Data Basics

Colby Community College

Definition

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	loan_amount	interest_rate	term	grade	state	total_income	homeownership
1	7500	7.34	36	A	MD	70000	rent
2	25000	9.43	60	B	OH	254000	mortgage
3	14500	6.08	36	A	MO	80000	mortgage
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50	3000	7.96	36	A	CA	34000	rent

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Each row is called a **case** or **observational unit**.

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Each column is called a **variable**.

Note

It is very important to provide descriptions of all the variables in a data matrix. Be sure to include the units of measurement.

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variable	description
loan_amount	Amount of the load received, in US dollars.
interest_rate	Interest rate on the loan, in an annual percentage.
term	The length of the loan, which is always a whole number of months.
grade	Loan grade, which takes values A through G and represents the quality of the loan and its likelihood of being repaid.
state	US state where the borrower resides.
total_income	Borrower's total income, including any second income, in US dollars.
homeownership	Indicates whether the person owns, owns but has a mortgage, or rents.

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Note

The names and labels in categorical data are sometimes coded with numbers. When a number is used as a name it is **not** quantitative.

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The numbers in Example 5 don't actually measure or count anything.

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Example 7

Casino employees plan to roll a fair die until the number 5 is rolled, and they count the number of rolls required to get a 5. (It is possible, but unlikely, that a 5 could never be rolled.)

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A grade school teacher measures the heights of his students.

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Example 12

For an item on a survey, respondents are given a choice of possible answers, and they are coded as follows:

1 is coded as “I agree”

2 is coded as “I disagree”

3 is coded as “I don’t care”

4 is coded as “I refuse to answer”

The numbers 1,2,3, and 4 don’t count or measure anything.

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Example 14

A survey asks people what they felt their blood pressure was. The possible answers are “Low”, “Normal”, “High.” These responses can be arranged in a meaningful order, but the differences between “Low” and “High” doesn’t make sense.

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Body temperatures of 98.2°F and 98.9°F are examples of data at this interval level of measurement. The values are ordered, and we can calculate their difference. There is no natural starting point. (The value 0°F is an arbitrary choice and doesn't represent the complete absence of heat.)

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Example 16

The years 1492 and 1776 can be arranged in order, and the difference of 284 years is meaningful. But, time doesn't not have a natural starting point that represents "no time."

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Data are at the **ratio level of measurement** if they can be arranged in order, differences can be found and are meaningful, and there is a natural starting point which indicates that none of the quantity is present.

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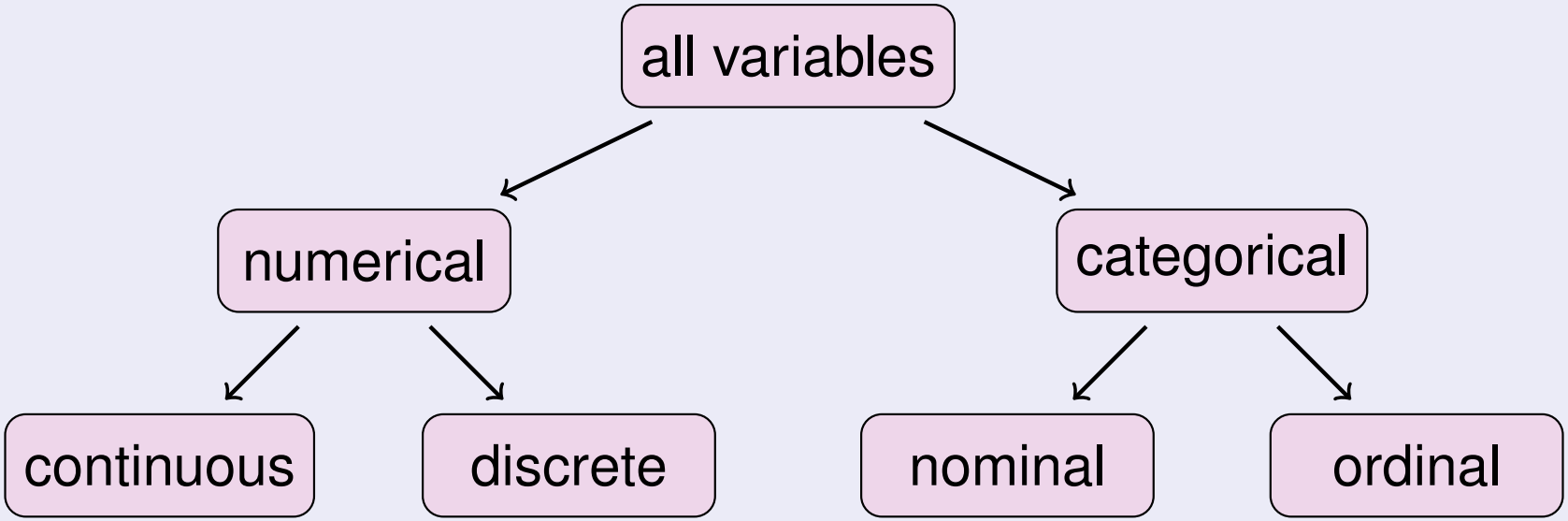
Example 18

The times of 50 minutes and 100 minutes for a math class are at the ratio level of measurement. (The starting point is 0 minutes and 100 minutes is twice as long as 50 minutes.)

Classification of Variables



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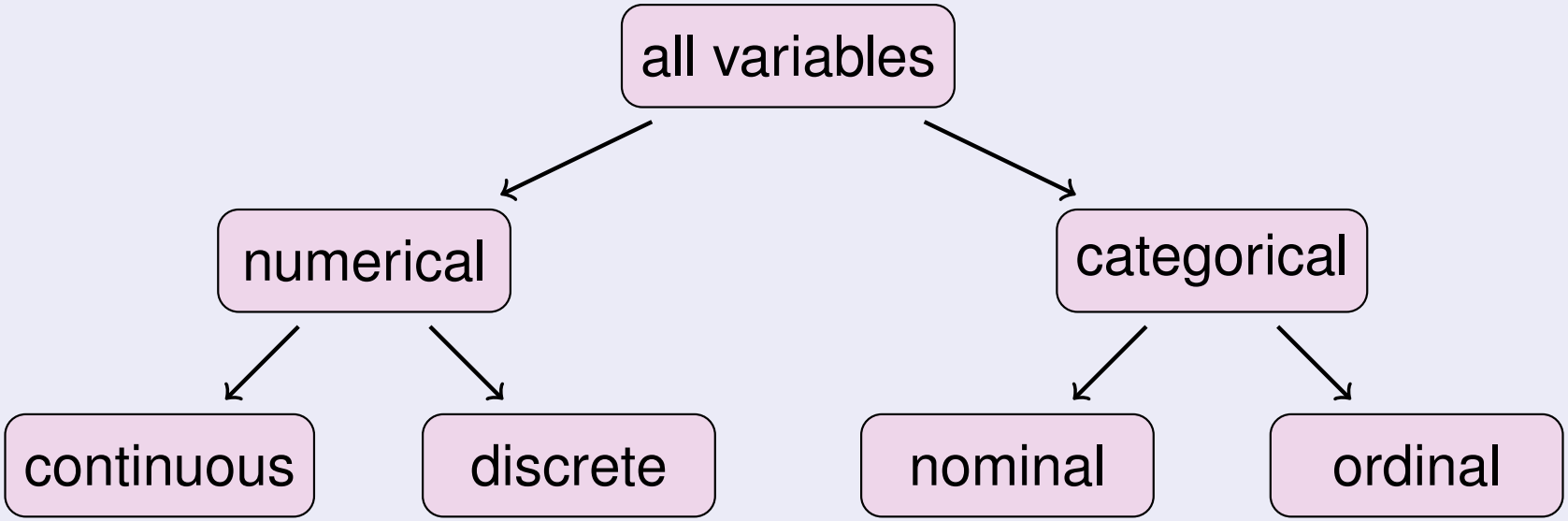

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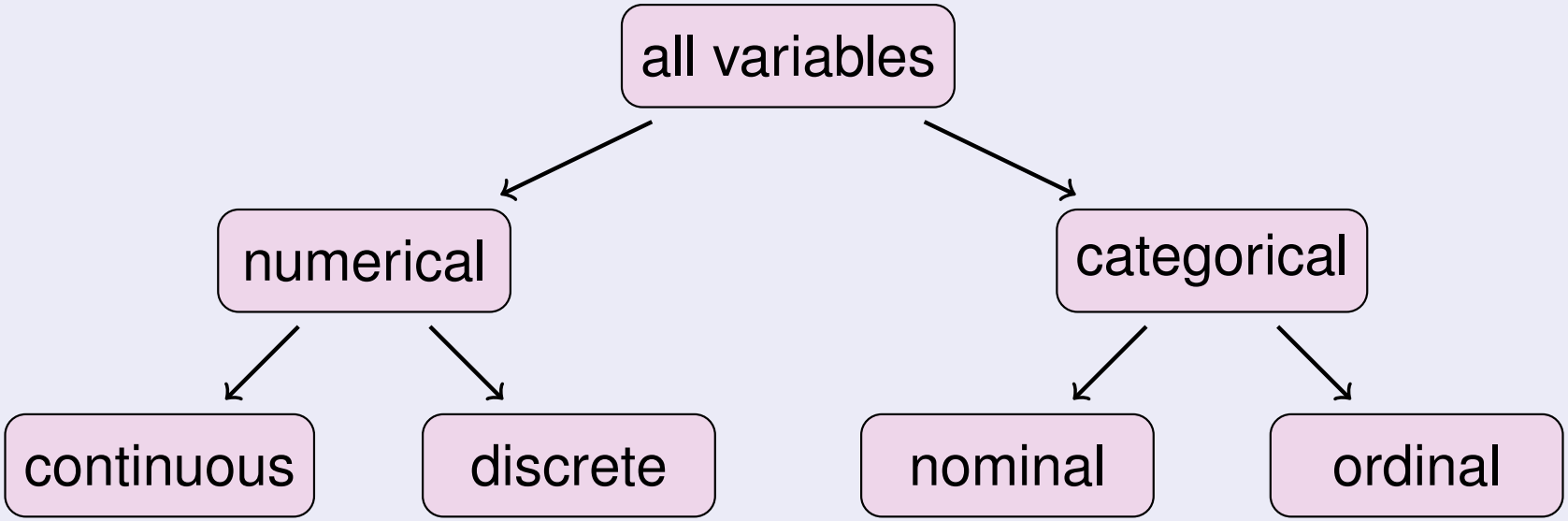

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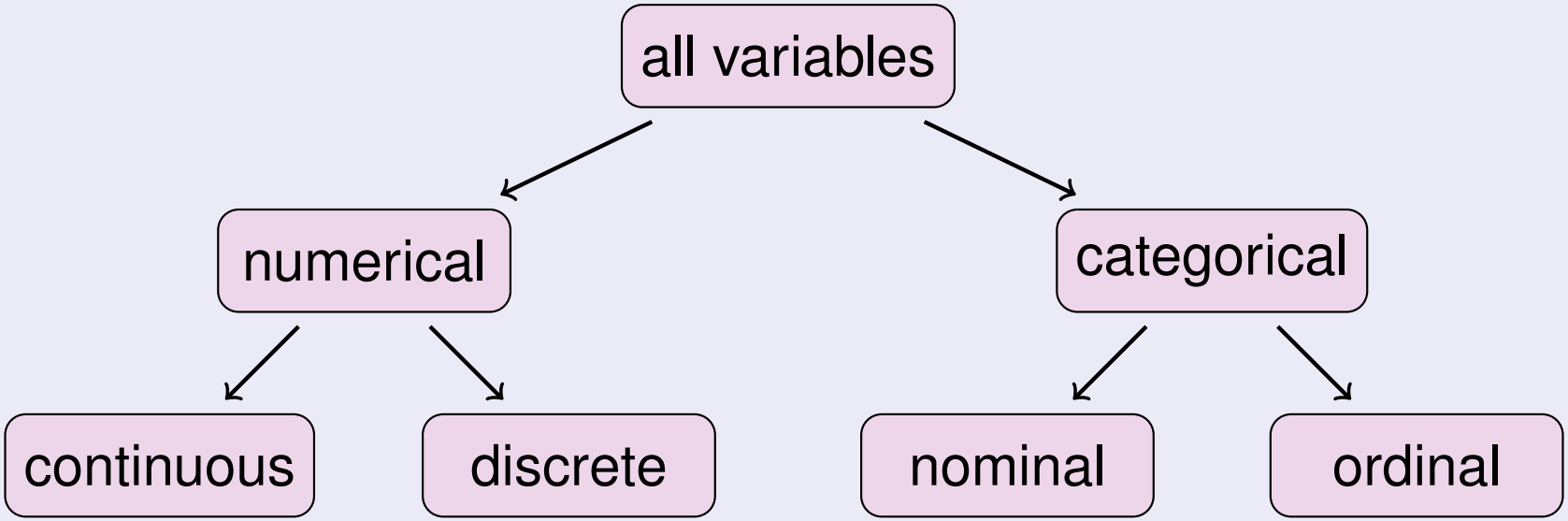

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If your data consists of only integers, then it is generally discrete.

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- Does a higher than average increase in county population tend to correspond to counties with higher or lower median household incomes?
- How useful a predictor is median education level for the median household income for US counties?

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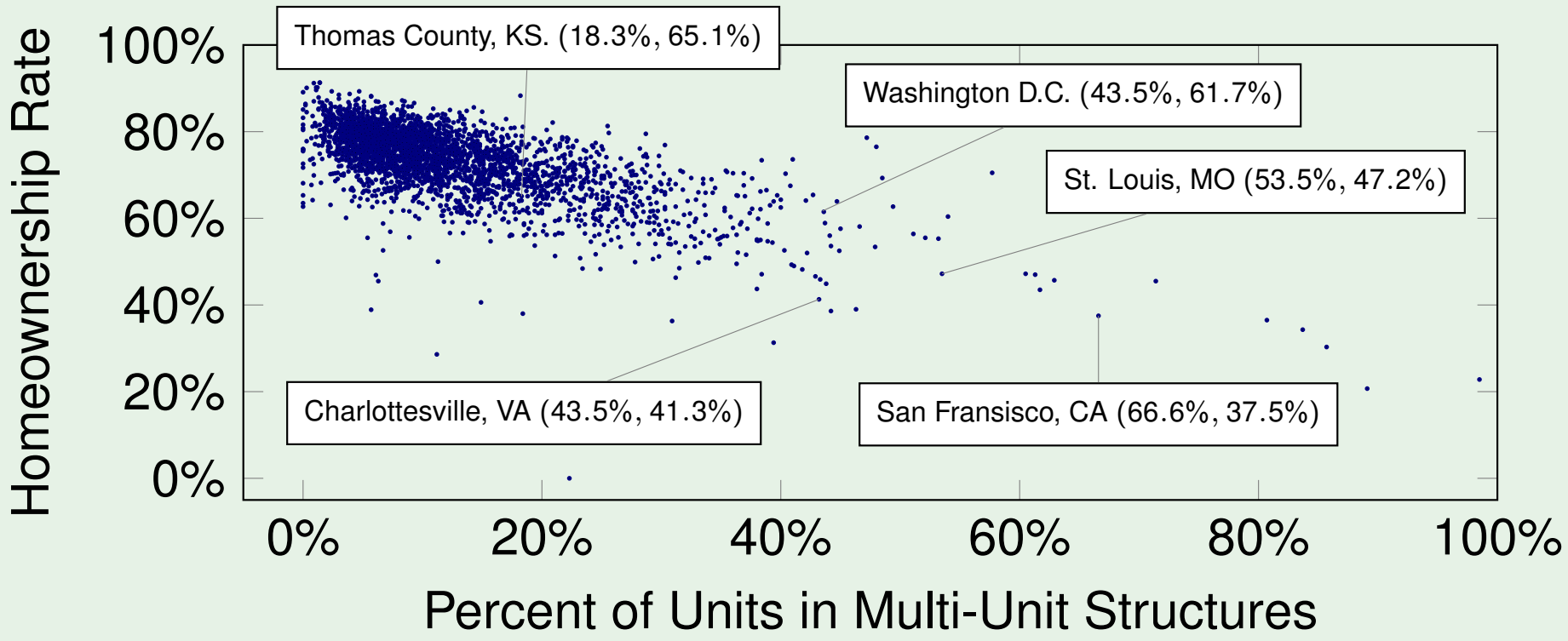

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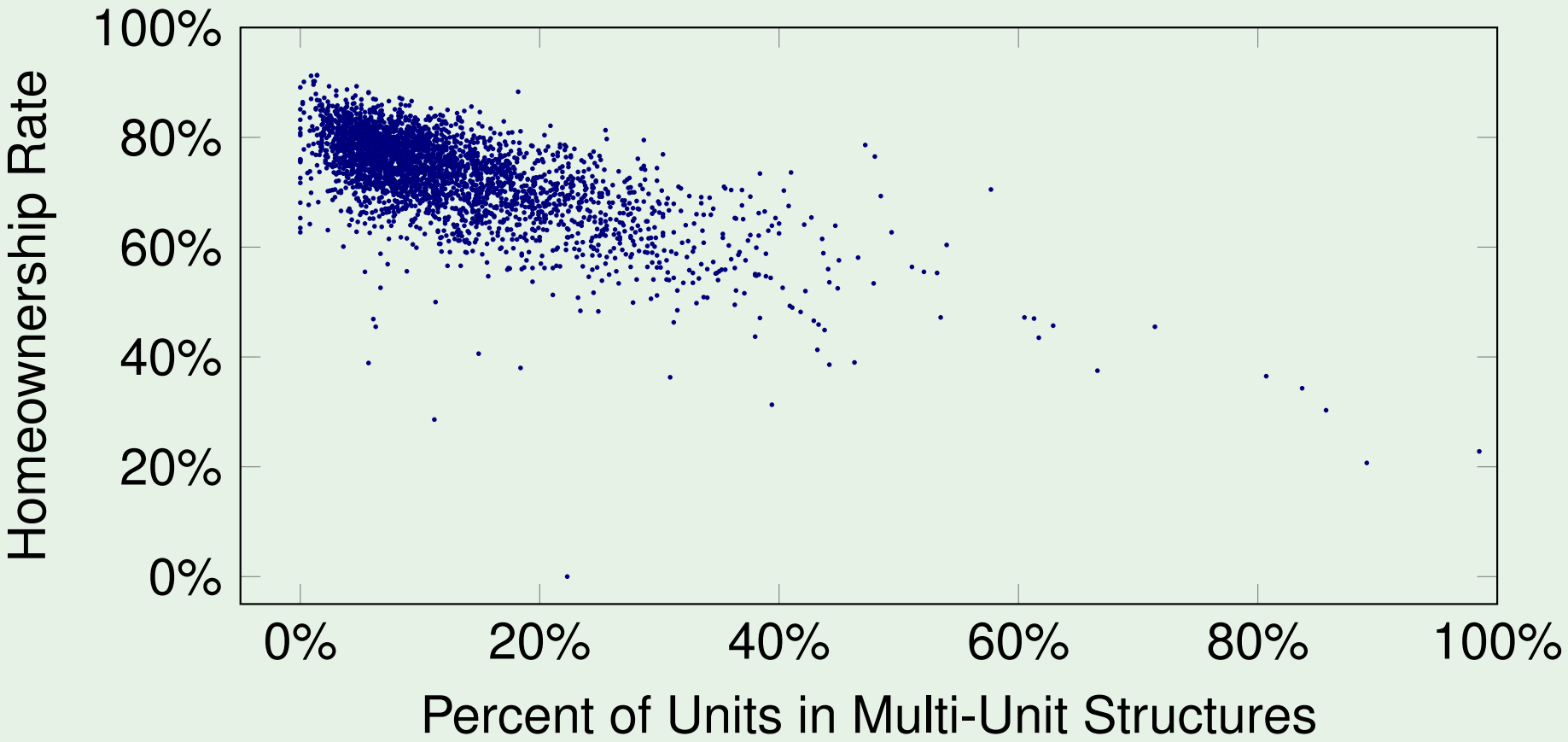

Are the Multi-Unit Structure Rate and the Homeownership Rate associated?

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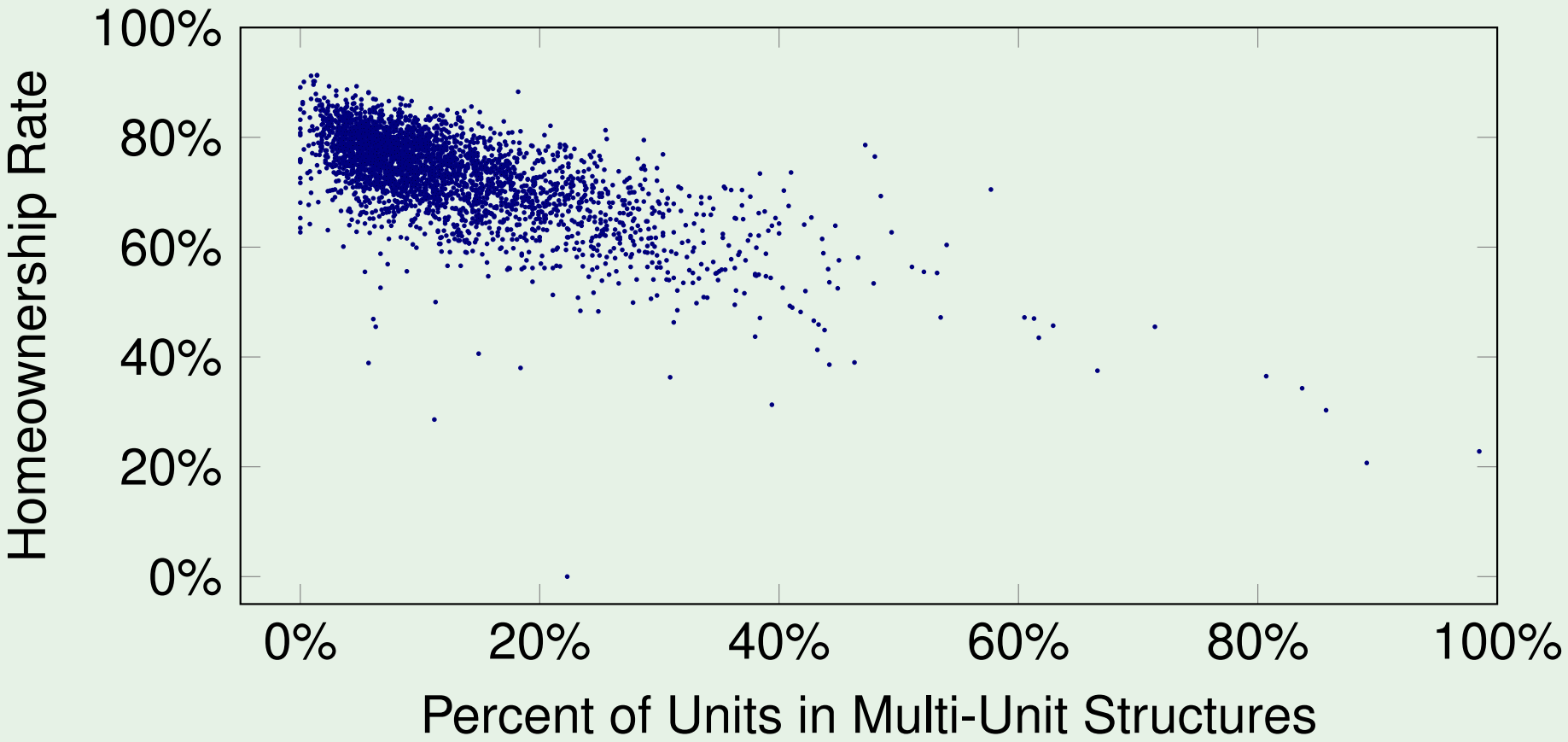

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Yes, they are negatively associated.

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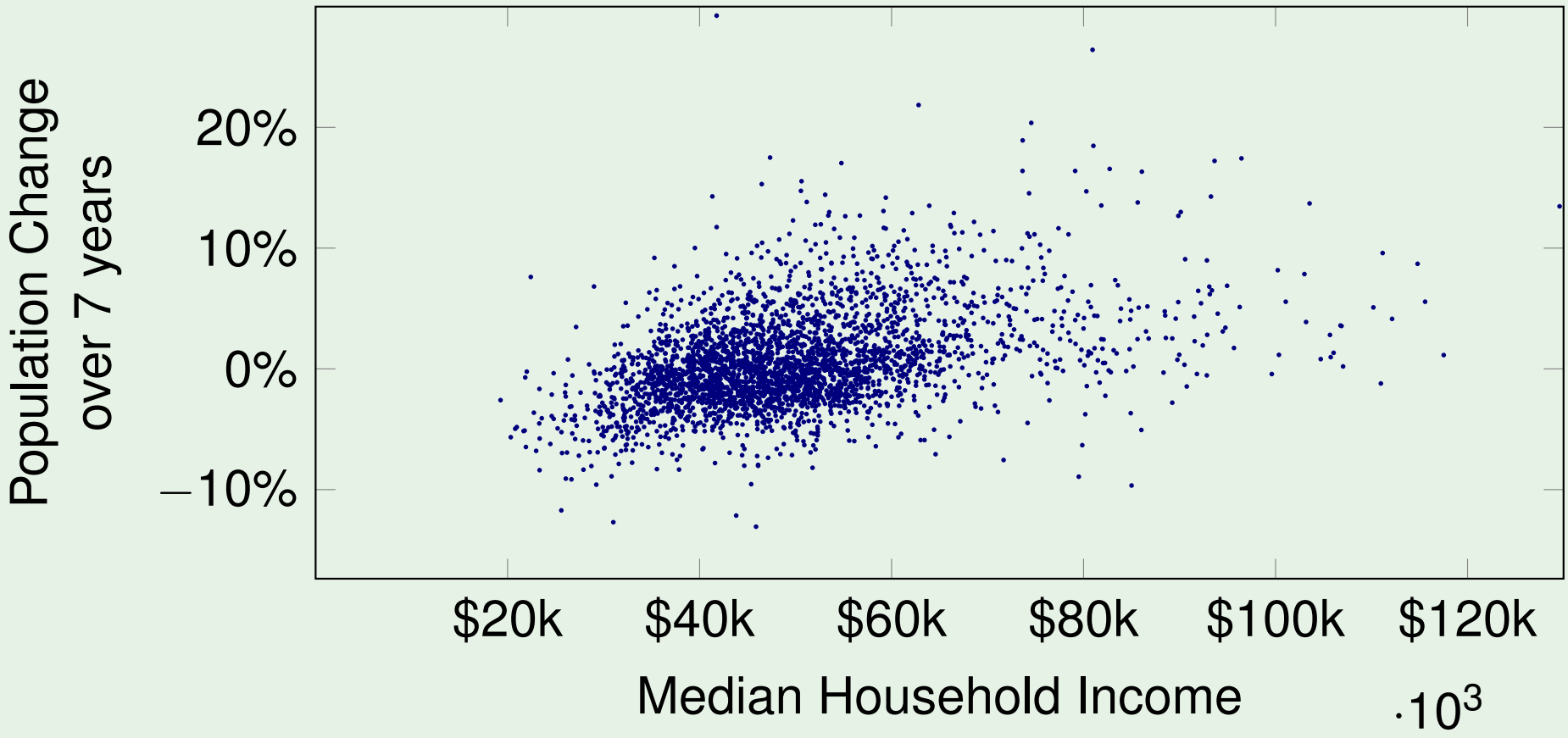

Are the Median Household Income and the Population Change associated?

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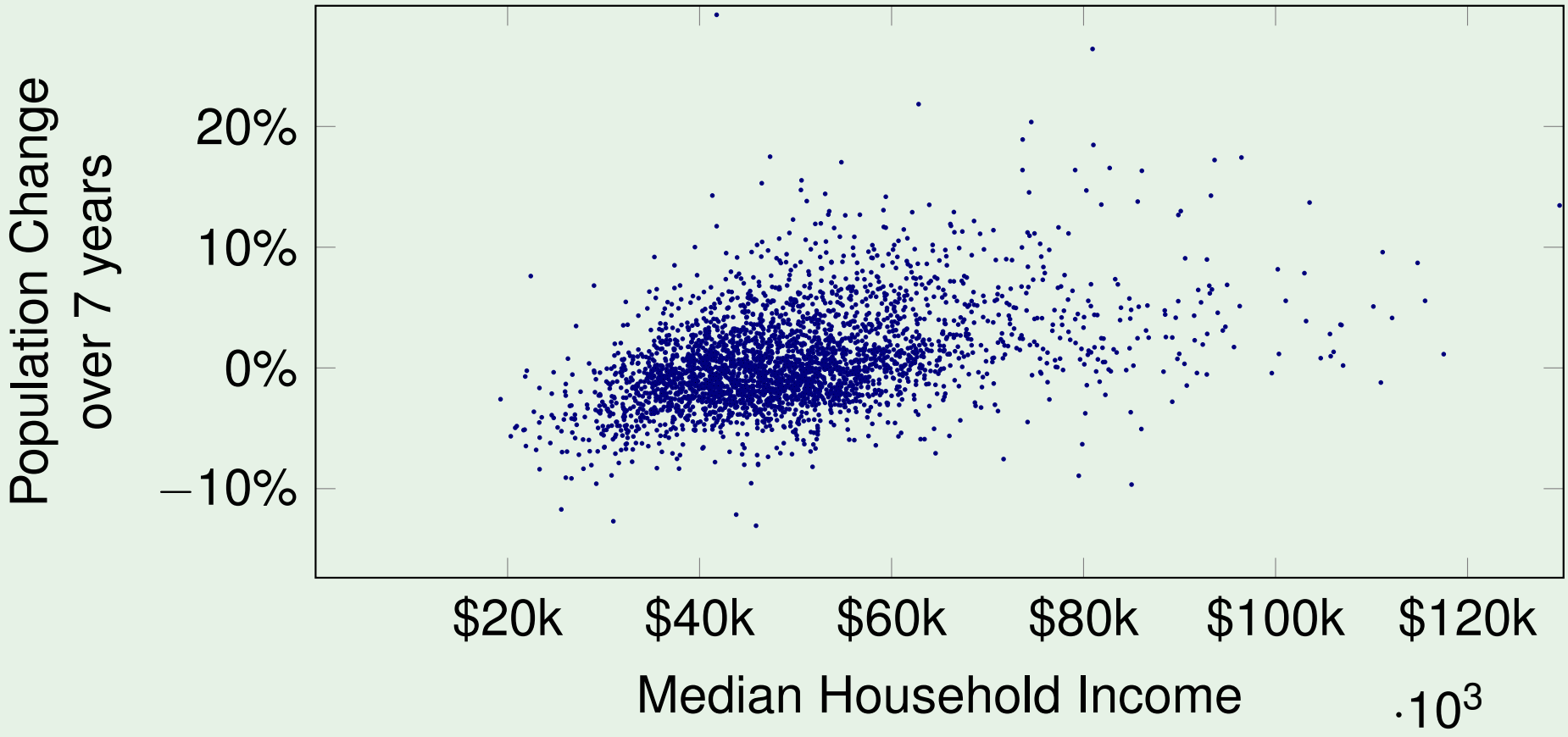

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Yes, they are positively associated.

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Consider the question:

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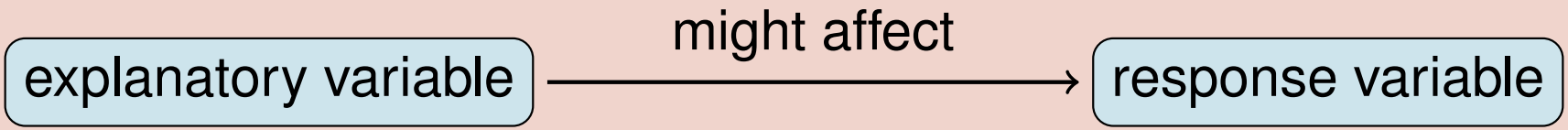

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Labeling a variable like this does **nothing** to guarantee that a casual relationship exists!

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Among the children given the Salk vaccine, 33 later developed paralytic polio, and among the children given a placebo, 115 later developed paralytic polio.

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In general, experiments are preferable to observational studies. But there are times where there are cost, time, or ethical concerns that prohibit the use of an experiment.

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Automobile collisions happen due to a large number of reasons, many of which have nothing to do with music.