

BENFORD'S LAW ANALYSIS

WHAT IS BENFORD'S LAW?

WHAT IS IT?

- Frank Benford was a physicist at GE Research Laboratories in the 1920s
- He found that numbers with low first digits occurred more frequently in sets of numbers and calculated the expected frequencies of the first digits in tabulated data
- In 1999, Mark Nigrini proposed using Benford's Law as an analysis method to alert users to possible errors, fraud, costly processing inefficiencies or other irregularities

WHAT IS IT?

- Benford's law states that if there is a set of non-manipulated, “naturally occurring” numbers, the occurrence frequency of digits one through nine as the first digit should be expected
- 30 percent of such numbers have **one** as a leading digit, and **nine** occurs as a leading digit only one time in twenty
- Because most financial and accounting data are “naturally occurring” numbers, by comparing the occurrence frequency of these first digits to Benford's pattern, auditors should be able to determine irregularities and possible manipulations

ANALYZING CITY DATA WITH BENFORD'S LAW

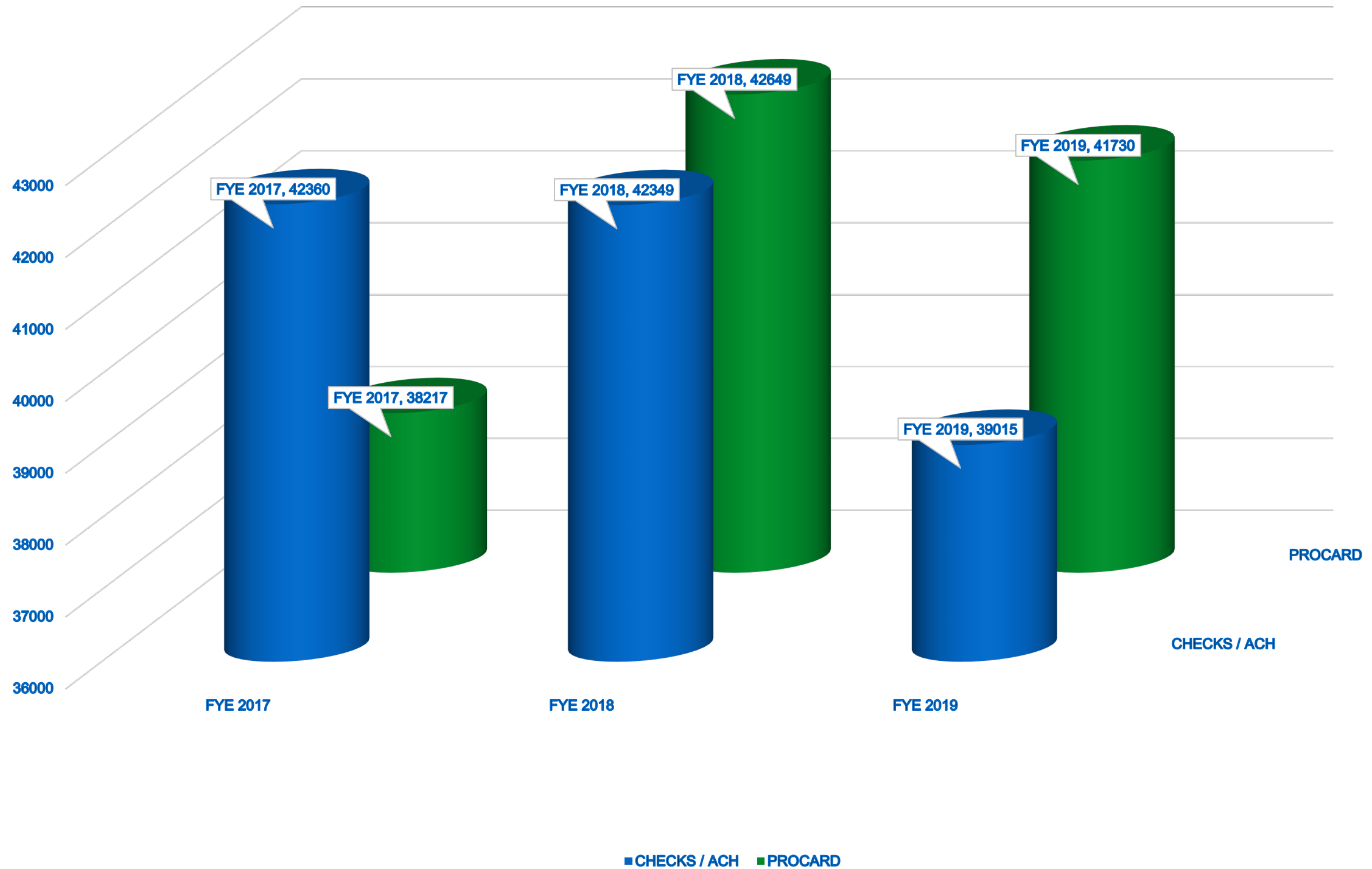
WHAT DATA IS SUITABLE?

- Data that has a wide variety in the number of figures - data with plenty of values in the hundreds, thousands, tens of thousands
- A data set that is fairly large
- Data that has no predefined maximum or minimum value
- Accounts payable data are a favorite target for digital analysis
- City has two main data “avenues” for accounts payable: ProCard transactions and Workday vendor payments

WHAT DATA IS SUITABLE?

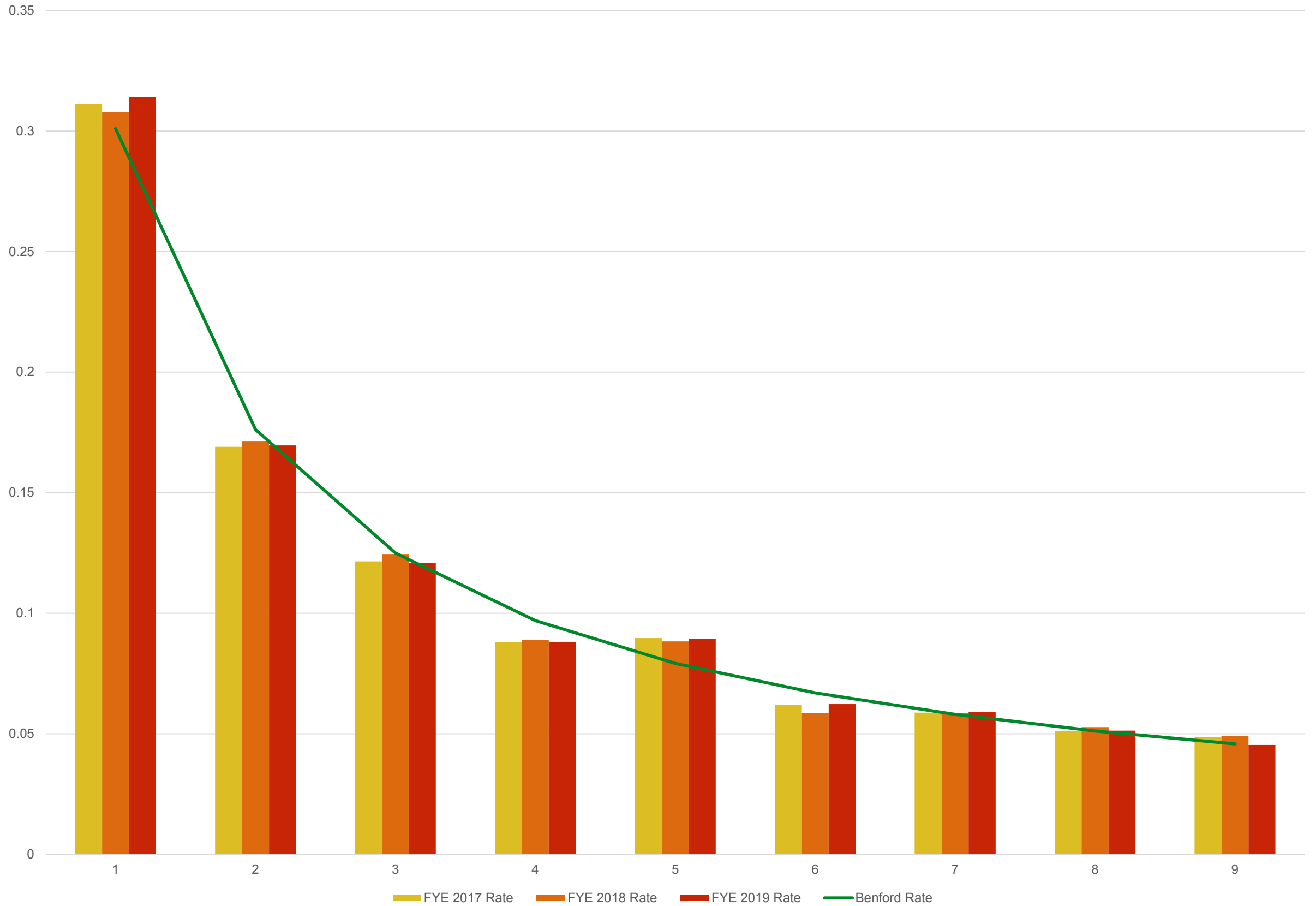
- Auditing reviewed the expense data available through Workday reports
- Found a useful Workday report: Finance - Supplier Payments
- Prepared reports for FYE 2017 - 2019 Check/ACH transactions
- Accounting has a dedicated staff member for ProCard oversight and she provided reports of monthly ProCard transactions
- Prepared reports for FYE 2017 - 2019 Procard transactions

ACCOUNTS PAYABLE TRANSACTIONS FYE 2017 - 2019

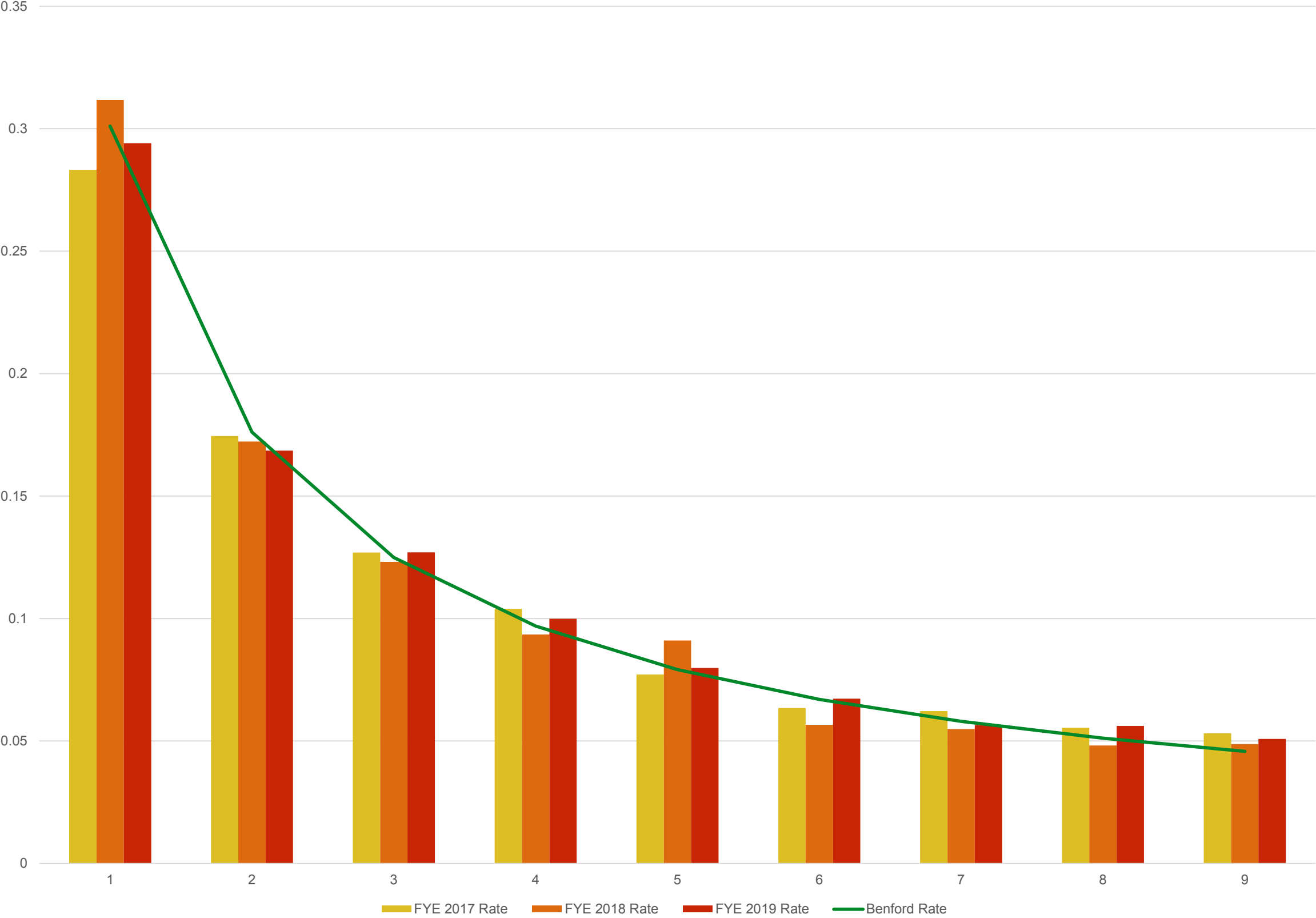


FIRST DIGIT ANALYSIS

FIRST DIGIT ANALYSIS - CHECK/ACH TRANSACTIONS
FYE 2017-2019

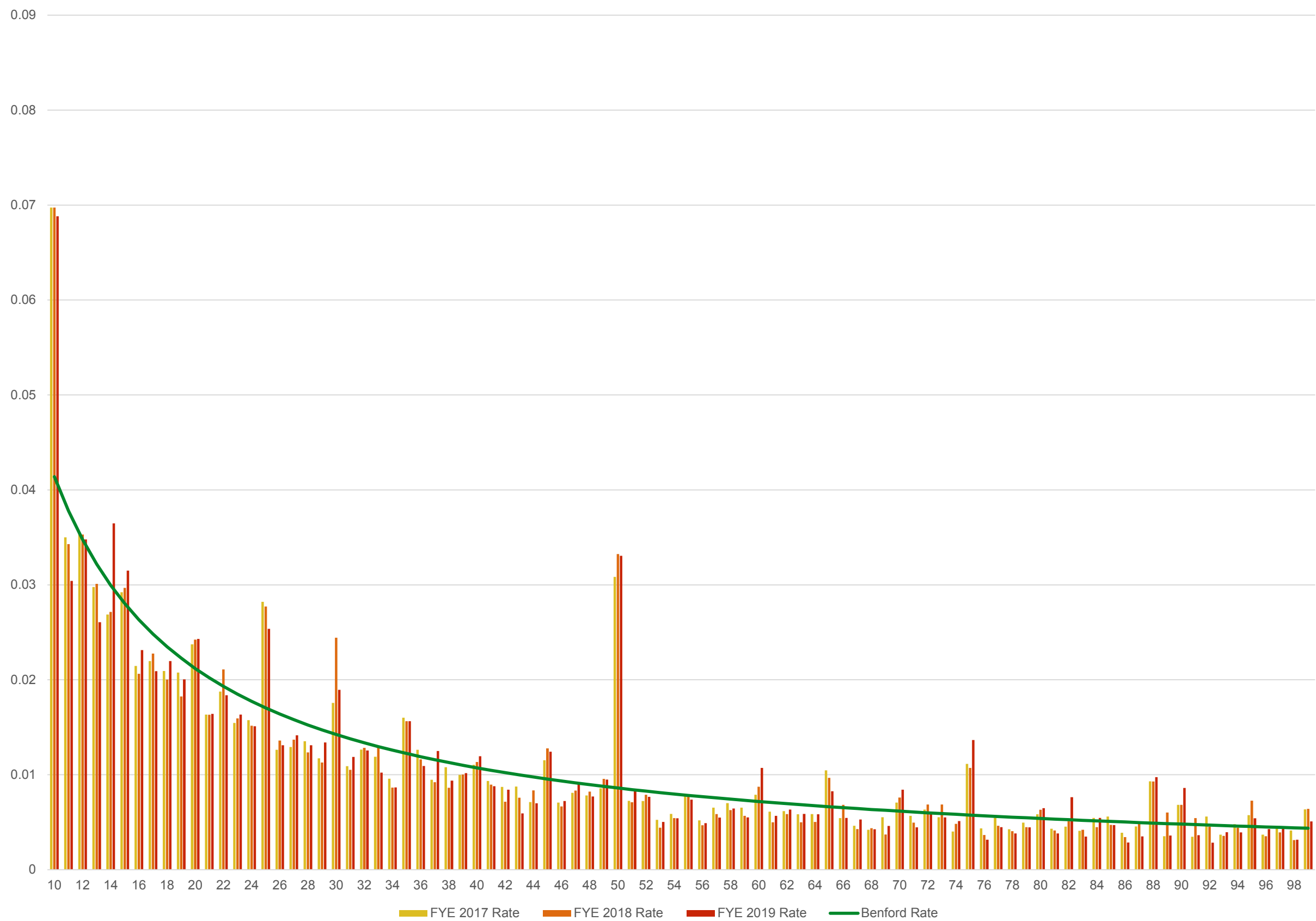


FIRST DIGIT ANALYSIS - PROCARD TRANSACTIONS
FYE 2017-2019

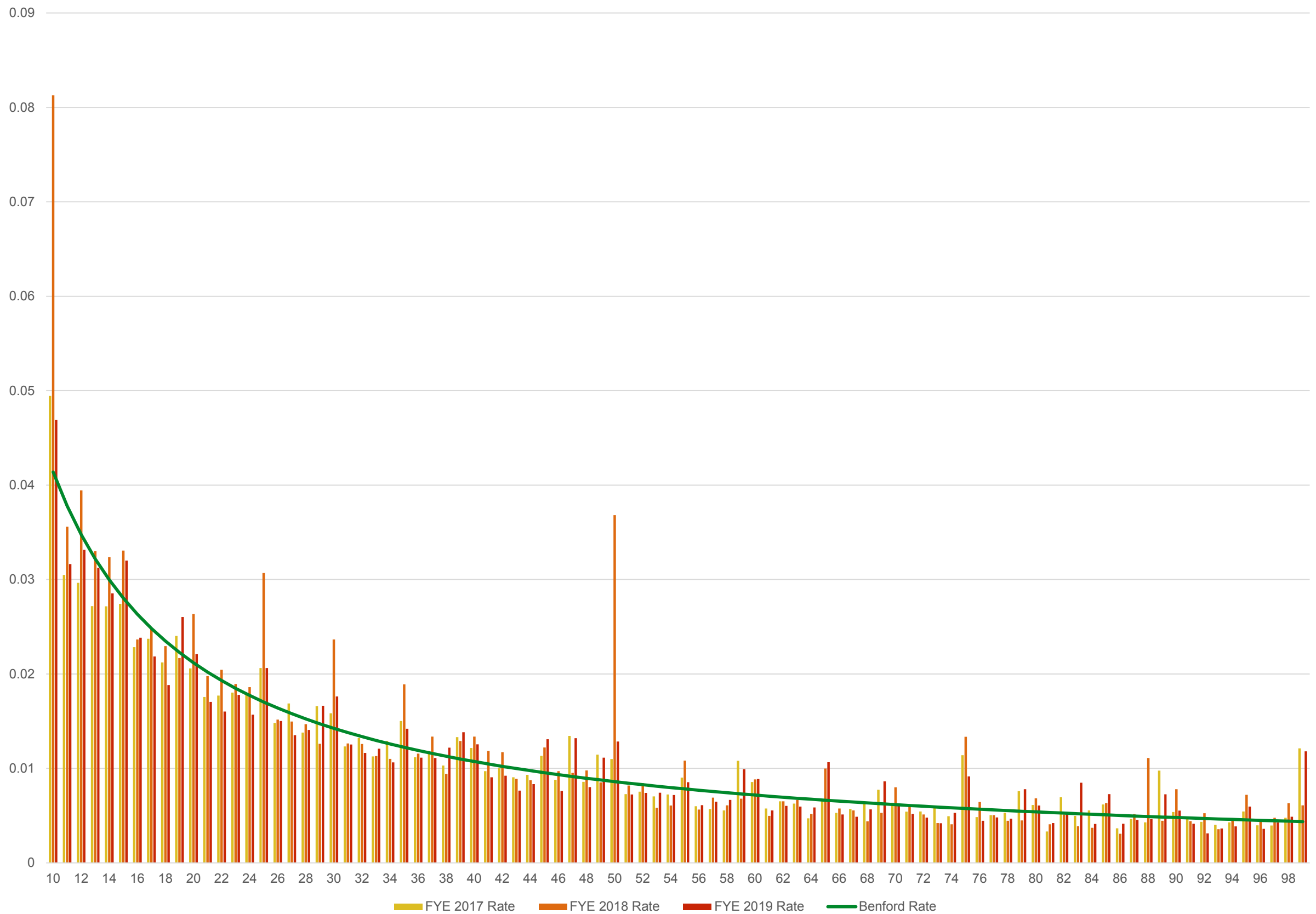


FIRST AND SECOND DIGIT ANALYSIS

FIRST TWO DIGIT ANALYSIS - CHECK/ACH TRANSACTIONS
FYE 2017 - 2019



FIRST TWO DIGIT ANALYSIS - PROCARD TRANSACTIONS FYE 2017 - 2019



CONCLUSIONS

- No major deviations from Benford Law expectation for first digits for payments selected
- Two digit analysis shows spikes at digits starting with 10, 50, 75 – history shows these spikes exist in all years. Audit reviewed payments and there are authorized recurring monthly payments of \$1,000, \$750, \$500, \$75 and \$50 skewing the results.
- Audit should continue to use Benford to analyze financial transactions and share results with Business Services.

