Communities Development Authority, Microgy Holdings Project, 9.0%, 12/1/38                          |
| 1,500,000 (d)  | City of Madera, Irrigation Financing Authority, 6.25%, 1/1/31  |
|                | City of Madera, Irrigation Financing Authority, 6.5%, 1/1/40   |

The accompanying notes are an integral part of these financial statements.

Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18 13

Schedule of Investments | 9/30/18 (unaudited) (continued)

---

Principal  
Amount  
USD (\$)

---

|               |   |
|---------------|---|
| 2,695,000 (b) | California -- (continued)   |
| 2,425,000 (b) | Coast Community College District, Election, Series D, 5.0%, 8/1/31                  |
| 465,000       | State of California, Various Purposes, 5.75%, 4/1/31                                |
|               | Tobacco Securitization Authority of Southern California, Series A-1, 5.125%, 6/1/46 |

---

|               |  |
|---------------|--|
| 1,500,000 (d) | Colorado -- 0.7%   |
|               | Colorado Educational & Cultural Facilities Authority, Rocky Mountain Classical Academy Project, 8.0%, 9/1/43 |

---

|               |   |
|---------------|---|
| 2,035,000     | Connecticut -- 3.9%                                   |
| 7,200,000 (b) | Mohegan Tribal Finance Authority, 7.0%, 2/1/45 (144A) |
|               | State of Connecticut, Series E, 4.0%, 9/1/30          |

Edgar Filing: PIONEER MUNICIPAL HIGH INCOME ADVANTAGE TRUST - Form N-CSRS

1,000,000 Town of Hamden, Whitney Center Project, Series A,  
7.75%, 1/1/43

---

3,975,000 District of Columbia -- 4.9%  
District of Columbia, Housing Product Trust Fund, Series A,  
4.25%, 6/1/37 (NATL Insured)  
1,995,000 District of Columbia Tobacco Settlement Financing Corp.,  
Asset-Backed, 6.5%, 5/15/33  
6,825,000 District of Columbia Tobacco Settlement Financing Corp.,  
Asset-Backed, 6.75%, 5/15/40

---

1,500,000 Florida -- 9.0%  
Alachua County Health Facilities Authority, Terraces Bonita  
Springs Project, Series A, 8.125%, 11/15/41  
1,500,000 Alachua County Health Facilities Authority, Terraces Bonita  
Springs Project, Series A, 8.125%, 11/15/46  
2,500,000 (d) County of Miami-Dade, Aviation Revenue, Series B,  
5.5%, 10/1/41  
5,000,000 County of Miami-Dade, Water & Sewer System Revenue,  
Series A, 4.0%, 10/1/44  
5,000,000 Florida's Turnpike Enterprise, Department of Transportation,  
Series A, 4.0%, 7/1/32  
1,000,000 (d) Hillsborough County Industrial Development Authority, Various  
Health Facilities, 8.0%, 8/15/32  
7,035,000 (b) State of Florida, Capital Outlay, Series A, 4.0%, 6/1/38

---

5,000,000 Georgia -- 6.3%  
City of Atlanta, Water & Wastewater Revenue, Series A,  
5.0%, 11/1/34  
900,000 (d) DeKalb County Georgia Hospital Authority, DeKalb Medical  
Center, Inc., Project, 6.0%, 9/1/30

The accompanying notes are an integral part of these financial statements.

14 Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18

---

Principal  
Amount  
USD (\$)

---

750,000 (d) Georgia -- (continued)  
DeKalb County Georgia Hospital Authority, DeKalb Medical  
Center, Inc., Project, 6.125%, 9/1/40  
8,750,000 Private Colleges & Universities Authority, Emory University,  
Series A, 5.0%, 10/1/43

---

Guam -- 0.4%

## Edgar Filing: PIONEER MUNICIPAL HIGH INCOME ADVANTAGE TRUST - Form N-CSRS

|               |   |
|---------------|---|
| 1,000,000     | Guam Department of Education, Certificates of Participation, John F. Kennedy High School, Series A, 6.625%, 12/1/30 |
| <hr/>         |   |
| 2,000,000     | Idaho -- 0.7%<br>Power County Industrial Development Corp., FMC Corp. Project, 6.45%, 8/1/32                        |
| <hr/>         |   |
| 1,000,000 (b) | Illinois -- 2.8%<br>Chicago Board of Education, Series A, 7.0%, 12/1/46 (144A)                                      |
| 417,400 (f)   | Illinois Finance Authority, Clare Oaks Project, Series B, 4.0%, 11/15/52  |
| 261,000 (c)   | Illinois Finance Authority, Clare Oaks Project, Series C-1, 11/15/52  |
| 52,200 (c)    | Illinois Finance Authority, Clare Oaks Project, Series C-2, 11/15/52  |
| 52,200 (c)    | Illinois Finance Authority, Clare Oaks Project, Series C-3, 11/15/52  |
| 1,450,000     | Illinois Finance Authority, Memorial Health System, 5.5%, 4/1/39  |
| 2,000,000 (d) | Illinois Finance Authority, Northwestern Memorial Hospital, Series A, 6.0%, 8/15/39                                 |
| 280,000 (d)   | Illinois Finance Authority, Swedish Covenant, Series A, 6.0%, 8/15/38   |
| 1,000,000     | Metropolitan Pier & Exposition Authority, McCormick Place, Series B, 5.0%, 6/15/52 (ST APPROP Insured)              |
| 1,350,000     | Southwestern Illinois Development Authority, Village of Sauget Project, 5.625%, 11/1/26                             |
| <hr/>         |   |
| 250,000       | Indiana -- 0.9%<br>City of Carmel, Barrington Carmel Project, Series A, 7.0%, 11/15/32                              |
| 750,000       | City of Carmel, Barrington Carmel Project, Series A, 7.125%, 11/15/42   |
| 500,000       | City of Carmel, Barrington Carmel Project, Series A, 7.125%, 11/15/47   |
| 1,000,000     | Indiana Finance Authority, Educational Facilities, 5.125%, 7/1/37   |

The accompanying notes are an integral part of these financial statements.

Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18 15

Schedule of Investments | 9/30/18 (unaudited) (continued)

Principal  
Amount  
USD (\$)

|               |   |
|---------------|---|
| 1,000,000 (d) | Kansas -- 0.4%<br>Kansas Development Finance Authority, Hayes Medical |
|---------------|---|

Edgar Filing: PIONEER MUNICIPAL HIGH INCOME ADVANTAGE TRUST - Form N-CSRS

Center, Inc., Series Q, 5.0%, 5/15/35

---

|           |   |
|-----------|---|
|           | Louisiana -- 2.9%   |
| 7,000,000 | Jefferson Parish Hospital Service District No. 2, East Jefferson General Hospital, 6.375%, 7/1/41       |
| 750,000   | Opelousas Louisiana General Hospital Authority, Opelousas General Health System Project, 5.75%, 10/1/23 |

---

|           |  |
|-----------|--|
|           | Maine -- 2.0%  |
| 1,500,000 | Maine Health & Higher Educational Facilities Authority, Maine General Medical Center, 7.5%, 7/1/32 |
| 3,500,000 | Maine Turnpike Authority, Series A, 5.0%, 7/1/42   |

---

|               |   |
|---------------|---|
|               | Maryland -- 3.9%  |
| 2,000,000 (d) | Maryland Health & Higher Educational Facilities Authority, Charlestown Community, 6.25%, 1/1/45                       |
| 2,090,000     | Maryland Health & Higher Educational Facilities Authority, City Neighbors, Series A, 6.75%, 7/1/44                    |
| 1,250,000 (d) | Maryland Health & Higher Educational Facilities Authority, Doctor's Community Hospital, 5.75%, 7/1/38                 |
| 4,500,000     | Maryland Health & Higher Educational Facilities Authority, Maryland University Medical System, Series A, 5.0%, 7/1/43 |

---

|               |  |
|---------------|--|
|               | Massachusetts -- 10.0%   |
| 7,000,000 (c) | Massachusetts Bay Transportation Authority, Series A, 7/1/28   |
| 2,575,000 (d) | Massachusetts Development Finance Agency, Broad Institute, Inc., Series A, 5.25%, 4/1/37                               |
| 961,679       | Massachusetts Development Finance Agency, Linden Ponds, Inc., Series A-1, 5.5%, 11/15/46                               |
| 2,200,000     | Massachusetts Development Finance Agency, Partner's Healthcare System, Series M-4, 5.0%, 7/1/39                        |
| 8,000,000     | Massachusetts Development Finance Agency, WGBH Foundation, Series A, 5.75%, 1/1/42 (AMBAC Insured)                     |
| 4,325,000     | Massachusetts Health & Educational Facilities Authority, Massachusetts Institute of Technology, Series K, 5.5%, 7/1/32 |

---

|           |   |
|-----------|---|
|           | Michigan -- 3.0%  |
| 2,000,000 | Flint Michigan Hospital Building Authority, Hurley Medical Center, 7.375%, 7/1/35 |
| 560,000   | Michigan Public Educational Facilities Authority, Crescent Academy, 7.0%, 10/1/36 |
| 5,000,000 | Michigan State University, Series A, 5.0%, 8/15/41                                |

---

The accompanying notes are an integral part of these financial statements.



Edgar Filing: PIONEER MUNICIPAL HIGH INCOME ADVANTAGE TRUST - Form N-CSRS

-----  
Principal  
Amount  
USD (\$)  
-----

|               |   |
|---------------|---|
|               | Minnesota -- 2.7%   |
| 2,000,000     | Bloomington Port Authority, Radisson Blu Mall of America, 9.0%, 12/1/35 |
| 1,000,000     | City of Ham Lake, DaVinci Academy, Series A, 5.0%, 7/1/47               |
| 3,755,000 (b) | State of Minnesota, Series B, 4.0%, 8/1/27                              |

|               |  |
|---------------|--|
|               | Montana -- 0.1%  |
| 2,445,000 (e) | City of Hardin, Tax Allocation, Rocky Mountain Power, Inc., Project, 6.25%, 9/1/31 |
| 1,000,000 (e) | Two Rivers Authority, Inc., 7.375%, 11/1/27  |

|           |  |
|-----------|--|
|           | Nevada -- 0.7%                           |
| 2,000,000 | County of Washoe, Fuel Tax, 5.0%, 2/1/43 |

|           |   |
|-----------|---|
|           | New Hampshire -- 0.7%   |
| 2,000,000 | New Hampshire Health & Education Facilities Authority Act, Catholic Medical Centre, 3.75%, 7/1/40 |

|                |   |
|----------------|---|
|                | New Jersey -- 9.6%  |
| 7,500,000      | New Jersey Economic Development Authority, Continental Airlines, 5.75%, 9/15/27                                   |
| 1,000,000      | New Jersey Economic Development Authority, Marion P. Thomas Charter School, Inc., Project, 5.375%, 10/1/50 (144A) |
| 3,500,000 (f)  | New Jersey State Turnpike Authority, RIB, 11.1%, 1/1/28 (144A) (AGM Insured)                                      |
| 15,375,000 (c) | New Jersey Transportation Trust Fund Authority, 12/15/27 (BHAC-CR MBIA Insured)                                   |

|               |  |
|---------------|--|
|               | New York -- 9.8%   |
| 5,000,000     | New York State Dormitory Authority, Columbia University, 5.0%, 10/1/41             |
| 2,000,000 (d) | New York State Dormitory Authority, Orange Medical Center, 6.125%, 12/1/29         |
| 7,500,000     | New York State Dormitory Authority, Series A, 4.0%, 7/1/37                         |
| 7,500,000     | New York State Dormitory Authority, Series C, 5.0%, 3/15/39                        |
| 1,500,000     | New York State Dormitory Authority, Trustees of Columbia University, 5.0%, 10/1/45 |
| 1,333,463     | Westchester County Healthcare Corp., Series A, 5.0%, 11/1/44                       |

|           |  |
|-----------|--|
|           | North Carolina -- 0.7%                                     |
| 500,000   | City of Charlotte, Airport Revenue, Series A, 5.0%, 7/1/42 |
| 1,250,000 | City of Charlotte, Airport Revenue, Series A, 5.0%, 7/1/47 |

-----

## Edgar Filing: PIONEER MUNICIPAL HIGH INCOME ADVANTAGE TRUST - Form N-CSRS

The accompanying notes are an integral part of these financial statements.

Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18 17

### Schedule of Investments | 9/30/18 (unaudited) (continued)

-----  
Principal  
Amount  
USD (\$)  
-----

|                   |   |
|-------------------|---|
|                   | Ohio -- 6.8%  |
| 3,000,000 (d)     | Akron Bath Copley Joint Township Hospital District, Akron General Health System, 5.0%, 1/1/31 |
| 2,500,000         | Buckeye Tobacco Settlement Financing Authority, Asset-Backed, Series A-2, 5.875%, 6/1/47      |
| 9,945,000         | Buckeye Tobacco Settlement Financing Authority, Asset-Backed, Series A-2, 6.5%, 6/1/47        |
| 2,500,000 (b) (d) | State of Ohio, Common Schools, Series B, 5.0%, 6/15/29  |

|           |  |
|-----------|--|
|           | Oregon -- 1.2%   |
| 1,000,000 | Oregon Health & Science University, Series A, 5.0%, 7/1/42                             |
| 2,000,000 | Oregon State Facilities Authority, Samaritan Health Services, Series A, 5.25%, 10/1/40 |

|               |  |
|---------------|--|
|               | Pennsylvania -- 8.6%   |
| 1,000,000     | Chester County Industrial Development Authority, Collegium Charter School, Series A, 5.25%, 10/15/47                           |
| 1,965,000     | Pennsylvania Economic Development Financing Authority, US Airways Group, Series B, 8.0%, 5/1/29                                |
| 5,000,000     | Pennsylvania Economic Development Financing Authority, USG Corp. Project, 6.0%, 6/1/31   |
| 1,555,000 (d) | Pennsylvania Turnpike Commission, Series D, 5.3%, 12/1/41  |
| 3,445,000 (d) | Pennsylvania Turnpike Commission, Series D, 5.3%, 12/1/41  |
| 500,000       | Philadelphia Authority for Industrial Development, Greater Philadelphia Health Action, Inc., Project, Series A, 6.625%, 6/1/50 |
| 6,000,000     | Philadelphia Authority for Industrial Development, Nueva Esperanza, Inc., 8.2%, 12/1/43  |
| 1,000,000     | Philadelphia Authority for Industrial Development, Performing Arts Charter School Project, 6.5%, 6/15/33 (144A)                |
| 2,000,000     | Philadelphia Authority for Industrial Development, Performing Arts Charter School Project, 6.75%, 6/15/43 (144A)               |

|                   |   |
|-------------------|---|
|                   | Puerto Rico -- 1.4%                                 |
| 6,500,000 (b) (e) | Commonwealth of Puerto Rico, Series A, 8.0%, 7/1/35 |

|               |  |
|---------------|--|
|               | Rhode Island -- 1.8%   |
| 1,355,000 (e) | Central Falls Detention Facility Corp., 7.25%, 7/15/35                                     |
| 3,000,000     | Rhode Island Health & Educational Building Corp., Brown University, Series A, 4.0%, 9/1/37 |

## Edgar Filing: PIONEER MUNICIPAL HIGH INCOME ADVANTAGE TRUST - Form N-CSRS

1,500,000 (d) Rhode Island Health & Educational Building Corp., Tockwatten Home Issue, 8.375%, 1/1/46

---

4,400,000 (g) South Carolina -- 2.1%  
Tobacco Settlement Revenue Management Authority, Series B, 6.375%, 5/15/30

---

The accompanying notes are an integral part of these financial statements.

18 Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18

---

Principal  
Amount  
USD (\$)

---

4,000,000 South Dakota -- 1.4%  
South Dakota Health & Educational Facilities Authority, Sanford Health, Series B, 4.0%, 11/1/44

---

5,000,000 (d) Tennessee -- 2.0%  
Johnson City Health & Educational Facilities Board, Mountain States Health Alliance, 6.5%, 7/1/38

---

1,000,000 Texas -- 17.0%  
Arlington Higher Education Finance Corp., Universal Academy, Series A, 7.0%, 3/1/34

1,500,000 Arlington Higher Education Finance Corp., Universal Academy, Series A, 7.125%, 3/1/44

2,500,000 (d) Central Texas Regional Mobility Authority, Sub Lien, 6.75%, 1/1/41

2,500,000 (b) County of Harris, Series A, 5.0%, 10/1/26

5,000,000 (b) Goose Creek Consolidated Independent School District, Series C, 4.0%, 2/15/26 (PSF-GTD Insured)

5,020,000 Grand Parkway Transportation Corp., Series A, 5.5%, 4/1/53

2,663,453 (e) Gulf Coast Industrial Development Authority, Microgy Holdings Project, 7.0%, 12/1/36

3,000,000 Houston Higher Education Finance Corp., St. John's School Project, Series A, 5.0%, 9/1/38

3,355,000 North Texas Tollway Authority, Series A, 5.0%, 1/1/30

1,500,000 (d) Red River Health Facilities Development Corp., MRC Crestview, Series A, 8.0%, 11/15/41

2,000,000 (b) Richardson Independent School District, School Building, 5.0%, 2/15/38 (PSF-GTD Insured)

6,960,000+ (e) Sanger Industrial Development Corp., Texas Pellets Project, Series B, 8.0%, 7/1/38

1,000,000 (e) Tarrant County Cultural Education Facilities Finance Corp., Mirador Project, Series A, 4.875%, 11/15/48

750,000 Tarrant County Cultural Education Facilities Finance Corp., Mirador Project, Series A, 5.0%, 11/15/55

1,000,000 (e) Texas Midwest Public Facility Corp., Secure Treatment Facility Project, 9.0%, 10/1/30

3,365,000 Texas Private Activity Bond Surface Transportation Corp.,

Edgar Filing: PIONEER MUNICIPAL HIGH INCOME ADVANTAGE TRUST - Form N-CSRS

|               |  |
|---------------|--|
| 2,500,000 (d) | NTE Mobility Partners LLC, 7.0%, 12/31/38<br>Travis County Health Facilities Development Corp., Longhorn Village Project, 7.125%, 1/1/46 |
| 5,000,000 (b) | Tyler Independent School District, School Building, 5.0%, 2/15/38 (PSF-GTD Insured)  |

---

|           |  |
|-----------|--|
| 5,000,000 | Utah -- 2.3%<br>County of Utah, IHC Health Services, Inc., Series B, 4.0%, 5/15/47 |
| 1,000,000 | Salt Lake City Corp., Airport Revenue, Series B, 5.0%, 7/1/36                      |

---

The accompanying notes are an integral part of these financial statements.

Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18 19

Schedule of Investments | 9/30/18 (unaudited) (continued)

---

Principal  
Amount  
USD (\$)

---

|               |   |
|---------------|---|
| 2,275,000 (b) | Virginia -- 8.5%<br>County of Arlington, 4.0%, 8/15/35  |
| 2,000,000 (d) | County of Washington, Industrial Development Authority,<br>Mountain States Health Alliance, Series C, 7.75%, 7/1/38 |
| 4,550,000     | Tobacco Settlement Financing Corp., Series B-1, 5.0%, 6/1/47  |
| 5,000,000     | University of Virginia, Multi Year Capital Project, Series A,<br>4.0%, 8/1/48                                       |
| 5,000,000     | University of Virginia, Series A, 5.0%, 4/1/42  |
| 3,000,000     | Virginia Public School Authority Revenue, 4.0%, 8/1/25<br>(State Aid Withholding)                                   |

---

|               |   |
|---------------|---|
| 3,000,000     | Washington -- 4.2%<br>City of Seattle, Water System Revenue, 4.0%, 8/1/32                           |
| 2,500,000 (b) | King County, Issaquah School District No. 411, 4.0%,<br>12/1/31 (SCH BD GTY Insured)                |
| 2,500,000     | University of Washington, Series B, 5.0%, 6/1/29  |
| 1,500,000 (d) | Washington State Health Care Facilities Authority, Kadlec<br>Regional Medical Center, 5.5%, 12/1/39 |
| 1,100,000     | Washington State Housing Finance Commission, Mirabella<br>Project, Series A, 6.75%, 10/1/47 (144A)  |

---

|               |  |
|---------------|--|
| 2,000,000 (e) | West Virginia -- 0.5%<br>City of Philippi, Alderson-Broadus College, Inc., Series A,<br>7.75%, 10/1/44 |
|---------------|--|

---

Edgar Filing: PIONEER MUNICIPAL HIGH INCOME ADVANTAGE TRUST - Form N-CSRS

|               |   |
|---------------|---|
|               | Wisconsin -- 3.9%   |
| 5,000,000     | Public Finance Authority, Glenridge Palmer Ranch, Series A, 8.25%, 6/1/46 (144A)                  |
| 750,000       | Public Finance Authority, Roseman University Health Sciences Project, 5.875%, 4/1/45              |
| 1,000,000     | Public Finance Authority, SearStone CCRC Project, Series A, 5.3%, 6/1/47                          |
| 1,490,000 (d) | Public Finance Authority, SearStone CCRC Project, Series A, 8.625%, 6/1/47                        |
| 1,500,000 (d) | Wisconsin Health & Educational Facilities Authority, Pro Healthcare, Inc., Group, 6.625%, 2/15/39 |

-----

The accompanying notes are an integral part of these financial statements.

20 Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18

-----

Principal  
Amount  
USD (\$)

TOTAL TAX EXEMPT OBLIGATIONS  
(Cost \$412,309,284)

-----

TOTAL INVESTMENTS IN UNAFFILIATED ISSUERS -- 157.4%  
(Cost \$416,741,284)

-----

OTHER ASSETS AND LIABILITIES -- 1.4%

-----

VARIABLE RATE MUNIFUND TERM PREFERRED  
SHARES AT REDEMPTION VALUE -- (58.8)%

-----

NET ASSETS APPLICABLE TO  
COMMON SHAREOWNERS -- 100.0%

=====

(144A) Security is exempt from registration under Rule 144A of the Securities Act of 1933. Such securities may be resold normally to qualified institutional buyers in a transaction exempt from registration. At September 30, 2018, the value of these securities amounted to \$29,154,202, or 10.7% of net assets applicable to common shareowners.

RIB Residual Interest Bond is purchased in a secondary market. The interest rate is subject to change periodically and inversely based upon prevailing market rates. The interest rate shown is the rate at September 30, 2018.

+ Securities that used significant unobservable inputs to determine their value.

(a) Consists of Revenue Bonds unless otherwise indicated.

## Edgar Filing: PIONEER MUNICIPAL HIGH INCOME ADVANTAGE TRUST - Form N-CSRS

- (b) Represents a General Obligation Bond.
- (c) Security issued with a zero coupon. Income is recognized through accretion of discount.
- (d) Prerefunded bonds have been collateralized by U.S. Treasury or U.S. Government Agency securities which are held in escrow to pay interest and principal on the tax exempt issue and to retire the bonds in full at the earliest refunding date.
- (e) Security is in default.
- (f) The interest rate is subject to change periodically. The interest rate spread shown at September 30, 2018.
- (g) Escrow to maturity.

Purchases and sales of securities (excluding temporary cash investments) for the six months ended September 30, 2018, aggregated \$21,498,130 and \$19,553,552, respectively.

The Trust is permitted to engage in purchase and sale transactions ("cross trades") with certain funds and accounts for which Amundi Pioneer Asset Management, Inc., (the "Adviser"), serves as the investment adviser, as set forth in Rule 17a-7 under the Investment Company Act of 1940, pursuant to procedures adopted by the Board of Trustees. Under these procedures, cross trades are effected at current market prices. During the six months ended September 30, 2018, the Trust did not engage in cross trade activity.

The accompanying notes are an integral part of these financial statements.

Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18 21

### Schedule of Investments | 9/30/18 (unaudited) (continued)

At September 30, 2018, the net unrealized appreciation on investments based on cost for federal tax purposes of \$416,493,757 was as follows:

|  |                 |
|--|-----------------|
| Aggregate gross unrealized appreciation for all investments in which there is an excess of value over tax cost | \$ 29,          |
| Aggregate gross unrealized depreciation for all investments in which there is an excess of tax cost over value | (17,            |
|  | -----           |
| Net unrealized appreciation  | \$ 11,<br>===== |

Various inputs are used in determining the value of the Trust's investments. These inputs are summarized in the three broad levels below.

Level 1 - quoted prices in active markets for identical securities.

Level 2 - other significant observable inputs (including quoted prices for similar securities, interest rates, prepayment speeds, credit risks, etc.). See Notes to Financial Statements -- Note 1A.

## Edgar Filing: PIONEER MUNICIPAL HIGH INCOME ADVANTAGE TRUST - Form N-CSRS

Level 3 - significant unobservable inputs (including the Trust's own assumptions in determining fair value of investments). See Notes to Financial Statements -- Note 1A.

The following is a summary of the inputs used as of September 30, 2018, in valuing the Trust's investments.

|                                  | Level 1 | Level 2       | Level 3     |
|----------------------------------|---------|---------------|-------------|
| Debtor in Possession Financing   | \$ --   | \$ 4,432,000  | \$ --       |
| Tax Exempt Obligations           |         |               |             |
| Texas                            | --      | 43,573,585    | 2,672,640   |
| All Other Tax Exempt Obligations | --      | 377,726,773   | --          |
| Total Investments in Securities  | \$ --   | \$425,732,358 | \$2,672,640 |

The following is a reconciliation of assets valued using significant unobservable inputs (Level 3):

|   |    |
|---|----|
| Balance as of 3/31/18                                 | \$ |
| Realized gain (loss) (1)                              |    |
| Changed in unrealized appreciation (depreciation) (2) |    |
| Accrued discounts/premiums                            |    |
| Purchases   |    |
| Sales   |    |
| Transfers in to Level 3*                              |    |
| Transfers out of Level 3*                             |    |
| Balance as of 9/30/18                                 | \$ |

(1) Realized gain (loss) on these securities is included in the realized gain (loss) from investments on the Statement of Operations.

(2) Unrealized appreciation (depreciation) on these securities is included in the change in unrealized appreciation (depreciation) from investments on the Statement of Operations.

\* Transfers are calculated on the beginning of period value. For the six months ended September 30, 2018, there were no transfers between Levels 1, 2 and 3.

Net change in unrealized appreciation (depreciation) of Level 3 investments still held and considered Level 3 at September 30, 2018:

# Edgar Filing: PIONEER MUNICIPAL HIGH INCOME ADVANTAGE TRUST - Form N-CSRS

The accompanying notes are an integral part of these financial statements.

22 Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18

Statement of Assets and Liabilities | 9/30/18 (unaudited)

## ASSETS:

Investments in unaffiliated issuers, at value (cost \$416,741,284)  
Receivables --  
    Investment securities sold  
    Interest  
Other assets

-----  
Total assets  
=====

## LIABILITIES:

Due to custodian  
Payables --  
    Administration fee  
    Trustees' fees  
Due to affiliates  
Accrued expenses

-----  
Total liabilities  
=====

Variable Rate MuniFund Term Preferred Shares, net of deferred offering costs:

\$100,000 liquidation value per share applicable to 1,600 shares,  
including dividends payable of \$12,885

## NET ASSETS APPLICABLE TO COMMON SHAREOWNERS:

Paid-in capital  
Distributable earnings (loss)

-----  
Net assets applicable to common shareowners  
=====

## NET ASSET VALUE PER COMMON SHARE:

No par value  
Based on \$272,224,852/23,899,020 common shares  
=====

The accompanying notes are an integral part of these financial statements.

Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18 23

Statement of Operations (unaudited)

For the Six Months Ended 9/30/18

INVESTMENT INCOME:



Edgar Filing: PIONEER MUNICIPAL HIGH INCOME ADVANTAGE TRUST - Form N-CSRS

|   |              |
|---|--------------|
| Interest from unaffiliated issuers                                    | \$10,083,810 |
| -----   |              |
| Total investment income   |              |
| -----   |              |
| EXPENSES:   |              |
| Management fees   | \$ 1,312,032 |
| Administrative expense  | 103,766      |
| Transfer agent fees   | 9,468        |
| Shareowner communications expense                                     | 5,707        |
| Custodian fees  | 3,247        |
| Registration fees   | 9,370        |
| Professional fees   | 60,630       |
| Printing expense  | 6,511        |
| Pricing fees  | 20,104       |
| Trustees' fees  | 9,840        |
| Miscellaneous   | 14,966       |
| -----   |              |
| Total expenses  |              |
| -----   |              |
| Net investment income   |              |
| -----   |              |
| REALIZED AND UNREALIZED GAIN (LOSS) ON INVESTMENTS:                   |              |
| Net realized gain (loss) on:  |              |
| Investments in unaffiliated issuers                                   |              |
| -----   |              |
| Change in net unrealized appreciation (depreciation) on:              |              |
| Investments in unaffiliated issuers                                   |              |
| -----   |              |
| Net realized and unrealized gain (loss) on investments                |              |
| -----   |              |
| DISTRIBUTIONS TO PREFERRED SHAREOWNERS FROM<br>NET INVESTMENT INCOME: |              |
| -----   |              |
| Net increase in net assets resulting from operations                  |              |
| =====   |              |

The accompanying notes are an integral part of these financial statements.

24 Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18

Statements of Changes in Net Assets

|  |              |    |
|--|--------------|----|
|  | Six Months   |    |
|  | Ended        | Y  |
|  | 9/30/18      | E  |
|  | (unaudited)  | 3  |
| -----  |              |    |
| FROM OPERATIONS:   |              |    |
| Net investment income (loss)   | \$ 8,528,169 | \$ |
| Net realized gain (loss) on investments                                | 237,878      |    |
| Change in net unrealized appreciation (depreciation)<br>on investments | (3,998,380)  |    |
| Distributions to preferred shareowners from net<br>investment income   | (2,026,131)  |    |
| -----  |              |    |

## Edgar Filing: PIONEER MUNICIPAL HIGH INCOME ADVANTAGE TRUST - Form N-CSRS

|  |                |    |
|--|----------------|----|
| Net increase in net assets resulting from operations   | \$ 2,741,536   | \$ |
| -----  |                |    |
| DISTRIBUTIONS TO COMMON SHAREOWNERS:<br>(\$0.32 and \$0.61 per share, respectively)              | \$ (7,528,191) | \$ |
| -----  |                |    |
| Total distributions to common shareowners  | \$ (7,528,191) | \$ |
| -----  |                |    |
| FROM TRUST SHARE TRANSACTIONS:<br>Net decrease in net assets applicable to<br>common shareowners | \$ (4,786,655) | \$ |
| NET ASSETS APPLICABLE TO COMMON SHAREOWNERS:*<br>Beginning of period                             | 277,011,507    |    |
| -----  |                |    |
| End of period  | \$272,224,852  | \$ |
| =====  |                |    |

\* For the year ended March 31, 2018 undistributed net investment income was presented as follows: \$2,936,714

The accompanying notes are an integral part of these financial statements.

Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18 25

### Financial Highlights

|   | Six Months<br>Ended<br>9/30/18<br>(unaudited) | Year<br>Ended<br>3/31/18 | Year<br>Ended<br>3/31/17* | Ye<br>En |
|---|---|--------------------------|---------------------------|----------|
| -----   |   |                          |                           |          |
| Per Share Operating Performance   |   |                          |                           |          |
| Net asset value, beginning of period  | \$ 11.59                                      | \$ 11.86                 | \$ 12.55                  | \$       |
| -----   |   |                          |                           |          |
| Increase (decrease) from investment operations: (a)                         |   |                          |                           |          |
| Net investment income (loss)  | \$ 0.36                                       | \$ 0.73                  | \$ 0.80                   | \$       |
| Net realized and unrealized gain (loss) on investments                      | (0.16)  | (0.28)                   | (0.68)                    |          |
| -----   |   |                          |                           |          |
| Distribution to preferred shareowners from:                                 |   |                          |                           |          |
| Net investment income   | \$ (0.08)                                     | \$ (0.11)                | \$ (0.07)                 | \$       |
| -----   |   |                          |                           |          |
| Net increase (decrease) from investment operations                          | \$ 0.12                                       | \$ 0.34                  | \$ 0.05                   | \$       |
| -----   |   |                          |                           |          |
| Distributions to common shareowners from:                                   |   |                          |                           |          |
| Net investment income and previously undistributed<br>net investment income | \$ (0.32)                                     | \$ (0.61)                | \$ (0.74)                 | \$       |
| -----   |   |                          |                           |          |
| Net increase (decrease) in net asset value                                  | \$ (0.20)                                     | \$ (0.27)                | \$ (0.69)                 | \$       |
| -----   |   |                          |                           |          |
| Net asset value, end of period  | \$ 11.39                                      | \$ 11.59                 | \$ 11.86                  | \$       |
| -----   |   |                          |                           |          |
| Market value, end of period   | \$ 10.66                                      | \$ 10.72                 | \$ 10.99                  | \$       |
| =====   |   |                          |                           |          |
| Total return at net asset value (b)   | 1.13% (c)                                     | 3.11%                    | 0.28%                     |          |
| Total return at market value (b)  | 2.33% (c)                                     | 2.92%                    | (15.92)%                  |          |
| Ratios to average net assets of common shareowners:                         |   |                          |                           |          |

## Edgar Filing: PIONEER MUNICIPAL HIGH INCOME ADVANTAGE TRUST - Form N-CSRS

|  |           |           |           |
|--|-----------|-----------|-----------|
| Total expenses (d)   | 1.12%(e)  | 1.16%     | 1.12%     |
| Net investment income before preferred share distributions     | 6.16%(e)  | 6.15%     | 6.47%     |
| Preferred share distributions                                  | 1.46%(e)  | 0.97%     | 0.53%     |
| Net investment income available to common shareowners          | 4.70%(e)  | 5.18%     | 5.94%     |
| Portfolio turnover rate  | 5%(c)     | 20%       | 9%        |
| Net assets of common shareowners, end of period (in thousands) | \$272,225 | \$277,012 | \$283,528 |

The accompanying notes are an integral part of these financial statements.

26 Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18

|   | Six Months<br>Ended<br>9/30/18<br>(unaudited) | Year<br>Ended<br>3/31/18 | Year<br>Ended<br>3/31/17 |
|---|---|--------------------------|--------------------------|
| Preferred shares outstanding (in thousands) (f) (g)                 | \$160,000                                     | \$160,000                | \$150,000                |
| Asset coverage per preferred share, end of period                   | \$270,132                                     | \$273,132                | \$ 72,000                |
| Average market value per preferred share (h)                        | \$100,000                                     | \$100,000                | \$ 25,000                |
| Liquidation value, including dividends payable, per preferred share | \$ 99,992                                     | \$100,000                | \$ 24,000                |

\* The Trust was audited by an independent registered public accounting firm other than Ernst & Young LLP.

\*\* The amount of distributions made to shareowners during the period was in excess of the net investment income earned by the Trust during the period. The Trust has accumulated undistributed net investment income which is the part of the Trust's NAV. A portion of this accumulated net investment income was distributed to shareowners during the period.

(a) The per common share data presented above is based upon the average common shares outstanding for the periods presented.

(b) Total investment return is calculated assuming a purchase of common shares at the current net asset value or market value on the first day and a sale at the current net asset value or market value on the last day of the periods reported. Dividends and distributions, if any, are assumed for purposes of this calculation to be reinvested at prices obtained under the Trust's dividend reinvestment plan. Total investment return does not reflect brokerage commissions. Past performance is not a guarantee of future results.

(c) Not annualized.

(d) Expense ratios do not reflect the effect of distribution payments to preferred shareowners.

(e) Annualized.

(f) Prior to February 20, 2018, there were 6,000 Auction Preferred Shares ("APS") outstanding, with a liquidation preference of \$25,000 per share.

## Edgar Filing: PIONEER MUNICIPAL HIGH INCOME ADVANTAGE TRUST - Form N-CSRS

The Trust redeemed all of its outstanding APS on February 20, 2018.

- (g) The Trust issued 1,600 Variable Rate MuniFund Term Preferred Shares, with a liquidation preference of \$100,000 per share, on February 20, 2018.
- (h) Market value is redemption value without an active market.

The accompanying notes are an integral part of these financial statements.

Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18 27

Notes to Financial Statements | 9/30/18 (unaudited)

### 1. Organization and Significant Accounting Policies

Pioneer Municipal High Income Advantage Trust (the "Trust") was organized as a Delaware statutory trust on August 6, 2003. Prior to commencing operations on October 20, 2003, the Trust had no operations other than matters relating to its organization and registration as a diversified, closed-end management investment company under the Investment Company Act of 1940, as amended. The investment objective of the Trust is to seek a high level of current income exempt from regular federal income tax, and the Trust may, as a secondary objective, also seek capital appreciation to the extent that it is consistent with its primary investment objective.

On July 3, 2017, Amundi acquired Pioneer Investments, a group of asset management companies located throughout the world. Amundi, one of the world's largest asset managers, is headquartered in Paris, France. As a result of the transaction, Pioneer Investment Management, Inc., the Trust's investment adviser, became an indirect wholly owned subsidiary of Amundi and Amundi's wholly owned subsidiary, Amundi USA, Inc. Prior to July 3, 2017, Pioneer Investments was owned by Pioneer Global Asset Management S.p.A., a wholly owned subsidiary of UniCredit S.p.A.

In connection with the transaction, the names of the Trust's investment adviser and principal underwriter changed. Effective July 3, 2017, the name of Pioneer Investment Management, Inc. changed to Amundi Pioneer Asset Management, Inc. (the "Adviser") and the name of Pioneer Funds Distributor, Inc. changed to Amundi Pioneer Distributor, Inc. (the "Distributor").

In October 2016, the Securities and Exchange Commission ("SEC") released its Final Rule on Investment Company Reporting Modernization. In addition to introducing two new regulatory reporting forms (Form N-PORT and Form N-CEN), the Final Rule amends Regulation S-X, which impacts financial statement presentation, particularly related to the presentation of derivative investments. The Trust's financial statements were prepared in compliance with the amendments to Regulation S-X.

In August 2018, the SEC released a Disclosure Update and Simplification Final Rule. The Final Rule amends Regulation S-X disclosures requirements to conform them to U.S. General Accepted Accounting Principles ("U.S. GAAP") for investment companies. The Trust's financial statements were prepared in compliance with the new amendments to Regulation S-X.

28 Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18

The Trust's financial statements have been prepared in conformity with U.S.

## Edgar Filing: PIONEER MUNICIPAL HIGH INCOME ADVANTAGE TRUST - Form N-CSRS

GAAP that require the management of the Trust to make estimates and assumptions that affect the reported amounts of assets and liabilities, the disclosure of contingent assets and liabilities at the date of the financial statements, and the reported amounts of income, expenses and gain or loss on investments during the reporting period. Actual results could differ from those estimates.

The Trust is an investment company and follows investment company accounting and reporting guidance under U.S. GAAP. The following is a summary of significant accounting policies followed by the Trust in the preparation of its financial statements:

### A. Security Valuation

The net asset value of the Trust is computed once daily, on each day the New York Stock Exchange ("NYSE") is open, as of the close of regular trading on the NYSE.

Fixed-income securities are valued by using prices supplied by independent pricing services, which consider such factors as market prices, market events, quotations from one or more brokers, Treasury spreads, yields, maturities and ratings, or may use a pricing matrix or other fair value methods or techniques to provide an estimated value of the security or instrument. A pricing matrix is a means of valuing a debt security on the basis of current market prices for other debt securities, historical trading patterns in the market for fixed-income securities and/or other factors. Non-U.S. debt securities that are listed on an exchange will be valued at the bid price obtained from an independent third party pricing service. When independent third party pricing services are unable to supply prices, or when prices or market quotations are considered to be unreliable, the value of that security may be determined using quotations from one or more broker-dealers.

Securities for which independent pricing services or broker dealers are unable to supply prices or for which market prices and/or quotations are not readily available or are considered to be unreliable are valued by a fair valuation team comprised of certain personnel of the Adviser pursuant to procedures adopted by the Trust's Board of Trustees. The Adviser's fair valuation team uses fair value methods approved by the Valuation Committee of the Board of Trustees. The Adviser's fair valuation team is responsible for monitoring developments that may impact fair valued securities and for discussing and assessing fair values on an ongoing basis, and at least quarterly, with the Valuation Committee of the Board of Trustees.

Inputs used when applying fair value methods to value a security may include credit ratings, the financial condition of the company, current market conditions and comparable securities. The Trust may use fair value methods

Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18 29

if it is determined that a significant event has occurred after the close of the exchange or market on which the security trades and prior to the determination of the Trust's net asset value. Examples of a significant event might include political or economic news, corporate restructurings, natural disasters, terrorist activity or trading halts. Thus, the valuation of the Trust's securities may differ significantly from exchange prices and such differences could be material.

At September 30, 2018, no securities were valued using fair value methods (other than securities valued using prices supplied by independent pricing

Edgar Filing: PIONEER MUNICIPAL HIGH INCOME ADVANTAGE TRUST - Form N-CSRS

services, broker-dealers or using a third party insurance industry pricing model).

B. Investment Income and Transactions

Interest income, including interest on income-bearing cash accounts, is recorded on the accrual basis. Dividend and interest income are reported net of unrecoverable foreign taxes withheld at the applicable country rates and net of income accrued on defaulted securities.

Discounts and premiums on purchase prices of debt securities are accreted or amortized, respectively, daily, into interest income on an effective yield to maturity basis with a corresponding increase or decrease in the cost basis of the security. Premiums and discounts related to certain mortgage-backed securities are amortized or accreted in proportion to the monthly paydowns.

Interest and dividend income payable by delivery of additional shares is reclassified as PIK (payment-in-kind) income upon receipt and is included in interest and dividend income, respectively.

Security transactions are recorded as of trade date. Gains and losses on sales of investments are calculated on the identified cost method for both financial reporting and federal income tax purposes.

C. Federal Income Taxes

It is the Trust's policy to comply with the requirements of the Internal Revenue Code applicable to regulated investment companies and to distribute all of its net taxable income and net realized capital gains, if any, to its shareowners. Therefore, no provision for federal income taxes is required. As of March 31, 2018, the Trust did not accrue any interest or penalties with respect to uncertain tax positions, which, if applicable, would be recorded as an income tax expense on the Statement of Operations. Tax returns filed within the prior three years remain subject to examination by federal and state tax authorities.

30 Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18

The amount and character of income and capital gain distributions to shareowners are determined in accordance with federal income tax rules, which may differ from U.S. GAAP. Distributions in excess of net investment income or net realized gains are temporary over distributions for financial statement purposes resulting from differences in the recognition or classification of income or distributions for financial statement and tax purposes. Capital accounts within the financial statements are adjusted for permanent book/tax differences to reflect tax character, but are not adjusted for temporary differences.

The tax character of current year distributions payable will be determined at the end of the current taxable year. The tax character of distributions paid during the year ended March 31, 2018 was as follows:

-----  
2018  
-----

Distributions paid from:

Edgar Filing: PIONEER MUNICIPAL HIGH INCOME ADVANTAGE TRUST - Form N-CSRS

|                   |              |
|-------------------|--------------|
| Tax exempt income | \$16,843,525 |
| Ordinary income   | 478,960      |
| -----             |              |
| Total             | \$17,322,485 |
| =====             |              |

The following shows the components of distributable earnings (losses) on a federal income tax basis at March 31, 2018:

|                                      |                |
|--------------------------------------|----------------|
|                                      | 2018           |
| -----                                |                |
| Distributable earnings:              |                |
| Undistributed ordinary income        | \$ 351,344     |
| Capital loss carryforward            | (29,943,708)   |
| Other book/tax temporary differences | 247,527        |
| Undistributed tax-exempt income      | 2,337,843      |
| Unrealized appreciation              | 15,662,094     |
| -----                                |                |
| Total                                | \$(11,344,900) |
| =====                                |                |

The difference between book-basis and tax-basis unrealized appreciation/depreciation is primarily attributable to the book/tax differences in the accrual of income on securities in default, the difference between book and tax amortization methods and discounts on fixed income securities.

D. Automatic Dividend Reinvestment Plan

All shareowners whose shares are registered in their own names automatically participate in the Automatic Dividend Reinvestment Plan (the "Plan"), under which participants receive all dividends and capital gain distributions (collectively, dividends) in full and fractional shares of the Trust in lieu of cash. Shareowners may elect not to participate in the Plan. Shareowners not participating in the Plan receive all dividends and capital gain distributions in cash. Participation in the Plan is completely voluntary and may be terminated or resumed at any time without penalty by notifying

Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18 31

American Stock Transfer & Trust Company, the agent for shareowners in administering the Plan (the "Plan Agent"), in writing prior to any dividend record date; otherwise such termination or resumption will be effective with respect to any subsequently declared dividend or other distribution.

If a shareowner's shares are held in the name of a brokerage firm, bank or other nominee, the shareowner can ask the firm or nominee to participate in the Plan on the shareowner's behalf. If the firm or nominee does not offer the Plan, dividends will be paid in cash to the shareowner of record. A firm or nominee may reinvest a shareowner's cash dividends in shares of the Trust on terms that differ from the terms of the Plan.

Whenever the Trust declares a dividend on shares payable in cash, participants in the Plan will receive the equivalent in shares acquired by the Plan Agent either (i) through receipt of additional unissued but authorized shares from the Trust or (ii) by purchase of outstanding shares on the New York Stock Exchange or elsewhere. If, on the payment date for any dividend, the net asset value per share is equal to or less than the market price per share plus estimated brokerage trading fees (market premium), the Plan Agent will invest the dividend amount in newly issued shares. The number of newly issued shares to be credited to each account will be determined by dividing the dollar amount of the dividend by the net asset value per share on the date the shares are issued, provided that the maximum discount from the then current market price per share on the date of issuance does not exceed 5%. If, on the payment date for any dividend, the net asset value per share is greater than the market value (market discount), the Plan Agent will invest the dividend amount in shares acquired in open-market purchases. There are no brokerage charges with respect to newly issued shares. However, each participant will pay a pro rata share of brokerage trading fees incurred with respect to the Plan Agent's open-market purchases. Participating in the Plan does not relieve shareowners from any federal, state or local taxes which may be due on dividends paid in any taxable year. Shareowners holding Plan shares in a brokerage account may be able to transfer the shares to another broker and continue to participate in the Plan.

E. Risks

The value of securities held by the Trust may go up or down, sometimes rapidly or unpredictably, due to general market conditions, such as real or perceived adverse economic, political or regulatory conditions, inflation, changes in interest rates, lack of liquidity in the bond markets or adverse investor sentiment. In the past several years, financial markets have experienced increased volatility, depressed valuations, decreased liquidity and heightened uncertainty. These conditions may continue, recur, worsen or spread.

32 Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18

Interest rates in the U.S. have been historically low and have begun to rise, so the Trust faces a heightened risk that interest rates may continue to rise. A general rise in interest rates may cause investors to move out of fixed income securities on a large scale, which could adversely affect the price and liquidity of fixed income securities.

The municipal bond market can be susceptible to unusual volatility, particularly for lower-rated and unrated securities. Liquidity can be reduced unpredictably in response to overall economic conditions or credit tightening. Municipal issuers may be adversely affected by rising health care costs, increasing unfunded pension liabilities, and by the phasing out of federal programs providing financial support. Unfavorable conditions and developments relating to projects financed with municipal securities can result in lower revenues to issuers of municipal securities, potentially resulting in defaults. Issuers often depend on revenues from these projects to make principal and interest payments. The value of municipal securities can also be adversely affected by changes in the financial condition of one or more individual municipal issuers or insurers of municipal issuers, regulatory and political developments, tax law changes or other legislative actions, and by uncertainties and public perceptions concerning these and other factors. Municipal securities may be more susceptible to down-grades or defaults during recessions or similar periods of economic stress. In recent periods, an increasing



number of municipal issuers in the United States have defaulted on obligations and commenced insolvency proceedings. Financial difficulties of municipal issuers may continue or get worse. To the extent the Trust invests significantly in a single state, including California, Massachusetts and Texas, or in securities the payments on which are dependent upon a single project or source of revenues, or that relate to a sector or industry, including health care facilities, education, transportation, special revenues and pollution control, the Trust will be more susceptible to associated risks and developments.

With the increased use of technologies such as the Internet to conduct business, the Trust is susceptible to operational, information security and related risks. While the Trust's Adviser has established business continuity plans in the event of, and risk management systems to prevent, limit or mitigate, such cyber-attacks, there are inherent limitations in such plans and systems including the possibility that certain risks have not been identified. Furthermore, the Trust cannot control the cybersecurity plans and systems put in place by service providers to the Trust such as Brown Brothers Harriman & Co., the Trust's custodian and accounting agent, and American Stock Transfer & Trust Company ("AST"), the Trust's transfer agent. In addition, many beneficial owners of Trust shares hold them through accounts at broker-dealers, retirement platforms and other financial market participants over which neither the Trust nor Amundi Pioneer exercises

Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18 33

control. Each of these may in turn rely on service providers to them, which are also subject to the risk of cyber-attacks. Cybersecurity failures or breaches at Amundi Pioneer or the Trust's service providers or intermediaries have the ability to cause disruptions and impact business operations, potentially resulting in financial losses, interference with the Trust's ability to calculate its net asset value, impediments to trading, the inability of Trust shareowners to effect share purchases or receive distributions, loss of or unauthorized access to private shareowners information and violations of applicable privacy and other laws, regulatory fines, penalties, reputational damage, or additional compliance costs. Such costs and losses may not be covered under any insurance. In addition, maintaining vigilance against cyber-attacks may involve substantial costs over time, and system enhancements may themselves be subject to cyber-attacks.

## 2. Management Agreement

The Adviser manages the Trust's portfolio. Management fees payable under the Trust's Advisory Agreement with the Adviser are calculated daily at the annual rate of 0.60% of the Trust's average daily managed assets. "Managed assets" means (a) the total assets of the Trust, including any form of investment leverage, minus (b) all accrued liabilities incurred in the normal course of operations, which shall not include any liabilities or obligations attributable to investment leverage obtained through (i) indebtedness of any type (including, without limitation, borrowing through a credit facility or the issuance of debt securities), (ii) the issuance of preferred stock or other similar preference securities, and/or (iii) any other means. For the six months ended September 30, 2018, the net management fee was 0.60% (annualized) of the Trust's average daily managed assets, which was equivalent to 0.96% (annualized) of the Trust's average daily net assets.

In addition, under the management and administration agreements, certain other services and costs, including accounting, regulatory reporting and insurance

## Edgar Filing: PIONEER MUNICIPAL HIGH INCOME ADVANTAGE TRUST - Form N-CSRS

premiums, are paid by the Trust as administrative reimbursements. Included in "Due to affiliates" reflected on the Statement of Assets and Liabilities is \$27,711 in management fees, administrative costs and certain other reimbursements payable to the Adviser at September 30, 2018.

### 3. Transfer Agent

American Stock Transfer & Trust Company ("AST") serves as the transfer agent with respect to the Trust's common shares. The Trust pays AST an annual fee, as is agreed to from time to time by the Trust and AST, for providing such services.

In addition, the Trust reimbursed the transfer agent for out-of-pocket expenses incurred by the transfer agent related to shareowner communications activities such as proxy and statement mailings and outgoing calls.

34 Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18

Deutsche Bank Trust Company Americas ("Deutsche Bank") served as the transfer agent, registrar, dividend-paying agent and auction agent with respect to the Trust's auction preferred shares ("APS"). The Trust paid Deutsche Bank an annual fee for providing such services.

### 4. Trust Shares

There are an unlimited number of common shares of beneficial interest authorized.

Transactions in common shares of beneficial interest for the six months ended September 30, 2018 and the year ended March 31, 2018 were as follows:

|   | 9/30/18    | 3/31/18    |
|---|------------|------------|
| Shares outstanding at beginning of period | 23,899,020 | 23,899,020 |
| Shares outstanding at end of period       | 23,899,020 | 23,899,020 |

The Trust may classify or reclassify any unissued shares of beneficial interest into one or more series of preferred shares of beneficial interest.

As of September 30, 2018, the Trust has outstanding 1,600 Variable Rate MuniFund Term Preferred Shares Series 2021 ("Series 2021 VMTP Shares or "VMTP Shares"). The Trust issued the VMTP Shares on February 20, 2018. See Note 5 for additional information.

Prior to February 20, 2018, the Trust had outstanding 3,000 Series A APS and 3,000 Series B APS. The Trust mailed a Notice of Redemption and deposited funds sufficient to redeem the APS with the auction agent on February 20, 2018. The Trust redeemed all outstanding Series A APS and Series B APS on February 20, 2018. See Note 6 for additional information.

### 5. Variable Rate MuniFund Term Preferred Shares

The Trust has 1,600 shares issued and outstanding of Series 2021 VMTP Shares,

## Edgar Filing: PIONEER MUNICIPAL HIGH INCOME ADVANTAGE TRUST - Form N-CSRS

with a liquidation preference of \$100,000 per share. VMTP Shares are issued via private placement and are not publicly available.

The Trust is obligated to redeem its VMTP Shares by the date as specified in its offering document ("Term Redemption Date"), unless earlier redeemed by the Trust. VMTP Shares are subject to optional and mandatory redemption in certain circumstances. The VMTP Shares may be redeemed at the option of the Trust, subject to payment of premium for approximately one year following the date of issuance ("Optional Redemption Date"), and at the redemption price per share thereafter. The redemption price per share is equal to the sum of the liquidation preference per share plus any accumulated but unpaid dividends. The Trust may be obligated to redeem a certain amount of the VMTP Shares if it fails to maintain certain asset coverage and leverage ratio

Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18 35

requirements and such failures are not cured by the applicable cure date. The Term Redemption Date and Optional Redemption Date for the Trust's Series 2021 VMTP Shares are August 2, 2021 and February 28, 2019, respectively.

VMTP Shares are subject to restrictions on transfer, generally do not trade, and market quotations are generally not available. VMTP Shares are short-term or short/intermediate-term instruments that pay a variable dividend rate tied to a short-term index, plus an additional fixed "spread" amount established at the time of issuance. For financial reporting purposes, the liquidation preference of VMTP Shares is a liability and is recognized as a component of "Variable Rate MuniFund Term Preferred Shares, net of deferred offering costs" on the Statement of Assets and Liabilities.

Dividends on the VMTP Shares (which are treated as interest payments for financial reporting purposes) are declared daily. The dividend rate for the VMTP Shares is determined weekly. Unpaid dividends on VMTP Shares are recognized as a component of "Dividend payable" on the Statement of Assets and Liabilities. From February 22, 2018 (issuance) through September 30, 2018, the Series 2021 VMTP Shares paid an average dividend rate of 2.54%.

Costs incurred in connection with the Trust's offering of VMTP Shares were recorded as a deferred charge, which is being amortized over the life of the shares and is recognized as a component of "Variable Rate MuniFund Term Preferred Shares, net of deferred offering costs" on the Statement of Assets and Liabilities.

Transactions in the Series 2021 VMTP Shares during the Trust's current and prior reporting periods were as follows:

|                         | Six Months Ended 9/30/2018 |        | Year Ended 3/31/2018 |               |
|-------------------------|----------------------------|--------|----------------------|---------------|
|                         | Shares                     | Amount | Shares               | Amount        |
| VMTP Shares issued      | --                         | --     | 1,600                | \$160,000,000 |
| VMTP Shares exchanged   | --                         | --     | --                   | --            |
| Net increase (decrease) | --                         | --     | 1,600                | \$160,000,000 |

6. Redemption of APS

## Edgar Filing: PIONEER MUNICIPAL HIGH INCOME ADVANTAGE TRUST - Form N-CSRS

The Trust redeemed all of its outstanding APS at the liquidation preference per share, together with accrued and unpaid dividends, if any, as of the redemption date as follows:

| Series | Shares Outstanding | Redemption Date   | Preference Per Share | Accrued and Unpaid Dividends Per Share |
|--------|--------------------|-------------------|----------------------|--|
| A      | 3,000              | February 20, 2018 | \$25,000             | \$18,840                               |
| B      | 3,000              | February 20, 2018 | \$25,000             | \$19,260                               |

36 Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18

The Trust continues to employ leverage for investment purposes through the issuance of VMTP shares. See Note 5 for additional information.

### 7. Dividends to APS Shareowners

Prior to the redemption of the Trust's APS (See Note 6), dividends on Series A and Series B were cumulative at a rate which reset every seven days based on the results of an auction. Since February 2008, the Trust's auctions related to the APS failed. Accordingly, during the period, dividends were paid at the maximum rate on the auction dates described in the prospectus for the APS. The maximum rate for each series was 125% of the 7 day commercial paper rate or adjusted Kenny rate. Dividend rates on APS ranged from 1.276% to 3.491% during the year ended March 31, 2018.

### 8. Subsequent Events

A monthly dividend was declared on October 3, 2018 from undistributed and accumulated net investment income of \$0.0525 per common share payable October 31, 2018, to common shareowners of record on October 17, 2018.

Subsequent to September 30, 2018, dividends declared and paid on VMTP Shares totaled \$372,265 through October 31, 2018.

Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18 37

### ADDITIONAL INFORMATION (unaudited)

During the period, there have been no material changes in the Trust's investment objective or fundamental policies that have not been approved by the shareowners. There have been no changes in the Trust's charter or By-Laws that would delay or prevent a change in control of the Trust which has not been approved by the shareowners. During the period, there have been no changes in the principal risk factors associated with investment in the Trust. There were no changes in the persons who are primarily responsible for the day-to-day management of the Trust's portfolio.

## Edgar Filing: PIONEER MUNICIPAL HIGH INCOME ADVANTAGE TRUST - Form N-CSRS

Notice is hereby given in accordance with Section 23(c) of the Investment Company Act of 1940 that the Trust may purchase, from time to time, its common shares in the open market.

### Change in Independent Registered Public Accounting Firm

Prior to July 3, 2017 Pioneer Investment Management, Inc. ("the Adviser"), the Trust's investment adviser, was an indirect, wholly owned subsidiary of UniCredit S.p.A. ("UniCredit"). On that date, UniCredit completed the sale of its Pioneer Investments business, which includes the Adviser, to Amundi (the "Transaction"). As a result of the Transaction, the Adviser became an indirect, wholly owned subsidiary of Amundi. Amundi is controlled by Credit Agricole S.A. Amundi is headquartered in Paris, France, and, as of September 30, 2016, had more than \$1.1 trillion in assets under management worldwide.

Deloitte & Touche LLP ("D&T"), the Trust's previous independent registered public accounting firm, informed the Audit Committee and the Board that it would no longer be independent with respect to the Trust upon the completion of the Transaction as a result of certain services being provided to Amundi and Credit Agricole, and, accordingly, that it intended to resign as the Trust's independent registered public accounting firm upon the completion of the Transaction. D&T's resignation was effective on July 3, 2017, when the Transaction was completed.

During the periods as to which D&T has served as the Trust's independent registered public accounting firm, D&T's reports on the Trust's financial statements have not contained an adverse opinion or disclaimer of opinion and have not been qualified or modified as to uncertainty, audit scope or accounting principles. Further, there have been no disagreements with D&T on any matter of accounting principles or practices, financial statement disclosure, or auditing scope or procedure, which, if not resolved to the satisfaction of D&T, would have caused D&T to make reference to the subject matter of the disagreement in connection with its report on the financial statements. In addition, there have been no reportable events of the kind described in Item 304(a)(1)(v) of Regulation S-K under the Securities Exchange Act of 1934.

38 Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18

Effective immediately following the completion of the Transaction on July 3, 2017, the Board, acting upon the recommendation of the Audit Committee, engaged an independent registered public accounting firm, Ernst & Young LLP ("EY").

Prior to its engagement, EY had advised the Trust's Audit Committee that EY had identified the following matters, in each case relating to services rendered by other member firms of Ernst & Young Global Limited, all of which are located outside the United States, to UniCredit and certain of its subsidiaries during the period commencing July 1, 2016, that it determined to be inconsistent with the auditor independence rules set forth by the Securities and Exchange Commission ("SEC"): (a) project management support services to UniCredit in the Czech Republic, Germany, Italy, Serbia and Slovenia in relation to twenty-two projects, that were determined to be inconsistent with Rule 2-01(c)(4)(vi) of Regulation S-X (management functions); (b) two engagements for UniCredit in Italy where fees were contingent/success based and that were determined to be inconsistent with Rule 2-01(c)(5) of Regulation S-X (contingent fees); (c) four engagements where legal and expert services were provided to UniCredit in the Czech Republic and Germany, and twenty engagements where the legal advisory services were provided to UniCredit in Austria, Czech Republic, Italy and Poland, that were determined to be inconsistent with Rule 2-01(c)(4)(ix) and (x) of Regulation S-X (legal and expert services); and (d) two engagements for

## Edgar Filing: PIONEER MUNICIPAL HIGH INCOME ADVANTAGE TRUST - Form N-CSRS

UniCredit in Italy involving assistance in the sale of certain assets, that were determined to be inconsistent with Rule 2-01(c)(4)(viii) of Regulation S-X (broker-dealer, investment adviser or investment banking services). None of the foregoing services involved the Trust, any of the other funds in the Pioneer Family of Funds or any other Pioneer entity sold by UniCredit in the Transaction.

EY advised the Audit Committee that it had considered the matters described above and had concluded that such matters would not impair EY's ability to exercise objective and impartial judgment in connection with the audits of the financial statements of the Trust under the SEC and Public Company Accounting Oversight Board independence rules, and that a reasonable investor with knowledge of all relevant facts and circumstances would reach the same conclusion. Management and the Audit Committee considered these matters and discussed the matters with EY and, based upon EY's description of the matters and statements made by EY, Management and the Audit Committee believe that EY will be capable of exercising objective and impartial judgment in connection with the audits of the financial statements of the Trust, and Management further believes that a reasonable investor with knowledge of all relevant facts and circumstances would reach the same conclusion.

Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18 39

### Results of Shareholder Meeting

At the annual meeting held on September 20, 2018, shareowners of the Trust were asked to consider the proposals described below. A report of the total votes cast by the Trust's shareholders follows:

#### Proposal 1 - To elect three Class III Trustees

| Nominee              | For        | Withheld  |
|----------------------|------------|-----------|
| Thomas J. Perna      | 20,696,515 | 1,731,525 |
| Marguerite A. Piret* | 1,600      | 0         |
| Fred J. Ricciardi    | 21,001,201 | 1,426,839 |

\* Elected by preferred shares only

40 Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18

### Approval of Investment Management Agreement

Amundi Pioneer Asset Management, Inc. ("APAM") serves as the investment adviser to Pioneer Municipal High Income Advantage Trust (the "Trust") pursuant to an investment management agreement between APAM and the Trust. In order for APAM to remain the investment adviser of the Trust, the Trustees of the Trust must determine annually whether to renew the investment management agreement for the Trust.

The contract review process began in January 2018 as the Trustees of the Trust agreed on, among other things, an overall approach and timeline for the process. Contract review materials were provided to the Trustees in March 2018,

## Edgar Filing: PIONEER MUNICIPAL HIGH INCOME ADVANTAGE TRUST - Form N-CSRS

July 2018 and September 2018. In addition, the Trustees reviewed and discussed the Trust's performance at regularly scheduled meetings throughout the year, and took into account other information related to the Trust provided to the Trustees at regularly scheduled meetings, in connection with the review of the Trust's investment management agreement.

In March 2018, the Trustees, among other things, discussed the memorandum provided by Fund counsel that summarized the legal standards and other considerations that are relevant to the Trustees in their deliberations regarding the renewal of the investment management agreement, and reviewed and discussed the qualifications of the investment management teams for the Trust, as well as the level of investment by the Trust's portfolio managers in the Trust. In July 2018, the Trustees, among other things, reviewed the Trust's management fees and total expense ratios, the financial statements of APAM and its parent companies, profitability analyses provided by APAM, and analyses from APAM as to possible economies of scale. The Trustees also reviewed the profitability of the institutional business of APAM and APAM's affiliate, Amundi Pioneer Institutional Asset Management, Inc. ("APIAM" and, together with APAM, "Amundi Pioneer"), as compared to that of APAM's fund management business, and considered the differences between the fees and expenses of the Trust and the fees and expenses of APAM's and APIAM's institutional accounts, as well as the different services provided by APAM to the Trust and by APAM and APIAM to the institutional accounts. The Trustees further considered contract review materials, including additional materials received in response to the Trustees' request, in September 2018.

At a meeting held on September 18, 2018, based on their evaluation of the information provided by APAM and third parties, the Trustees of the Trust, including the Independent Trustees voting separately, unanimously approved the renewal of the investment management agreement for another year. In approving the renewal of the investment management agreement, the Trustees

Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18 41

considered various factors that they determined were relevant, including the factors described below. The Trustees did not identify any single factor as the controlling factor in determining to approve the renewal of the agreement.

### Nature, Extent and Quality of Services

The Trustees considered the nature, extent and quality of the services that had been provided by APAM to the Trust, taking into account the investment objective and strategy of the Trust. The Trustees also reviewed APAM's investment approach for the Trust and its research process. The Trustees considered the resources of APAM and the personnel of APAM who provide investment management services to the Trust. They also reviewed the amount of non-Trust assets managed by the portfolio managers of the Trust. They considered the non-investment resources and personnel of APAM that are involved in APAM's services to the Trust, including APAM's compliance, risk management, and legal resources and personnel. The Trustees noted the substantial attention and high priority given by APAM's senior management to the Pioneer Fund complex.

The Trustees considered that APAM supervises and monitors the performance of the Trust's service providers and provides the Trust with personnel (including Trust officers) and other resources that are necessary for the Trust's business management and operations. The Trustees also considered that, as administrator, APAM is responsible for the administration of the Trust's business and other affairs. The Trustees considered the fees paid to APAM for the provision of administration services.

## Edgar Filing: PIONEER MUNICIPAL HIGH INCOME ADVANTAGE TRUST - Form N-CSRS

Based on these considerations, the Trustees concluded that the nature, extent and quality of services that had been provided by APAM to the Trust were satisfactory and consistent with the terms of the investment management agreement.

### Performance of the Trust

In considering the Trust's performance, the Trustees regularly review and discuss throughout the year data prepared by APAM and information comparing the Trust's performance with the performance of its peer group of funds, as classified by Morningstar, Inc. (Morningstar), and the performance of the Trust's benchmark index. They also discuss the Trust's performance with APAM on a regular basis. The Trustees' regular reviews and discussions were factored into the Trustees' deliberations concerning the renewal of the investment management agreement.

42 Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18

### Management Fee and Expenses

The Trustees considered information showing the fees and expenses of the Trust in comparison to the management fees and expense ratios of a peer group of funds selected on the basis of criteria determined by the Independent Trustees for this purpose using data provided by Strategic Insight Mutual Fund Research and Consulting, LLC (Strategic Insight), an independent third party. The peer group comparisons referred to below are organized in quintiles. Each quintile represents one-fifth of the peer group. In all peer group comparisons referred to below, first quintile is most favorable to the Trust's shareowners.

The Trustees considered that the Trust's management fee (based on managed assets) for the most recent fiscal year was in the third quintile relative to the management fees paid by other funds in its Strategic Insight peer group for the comparable period. The Trustees considered that the expense ratio (based on managed assets) of the Trust's common shares for the most recent fiscal year was in the first quintile relative to its Strategic Insight peer group for the comparable period.

The Trustees reviewed management fees charged by APAM and APIAM to institutional and other clients, including publicly offered European funds sponsored by APAM's affiliates, unaffiliated U.S. registered investment companies (in a sub-advisory capacity), and unaffiliated foreign and domestic separate accounts. The Trustees also considered APAM's costs in providing services to the Trust and APAM's and APIAM's costs in providing services to the other clients and considered the differences in management fees and profit margins for fund and non-fund services. In evaluating the fees associated with APAM's and APIAM's client accounts, the Trustees took into account the respective demands, resources and complexity associated with the Trust and other client accounts. The Trustees noted that, in some instances, the fee rates for those clients were lower than the management fee for the Trust and considered that, under the investment management agreement with the Trust, APAM performs additional services for the Trust that it does not provide to those other clients or services that are broader in scope, including oversight of the Trust's other service providers and activities related to compliance and the extensive regulatory and tax regimes to which the Trust is subject. The Trustees also considered the entrepreneurial risks associated with APAM's management of the Trust.

The Trustees concluded that the management fee payable by the Trust to APAM was reasonable in relation to the nature and quality of the services provided by



APAM.

Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18 43

#### Profitability

The Trustees considered information provided by APAM regarding the profitability of APAM with respect to the advisory services provided by APAM to the Trust, including the methodology used by APAM in allocating certain of its costs to the management of the Trust. The Trustees also considered APAM's profit margin in connection with the overall operation of the Trust. They further reviewed the financial results, including the profit margins, realized by APAM and APIAM from non-fund businesses. The Trustees considered APAM's profit margins in comparison to the limited industry data available and noted that the profitability of any adviser was affected by numerous factors, including its organizational structure and method for allocating expenses. The Trustees concluded that APAM's profitability with respect to the management of the Trust was not unreasonable.

#### Economies of Scale

The Trustees considered the extent to which APAM may realize economies of scale or other efficiencies in managing and supporting the Trust. Since the Trust is a closed-end fund that has not raised additional capital, the Trustees concluded that economies of scale were not a relevant consideration in the renewal of the investment advisory agreement.

#### Other Benefits

The Trustees considered the other benefits that APAM enjoys from its relationship with the Trust. The Trustees considered the character and amount of fees paid or to be paid by the Trust, other than under the investment management agreement, for services provided by APAM and its affiliates. The Trustees further considered the revenues and profitability of APAM's businesses other than the Fund business. To the extent applicable, the Trustees also considered the benefits to the Trust and to APAM and its affiliates from the use of "soft" commission dollars generated by the Trust to pay for research and brokerage services.

The Trustees considered that Amundi Pioneer is the principal U.S. asset management business of Amundi, which is one of the largest asset managers globally. Amundi's worldwide asset management business manages over \$1.7 trillion in assets (including the Pioneer Funds). The Trustees considered that APAM's relationship with Amundi creates potential opportunities for APAM, APIAM and Amundi that derive from APAM's relationships with the Trust, including Amundi's ability to market the services of APAM globally. The Trustees noted that APAM has access to additional research and portfolio management capabilities as a result of its relationship with Amundi and Amundi's enhanced global presence that may contribute to an increase in the

44 Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18

resources available to APAM. The Trustees considered that APAM and the Trust receive reciprocal intangible benefits from the relationship, including mutual brand recognition and, for the Trust, direct and indirect access to the resources of a large global asset manager. The Trustees concluded that any such benefits received by APAM as a result of its relationship with the Trust were reasonable.

Conclusion

After consideration of the factors described above as well as other factors, the Trustees, including the Independent Trustees, concluded that the investment management agreement for the Trust, including the fees payable thereunder, was fair and reasonable and voted to approve the proposed renewal of the investment management agreement.

Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18 45

Trustees, Officers and Service Providers

Trustees

Thomas J. Perna, Chairman  
David R. Bock  
Benjamin M. Friedman  
Margaret B.W. Graham  
Lisa M. Jones  
Lorraine H. Monchak  
Marguerite A. Piret  
Fred J. Ricciardi  
Kenneth J. Taubes

Officers

Lisa M. Jones, President and  
Chief Executive Officer  
Mark E. Bradley, Treasurer and  
Chief Financial Officer  
Christopher J. Kelley, Secretary and  
Chief Legal Officer

Investment Adviser and Administrator  
Amundi Pioneer Asset Management, Inc.

Custodian and Sub-Administrator  
Brown Brothers Harriman & Co.

Principal Underwriter  
Amundi Pioneer Distributor, Inc.

Legal Counsel  
Morgan, Lewis & Bockius LLP

Transfer Agent  
American Stock Transfer & Trust Company

Proxy Voting Policies and Procedures of the Fund are available without charge, upon request, by calling our toll free number (1-800-225-6292). Information regarding how the Fund voted proxies relating to portfolio securities during the most recent 12-month period ended June 30 is publicly available to shareowners at [www.amundipioneer.com](http://www.amundipioneer.com). This information is also available on the Securities and Exchange Commission's web site at [www.sec.gov](http://www.sec.gov).

46 Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18

This page is for your notes.

Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18 47

This page is for your notes.

48 Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18

# Edgar Filing: PIONEER MUNICIPAL HIGH INCOME ADVANTAGE TRUST - Form N-CSRS

This page is for your notes.

Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18 49

This page is for your notes.

50 Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18

This page is for your notes.

Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18 51

This page is for your notes.

52 Pioneer Municipal High Income Advantage Trust | Semiannual Report | 9/30/18

## How to Contact Amundi Pioneer

We are pleased to offer a variety of convenient ways for you to contact us for assistance or information.

You can call American Stock Transfer & Trust Company (AST) for:

-----  
Account Information 1-800-710-0935

Or write to AST:

-----  
For Write to  
General inquiries, lost dividend checks, American Stock  
change of address, lost stock certificates, Transfer & Trust  
stock transfer Operations Center  
6201 15th Ave.  
Brooklyn, NY 11219  
Dividend reinvestment plan (DRIP) American Stock  
Transfer & Trust  
Wall Street Station  
P.O. Box 922  
New York, NY 10269-0560

Website [www.amstock.com](http://www.amstock.com)

For additional information, please contact your investment advisor or visit our web site [www.amundipioneer.com](http://www.amundipioneer.com).

The Trust files a complete schedule of investments with the Securities and Exchange Commission for the first and third quarters for each fiscal year on Form N-Q. Shareowners may view the filed Form N-Q by visiting the Commission's web site at [www.sec.gov](http://www.sec.gov).

## Edgar Filing: PIONEER MUNICIPAL HIGH INCOME ADVANTAGE TRUST - Form N-CSRS

[LOGO] Amundi Pioneer  
=====

ASSET MANAGEMENT

Amundi Pioneer Asset Management, Inc.  
60 State Street  
Boston, MA 02109  
www.amundipioneer.com

Securities offered through Amundi Pioneer Distributor, Inc.  
60 State Street, Boston, MA 02109  
Underwriter of Pioneer Mutual Funds, Member SIPC  
[C] 2018 Amundi Pioneer Asset Management 19435-12-1118

### ITEM 2. CODE OF ETHICS.

(a) Disclose whether, as of the end of the period covered by the report, the registrant has adopted a code of ethics that applies to the registrant's principal executive officer, principal financial officer, principal accounting officer or controller, or persons performing similar functions, regardless of whether these individuals are employed by the registrant or a third party. If the registrant has not adopted such a code of ethics, explain why it has not done so.

The registrant has adopted, as of the end of the period covered by this report, a code of ethics that applies to the registrant's principal executive officer, principal financial officer, principal accounting officer and controller.

(b) For purposes of this Item, the term "code of ethics" means written standards that are reasonably designed to deter wrongdoing and to promote:

- (1) Honest and ethical conduct, including the ethical handling of actual or apparent conflicts of interest between personal and professional relationships;
- (2) Full, fair, accurate, timely, and understandable disclosure in reports and documents that a registrant files with, or submits to, the Commission and in other public communications made by the registrant;
- (3) Compliance with applicable governmental laws, rules, and regulations;
- (4) The prompt internal reporting of violations of the code to an appropriate person or persons identified in the code; and
- (5) Accountability for adherence to the code.

(c) The registrant must briefly describe the nature of any amendment, during the period covered by the report, to a provision of its code of ethics that applies to the registrant's principal executive officer, principal financial officer, principal accounting officer or controller, or persons performing similar functions, regardless of whether these individuals are employed by the registrant or a third party, and that relates to any element of the code of ethics definition enumerated in paragraph (b) of this Item. The registrant must file a copy of any such amendment as an exhibit pursuant to Item 10(a), unless the registrant has elected to satisfy paragraph (f) of this Item by posting its code of ethics on its website pursuant to paragraph (f)(2) of this Item, or by undertaking to provide its code of ethics to any person without charge, upon

## Edgar Filing: PIONEER MUNICIPAL HIGH INCOME ADVANTAGE TRUST - Form N-CSRS

request, pursuant to paragraph (f)(3) of this Item.

The registrant has made no amendments to the code of ethics during the period covered by this report.

(d) If the registrant has, during the period covered by the report, granted a waiver, including an implicit waiver, from a provision of the code of ethics to the registrant's principal executive officer, principal financial officer, principal accounting officer or controller, or persons performing similar functions, regardless of whether these individuals are employed by the registrant or a third party, that relates to one or more of the items set forth in paragraph (b) of this Item, the registrant must briefly describe the nature of the waiver, the name of the person to whom the waiver was granted, and the date of the waiver.

Not applicable.

(e) If the registrant intends to satisfy the disclosure requirement under paragraph (c) or (d) of this Item regarding an amendment to, or a waiver from, a provision of its code of ethics that applies to the registrant's principal executive officer, principal financial officer, principal accounting officer or controller, or persons performing similar functions and that relates to any element of the code of ethics definition enumerated in paragraph (b) of this Item by posting such information on its Internet website, disclose the registrant's Internet address and such intention.

Not applicable.

(f) The registrant must:

(1) File with the Commission, pursuant to Item 12(a)(1), a copy of its code of ethics that applies to the registrant's principal executive officer, principal financial officer, principal accounting officer or controller, or persons performing similar functions, as an exhibit to its annual report on this Form N-CSR (see attachment);

(2) Post the text of such code of ethics on its Internet website and disclose, in its most recent report on this Form N-CSR, its Internet address and the fact that it has posted such code of ethics on its Internet website; or

(3) Undertake in its most recent report on this Form N-CSR to provide to any person without charge, upon request, a copy of such code of ethics and explain the manner in which such request may be made.  
See Item 10(2)

### ITEM 3. AUDIT COMMITTEE FINANCIAL EXPERT.

(a) (1) Disclose that the registrant's board of trustees has determined that the registrant either:

(i) Has at least one audit committee financial expert serving on its audit committee; or

(ii) Does not have an audit committee financial expert serving on its audit committee.

The registrant's Board of Trustees has determined that the registrant has at least one audit committee financial expert.

(2) If the registrant provides the disclosure required by paragraph

## Edgar Filing: PIONEER MUNICIPAL HIGH INCOME ADVANTAGE TRUST - Form N-CSRS

(a)(1)(i) of this Item, it must disclose the name of the audit committee financial expert and whether that person is "independent." In order to be considered "independent" for purposes of this Item, a member of an audit committee may not, other than in his or her capacity as a member of the audit committee, the board of trustees, or any other board committee:

- (i) Accept directly or indirectly any consulting, advisory, or other compensatory fee from the issuer; or
- (ii) Be an "interested person" of the investment company as defined in Section 2(a)(19) of the Act (15 U.S.C. 80a-2(a)(19)).

Ms. Marguerite A. Piret, an independent trustee, is such an audit committee financial expert.

(3) If the registrant provides the disclosure required by paragraph (a)(1)(ii) of this Item, it must explain why it does not have an audit committee financial expert.

Not applicable.

### ITEM 4. PRINCIPAL ACCOUNTANT FEES AND SERVICES.

(a) Disclose, under the caption AUDIT FEES, the aggregate fees billed for each of the last two fiscal years for professional services rendered by the principal accountant for the audit of the registrant's annual financial statements or services that are normally provided by the accountant in connection with statutory and regulatory filings or engagements for those fiscal years.

N/A

(b) Disclose, under the caption AUDIT-RELATED FEES, the aggregate fees billed in each of the last two fiscal years for assurance and related services by the principal accountant that are reasonably related to the performance of the audit of the registrant's financial statements and are not reported under paragraph (a) of this Item. Registrants shall describe the nature of the services comprising the fees disclosed under this category.

N/A

(c) Disclose, under the caption TAX FEES, the aggregate fees billed in each of the last two fiscal years for professional services rendered by the principal accountant for tax compliance, tax advice, and tax planning. Registrants shall describe the nature of the services comprising the fees disclosed under this category.

N/A

(d) Disclose, under the caption ALL OTHER FEES, the aggregate fees billed in each of the last two fiscal years for products and services provided by the principal accountant, other than the services reported in paragraphs (a) through (c) of this Item. Registrants shall describe the nature of the services comprising the fees disclosed under this category.

N/A

(e) (1) Disclose the audit committee's pre-approval policies and procedures described in paragraph (c)(7) of Rule 2-01 of Regulation S-X.

PIONEER FUNDS

# Edgar Filing: PIONEER MUNICIPAL HIGH INCOME ADVANTAGE TRUST - Form N-CSRS

## APPROVAL OF AUDIT, AUDIT-RELATED, TAX AND OTHER SERVICES PROVIDED BY THE INDEPENDENT AUDITOR

### SECTION I - POLICY PURPOSE AND APPLICABILITY

The Pioneer Funds recognize the importance of maintaining the independence of their outside auditors. Maintaining independence is a shared responsibility involving Amudi Pioneer Asset Management, Inc, the audit committee and the independent auditors.

The Funds recognize that a Fund's independent auditors: 1) possess knowledge of the Funds, 2) are able to incorporate certain services into the scope of the audit, thereby avoiding redundant work, cost and disruption of Fund personnel and processes, and 3) have expertise that has value to the Funds. As a result, there are situations where it is desirable to use the Fund's independent auditors for services in addition to the annual audit and where the potential for conflicts of interests are minimal. Consequently, this policy, which is intended to comply with Rule 210.2-01(C) (7), sets forth guidelines and procedures to be followed by the Funds when retaining the independent audit firm to perform audit, audit-related tax and other services under those circumstances, while also maintaining independence.

Approval of a service in accordance with this policy for a Fund shall also constitute approval for any other Fund whose pre-approval is required pursuant to Rule 210.2-01(c) (7) (ii).

In addition to the procedures set forth in this policy, any non-audit services that may be provided consistently with Rule 210.2-01 may be approved by the Audit Committee itself and any pre-approval that may be waived in accordance with Rule 210.2-01(c) (7) (i) (C) is hereby waived.

Selection of a Fund's independent auditors and their compensation shall be determined by the Audit Committee and shall not be subject to this policy.

### SECTION II - POLICY

| SERVICE CATEGORY           | SERVICE CATEGORY DESCRIPTION   | SPECIFIC PRE-APPROVED SERVICE SUBCATEGORIES  |
|----------------------------|--|--|
| I. AUDIT SERVICES          | Services that are directly related to performing the independent audit of the Funds  | <ul style="list-style-type: none"><li>o Accounting research assistance</li><li>o SEC consultation, registration statements, and reporting</li><li>o Tax accrual related matters</li><li>o Implementation of new accounting standards</li><li>o Compliance letters (e.g. rating agency letters)</li><li>o Regulatory reviews and assistance regarding financial matters</li><li>o Semi-annual reviews (if requested)</li><li>o Comfort letters for closed end offerings</li></ul> |
| II. AUDIT-RELATED SERVICES | Services which are not prohibited under Rule 210.2-01(C) (4) (the "Rule") and are related extensions of the audit services support the | <ul style="list-style-type: none"><li>o AICPA attest and agreed-upon procedures</li><li>o Technology control assessments</li><li>o Financial reporting control assessments</li><li>o Enterprise security architecture assessment</li></ul>   |

audit, or use the knowledge/expertise gained from the audit procedures as a foundation to complete the project. In most cases, if the Audit-Related Services are not performed by the Audit firm, the scope of the Audit Services would likely increase. The Services are typically well-defined and governed by accounting professional standards (AICPA, SEC, etc.)

AUDIT COMMITTEE APPROVAL POLICY

AUDIT COMMITTEE REPORTING POLICY

o "One-time" pre-approval for the audit period for all pre-approved specific service subcategories. Approval of the independent auditors as auditors for a Fund shall constitute pre approval for these services.

o A summary of all such services and related fees reported at each regularly scheduled Audit Committee meeting.

o "One-time" pre-approval for the fund fiscal year within a specified dollar limit for all pre-approved specific service subcategories

o A summary of all such services and related fees (including comparison to specified dollar limits) reported quarterly.

o Specific approval is needed to exceed the pre-approved dollar limit for these services (see general Audit Committee approval policy below for details on obtaining specific approvals)

o Specific approval is needed to use the Fund's auditors for Audit-Related Services not denoted as "pre-approved", or to add a specific service subcategory as "pre-approved"

SECTION III - POLICY DETAIL, CONTINUED

SERVICE CATEGORY

SERVICE CATEGORY DESCRIPTION

SPECIFIC PRE-APPROVED SERVICE SUBCATEGORIES



|                          |  |   |
|--------------------------|--|---|
| <p>III. TAX SERVICES</p> | <p>Services which are not prohibited by the Rule, if an officer of the Fund determines that using the Fund's auditor to provide these services creates significant synergy in the form of efficiency, minimized disruption, or the ability to maintain a desired level of confidentiality.</p> | <ul style="list-style-type: none"> <li>o Tax planning and support</li> <li>o Tax controversy assistance</li> <li>o Tax compliance, tax returns, excise tax returns and support</li> <li>o Tax opinions</li> </ul> |
|--------------------------|--|---|

| AUDIT COMMITTEE APPROVAL POLICY  | AUDIT COMMITTEE REPORTING POLICY  |
|--|---|
| <ul style="list-style-type: none"> <li>o "One-time" pre-approval for the fund fiscal year within a specified dollar limit</li> <li>o Specific approval is needed to exceed the pre-approved dollar limits for these services (see general Audit Committee approval policy below for details on obtaining specific approvals)</li> <li>o Specific approval is needed to use the Fund's auditors for tax services not denoted as pre-approved, or to add a specific service subcategory as "pre-approved"</li> </ul> | <ul style="list-style-type: none"> <li>o A summary of all such services and related fees (including comparison to specified dollar limits) reported quarterly.</li> </ul> |

SECTION III - POLICY DETAIL, CONTINUED

| SERVICE CATEGORY  | SERVICE CATEGORY DESCRIPTION  | SPECIFIC PRE-APPROVED SERVICE SUBCATEGORIES  |
|---|---|--|
| <p>IV. OTHER SERVICES<br/>A. SYNERGISTIC, UNIQUE QUALIFICATIONS</p> | <p>Services which are not prohibited by the Rule, if an officer of the Fund determines that using the Fund's auditor to provide these services creates significant synergy in</p> | <ul style="list-style-type: none"> <li>o Business Risk Management support</li> <li>o Other control and regulatory compliance projects</li> </ul> |

the form of efficiency,  
 minimized disruption,  
 the ability to maintain a  
 desired level of  
 confidentiality, or where  
 the Fund's auditors  
 possess unique or superior  
 qualifications to provide  
 these services, resulting  
 in superior value and  
 results for the Fund.

AUDIT COMMITTEE APPROVAL POLICY

AUDIT COMMITTEE  
 REPORTING POLICY

- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li>o "One-time" pre-approval for the fund fiscal year within a specified dollar limit</li> <li>o Specific approval is needed to exceed the pre-approved dollar limits for these services (see general Audit Committee approval policy below for details on obtaining specific approvals)</li> <li>o Specific approval is needed to use the Fund's auditors for "Synergistic" or "Unique Qualifications" Other Services not denoted as pre-approved to the left, or to add a specific service subcategory as "pre-approved"</li> </ul> | <ul style="list-style-type: none"> <li>o A summary of all such services and related fees (including comparison to specified dollar limits) reported quarterly.</li> </ul> |
|---|---|

SECTION III - POLICY DETAIL, CONTINUED

| SERVICE CATEGORY    | SERVICE CATEGORY DESCRIPTION   | SPECIFIC PROHIBITED SERVICE SUBCATEGORIES   |
|---------------------|--|---|
| PROHIBITED SERVICES | Services which result in the auditors losing independence status under the Rule. | <ol style="list-style-type: none"> <li>1. Bookkeeping or other services related to the accounting records or financial statements of the audit client*</li> <li>2. Financial information systems design and implementation*</li> <li>3. Appraisal or valuation services, fairness* opinions, or contribution-in-kind reports</li> </ol> |

4. Actuarial services (i.e., setting actuarial reserves versus actuarial audit work)\*
5. Internal audit outsourcing services\*
6. Management functions or human resources
7. Broker or dealer, investment advisor, or investment banking services
8. Legal services and expert services unrelated to the audit
9. Any other service that the Public Company Accounting Oversight Board determines, by regulation, is impermissible

---

AUDIT COMMITTEE APPROVAL POLICY

- o These services are not to be performed with the exception of the(\*) services that may be permitted if they would not be subject to audit procedures at the audit client (as defined in rule 2-01(f)(4)) level the firm providing the service.

---

AUDIT COMMITTEE REPORTING POLICY

- o A summary of all services and related fees reported at each regularly scheduled Audit Committee meeting will serve as continual confirmation that has not provided any restricted services.

---

GENERAL AUDIT COMMITTEE APPROVAL POLICY:

- o For all projects, the officers of the Funds and the Fund's auditors will each make an assessment to determine that any proposed projects will not impair independence.
- o Potential services will be classified into the four non-restricted service categories and the "Approval of Audit, Audit-Related, Tax and Other Services" Policy above will be applied. Any services outside the specific pre-approved service subcategories set forth above must be specifically approved by the Audit Committee.
- o At least quarterly, the Audit Committee shall review a report summarizing the services by service category, including fees, provided by the Audit firm as set forth in the above policy.

---

(2) Disclose the percentage of services described in each of paragraphs (b) through (d) of this Item that were approved by the audit committee pursuant to paragraph (c) (7) (i) (C) of Rule 2-01 of Regulation S-X.

N/A

(f) If greater than 50 percent, disclose the percentage of hours expended on the principal accountants engagement to audit the registrant's financial statements for the most recent fiscal year that were attributed to work performed by persons other than the principal accountant's full-time, permanent employees.

## Edgar Filing: PIONEER MUNICIPAL HIGH INCOME ADVANTAGE TRUST - Form N-CSRS

N/A

(g) Disclose the aggregate non-audit fees billed by the registrants accountant for services rendered to the registrant, and rendered to the registrants investment adviser (not including any sub-adviser whose role is primarily portfolio management and is subcontracted with or overseen by another investment adviser), and any entity controlling, controlled by, or under common control with the adviser that provides ongoing services to the registrant for each of the last two fiscal years of the registrant.

N/A

(h) Disclose whether the registrants audit committee of the board of trustees has considered whether the provision of non-audit services that were rendered to the registrants investment adviser (not including any subadviser whose role is primarily portfolio management and is subcontracted with or overseen by another investment adviser), and any entity controlling, controlled by, or under common control with the investment adviser that provides ongoing services to the registrant that were not pre-approved pursuant to paragraph (c) (7) (ii) of Rule 2-01 of Regulation S-X is compatible with maintaining the principal accountant's independence.

The Fund's audit committee of the Board of Trustees has considered whether the provision of non-audit services that were rendered to the Affiliates (as defined) that were not pre- approved pursuant to paragraph (c) (7) (ii) of Rule 2-01 of Regulation S-X is compatible with maintaining the principal accountant's independence.

### ITEM 5. AUDIT COMMITTEE OF LISTED REGISTRANTS

(a) If the registrant is a listed issuer as defined in Rule 10A-3 under the Exchange Act (17 CFR 240.10A-3), state whether or not the registrant has a separately-designated standing audit committee established in accordance with Section 3(a) (58) (A) of the Exchange Act (15 U.S.C. 78c(a) (58) (A)). If the registrant has such a committee, however designated, identify each committee member. If the entire board of directors is acting as the registrant's audit committee as specified in Section 3(a) (58) (B) of the Exchange Act (15 U.S.C. 78c(a) (58) (B)), so state.

N/A

(b) If applicable, provide the disclosure required by Rule 10A-3(d) under the Exchange Act (17 CFR 240.10A-3(d)) regarding an exemption from the listing standards for audit committees.

N/A

### ITEM 6. SCHEDULE OF INVESTMENTS.

File Schedule of Investments in securities of unaffiliated issuers as of the close of the reporting period as set forth in 210.1212 of Regulation S-X [17 CFR 210.12-12], unless the schedule is included as part of the report to shareholders filed under Item 1 of this Form.

Included in Item 1

## Edgar Filing: PIONEER MUNICIPAL HIGH INCOME ADVANTAGE TRUST - Form N-CSRS

### ITEM 7. DISCLOSURE OF PROXY VOTING POLICIES AND PROCEDURES FOR CLOSED-END MANAGEMENT INVESTMENT COMPANIES.

A closed-end management investment company that is filing an annual report on this Form N-CSR must, unless it invests exclusively in non-voting securities, describe the policies and procedures that it uses to determine how to vote proxies relating to portfolio securities, including the procedures that the company uses when a vote presents a conflict between the interests of its shareholders, on the one hand, and those of the company's investment adviser; principal underwriter; or any affiliated person (as defined in Section 2(a)(3) of the Investment Company Act of 1940 (15 U.S.C. 80a-2(a)(3)) and the rules thereunder) of the company, its investment adviser, or its principal underwriter, on the other. Include any policies and procedures of the company's investment adviser, or any other third party, that the company uses, or that are used on the company's behalf, to determine how to vote proxies relating to portfolio securities.

N/A

### ITEM 8. PORTFOLIO MANAGERS OF CLOSED-END MANAGEMENT INVESTMENT COMPANIES.

(a) If the registrant is a closed-end management investment company that is filing an annual report on this Form N-CSR, provide the following information:

(1) State the name, title, and length of service of the person or persons employed by or associated with the registrant or an investment adviser of the registrant who are primarily responsible for the day-to-day management of the registrant's portfolio ("Portfolio Manager"). Also state each Portfolio Manager's business experience during the past 5 years.

N/A

### ITEM 9. PURCHASES OF EQUITY SECURITIES BY CLOSED-END MANAGEMENT INVESTMENT COMPANY AND AFFILIATED PURCHASERS.

(a) If the registrant is a closed-end management investment company, in the following tabular format, provide the information specified in paragraph (b) of this Item with respect to any purchase made by or on behalf of the registrant or any affiliated purchaser, as defined in Rule 10b-18(a)(3) under the Exchange Act (17 CFR 240.10b-18(a)(3)), of shares or other units of any class of the registrant's equity securities that is registered by the registrant pursuant to Section 12 of the Exchange Act (15 U.S.C. 781).

N/A

### ITEM 10. SUBMISSION OF MATTERS TO A VOTE OF SECURITY HOLDERS.

Describe any material changes to the procedures by which shareholders may recommend nominees to the registrant's board of directors, where those changes were implemented after the registrant last provided disclosure in response to the requirements of Item 407(c)(2)(iv) of Regulation S-R (17 CFR 229.407) (as required by Item 22(b)(15) of Schedule 14A (17 CFR 240.14a-101), or this Item.

There have been no material changes to the procedures by which the

## Edgar Filing: PIONEER MUNICIPAL HIGH INCOME ADVANTAGE TRUST - Form N-CSRS

shareholders may recommend nominees to the registrant's board of directors since the registrant last provided disclosure in response to the requirements of Item 407(c)(2)(iv) of Regulation S-R of Schedule 14(A) in its definitive proxy statement, or this item.

### ITEM 11. CONTROLS AND PROCEDURES.

(a) Disclose the conclusions of the registrant's principal executive and principal financial officers, or persons performing similar functions, regarding the effectiveness of the registrant's disclosure controls and procedures (as defined in Rule 30a-3(c) under the Act (17 CFR 270.30a-3(c))) as of a date within 90 days of the filing date of the report that includes the disclosure required by this paragraph, based on the evaluation of these controls and procedures required by Rule 30a-3(b) under the Act (17 CFR 270.30(a)-3(b) and Rules 13a-15(b) or 15d-15(b) under the Exchange Act (17 CFR 240.13a-15(b) or 240.15d-15(b)).

The registrant's principal executive officer and principal financial officer have concluded that the registrant's disclosure controls and procedures are effective based on the evaluation of these controls and procedures as of a date within 90 days of the filing date of this report.

(b) Disclose any change in the registrant's internal control over financial reporting (as defined in Rule 30a-3(d) under the Act (17CFR 270.30a-3(d)) that occurred during the second fiscal quarter of the period covered by this report that has materially affected, or is reasonably likely to materially affect, the registrant's internal control over financial reporting.

There were no significant changes in the registrant's internal control over financial reporting that occurred during the second fiscal quarter of the period covered by this report that have materially affected, or are reasonably likely to materially affect, the registrant's internal control over financial reporting.

The registrant's principal executive officer and principal financial officer, however, voluntarily are reporting the following information:

In August of 2006 the registrant's investment adviser enhanced its internal procedures for reporting performance information required to be included in prospectuses. Those enhancements involved additional internal controls over the appropriateness of performance data generated for this purpose. Such enhancements were made following an internal review which identified prospectuses relating to certain classes of shares of a limited number of registrants where, inadvertently, performance information not reflecting the deduction of applicable sales charges was included. Those prospectuses were revised, and the revised prospectuses were distributed to shareholders.

Item 12. Disclosure of Securities Lending Activities for Closed-End Management Investment Companies.

## Edgar Filing: PIONEER MUNICIPAL HIGH INCOME ADVANTAGE TRUST - Form N-CSRS

(a) If the registrant is a closed-end management investment company, provide the following dollar amounts of income and compensation related to the securities lending activities of the registrant during its most recent fiscal year:

N/A

(1) Gross income from securities lending activities;

N/A

(2) All fees and/or compensation for each of the following securities lending activities and related services: any share of revenue generated by the securities lending program paid to the securities lending agent(s) (revenue split); fees paid for cash collateral management services (including fees deducted from a pooled cash collateral reinvestment vehicle) that are not included in the revenue split; administrative fees that are not included in the revenue split; fees for indemnification that are not included in the revenue split; rebates paid to borrowers; and any other fees relating to the securities lending program that are not included in the revenue split, including a description of those other fees;

N/A

(3) The aggregate fees/compensation disclosed pursuant to paragraph (2); and

N/A

(4) Net income from securities lending activities (i.e., the dollar amount in paragraph (1) minus the dollar amount in paragraph (3)).

If a fee for a service is included in the revenue split, state that the fee is included in the revenue split.

N/A

(b) If the registrant is a closed-end management investment company, describe the services provided to the registrant by the securities lending agent in the registrants most recent fiscal year.

N/A

### ITEM 13. EXHIBITS.

(a) File the exhibits listed below as part of this Form. Letter or number the exhibits in the sequence indicated.

(1) Any code of ethics, or amendment thereto, that is the subject of the disclosure required by Item 2, to the extent that the registrant intends to satisfy the Item 2 requirements through filing of an exhibit.

(2) A separate certification for each principal executive officer and principal financial officer of the registrant as required by Rule 30a-2(a) under the Act (17 CFR 270.30a-2(a)) , exactly as set forth below:

Filed herewith.

SIGNATURES

[See General Instruction F]

Pursuant to the requirements of the Securities Exchange Act of 1934 and the Investment Company Act of 1940, the registrant has duly caused this report to be signed on its behalf by the undersigned, thereunto duly authorized.

(Registrant) Pioneer Municipal High Income Advantage Trust

By (Signature and Title)\* /s/ Lisa M. Jones  
Lisa M. Jones, President & Chief Executive Officer

Date November 29, 2018

Pursuant to the requirements of the Securities Exchange Act of 1934 and the Investment Company Act of 1940, this report has been signed below by the following persons on behalf of the registrant and in the capacities and on the dates indicated.

By (Signature and Title)\* /s/ Lisa M. Jones  
Lisa M. Jones, President & Chief Executive Officer

Date November 29, 2018

By (Signature and Title)\* /s/ Mark E. Bradley  
Mark E. Bradley, Treasurer & Chief Accounting & Financial Officer

Date November 29, 2018

\* Print the name and title of each signing officer under his or her signature.