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Testing for Penny Destruction Bias

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Abstract: A sample of US one-cent pieces (pennies) found in a US suburban household was found to be older than a sample of ten-cent pieces (dimes) also found in that house. The study found significant evidence that dime age-cohorts reduce over time, akin to an aging animal population. No analogous reduction over time was found within the penny sample. The findings do not support, and in fact contradict, the existence of a penny destruction bias.

Introduction: The question whether dimes outlive pennies, or vice versa, has not been asked in the existing literature. The authors have each observed, on an anecdotal basis, the destruction of pennies by placement on railroad tracks. They have seen pennies obliterated in penny-stretching machines at carnivals and amusement parks. At the outset of the study, the authors hypothesized the existence of a societal and institutional bias against pennies that is not experienced by dimes.

Fig. 1. US Penny and US Dime

In the first part of the study, the authors examined separate sample populations of pennies and dimes in order to understand how coins of different ages may be distributed within their respective subpopulations. The authors hoped to find support in the data that a sample of coins exhibits the same population profile as that of a naturally aging animal population. The idea being that if coins are continuously leaving circulation through destruction, as believed, there will typically be fewer old coins and more new coins within any random sample.

In the study's second part, the authors determined the median age of the penny sample population and the median age of the dime sample population. A finding that the median age of a representative sample population of pennies is less than the median age of an identically-sampled population of dimes would support the conclusion that pennies suffer from a destruction bias.

Method: The authors obtained access to a population of dimes and pennies collected over a period of 7 years and held together under a bed during that period. From this population, the authors used the Watson Bedroom Floor Scatter Method to randomly generate two sample sets. A set of 101 dimes and an identically-generated set of 101 pennies.

The year of minting (birth date) of each coin is found on its face. See Figure 1. Each coin's birth date was used to determine its age at the time of study. In limited cases, the birth date of a coin was not observable upon inspection because of, for example, damage to the coin or the presence of dirt, oil or other residue. In these cases, the affected coin was sent to E.E. Spectroscopy GmbH, a specialty laboratory in Switzerland, where the birth date was determined using nuclear magnetic resonance microscopy and other specialized techniques.

The age of each penny and each dime was recorded and charted.

A linear regression analysis was performed on each subpopulation sample in order to find correlation between age and incidence number within the sample. The median age of each population was determined and the significance of the difference in medians was measured using the Mann-Whitney Rank Sum Test. Because sufficiently large sample populations were studied, significance was tested against a critical z value.

Findings: A complete dataset of the research is disclosed in Table 1.

1. Linear Regression Analysis. The authors calculated a linear regression equation of age against incidence number for each coin set. For dimes, incidence number and age were found to be moderately negatively correlated.

$$r\ (99) = -.53,\ p < .001$$

For pennies, the result was a weak negative correlation.

$$r\ (99) = -.32,\ p < .001$$

Neither regression result provides support for the existence of penny destruction bias. Taken together, the regression analysis results give some support for the existence of bias against dimes, but the authors are unwilling to make this claim here. Scatterplot results for the dime and penny sets each visually demonstrates the lack of strong correlation. See Figure 2 and 3.

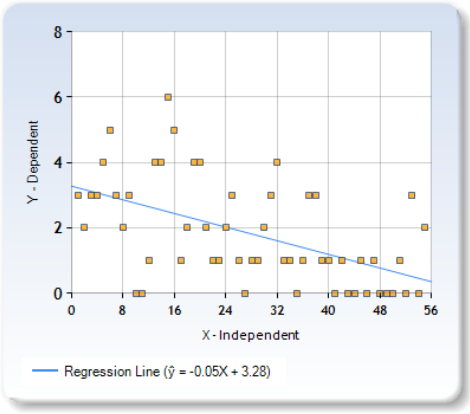


Figure 2. Linear Regression Scatterplot: Dimes

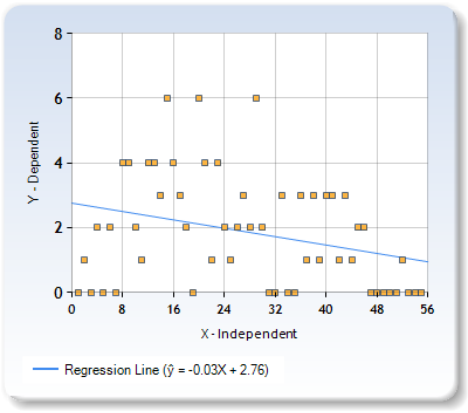


Figure 3 – Linear Regression Scatterplot: Pennies

2. Median Ages of Two Populations. The median ages of both coin sets were calculated. The median age of the dime sample was 18 years (IQR 8-31). The median age of the penny sample was 21 years (IQR 14-33). This difference in median age is statistically significant. $z = -2.18$, $p < .05$. Importantly, however, because the median age of pennies was found to be greater than the median age of dimes, the evidence does not support the existence of penny destruction bias. The evidence supports a contrary finding that the penny destruction phenomenon does not exist.

3. Age Cutoff Effect. Perhaps the most striking finding of the study is the complete lack of coins, of either type, older than 55 years. As can be seen in Table 1, no dimes or pennies older than 55 years were found. The authors conclude, on a preliminary basis, that someone, or something, is

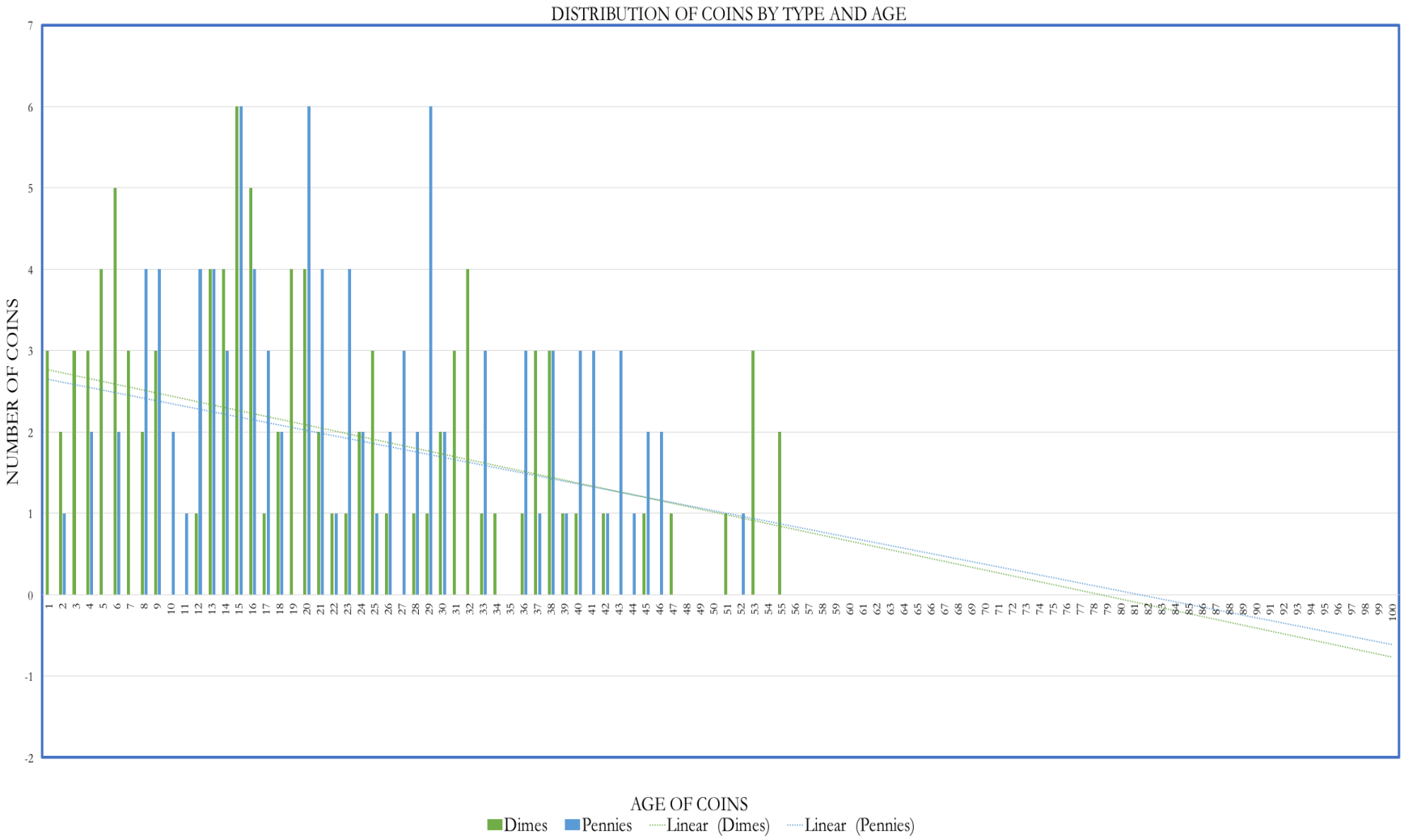
removing from circulation all dimes and pennies with a birth date before 1965. Further study is needed.

4. Summary of Findings. The study examined two coin samples, one comprised of pennies and the other comprised of dimes. Each coin was tallied and charted by age. Regression analysis found only weak evidence that age cohorts found in the two coin sets reduce differently over time. The median ages of the two populations were significantly different, but the median age of dimes was found to be less than the median age of pennies. A finding that does not support the existence of penny destruction bias. Indeed, the analysis of median ages tends to prove that penny destruction bias does not exist.

Weaknesses: Importantly, this study assumed that the same number of pennies are minted each year. And that the same number of dimes are minted in each year. This assumption may not hold under scrutiny. The authors note that due to the source of coins used, the two samples may not have been free from systemic bias and may not have been representative of dimes and pennies found in general circulation. Different and larger sample populations should be studied.

Conclusion: The study examined the ages of pennies and dimes found in a US household. It compared the median ages of a population of pennies and population of dimes. The study found no support for a greater rate of death in the penny population. Indeed, the findings support the contrary conclusion that dimes leave circulation over time faster than do pennies.

TABLE 1


DISTRIBUTION OF COINS BY TYPE AND AGE
NUMBER OF COINS
AGE OF COINS
Dimes
Pennies
Linear (Dimes)
Linear (Pennies)