

Factors affecting the annual total number of pet dogs and the changes in the pet dog population in Britain over the last decade

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Introduction

- Pet dogs are the world's *most popular* mammal species kept as companion animals.
- The total global population -- 175 million (*Hughes & Macdonald, 2013*)
- **Benefit:** improve physical and mental health
- **Disadvantage:** source of zoonotic infection
- Local pet dog population size and influencing factors-- rabies control strategies and the veterinary field

Aims of this report

- Identify the factors that affect the annual total pet dog population size.
- Find out how the pet dog population size has changed in the UK over the past decade.

Hypothesis

1. The *average annual cost of raising a dog* and *the annual number of households without children* are the affected factors of the total pet dog number
2. The population size in the UK will *increase* yearly

Method

- Collect and extrapolate data from **Statista 2023** (www.statista.com)
- The annual total pet dog number is the sum of **ten common pet dogs**' annual registration numbers in the UK from 2011 to 2021
- **A multiple regression model** --- Investigate factors affecting UK annual pet dog population size
- **Variance Inflation Factor (VIF)** with threshold = 3 --- Remove variables with strong multicollinearity
- **Scale ()** --- multiple continuous explanatory variables are on different scales
- **visreg ()** --- Visualise multiple linear regression (*Breheny & Burchett, 2017*)
- A time series graph --- Investigate the changes in the size of the pet dog population

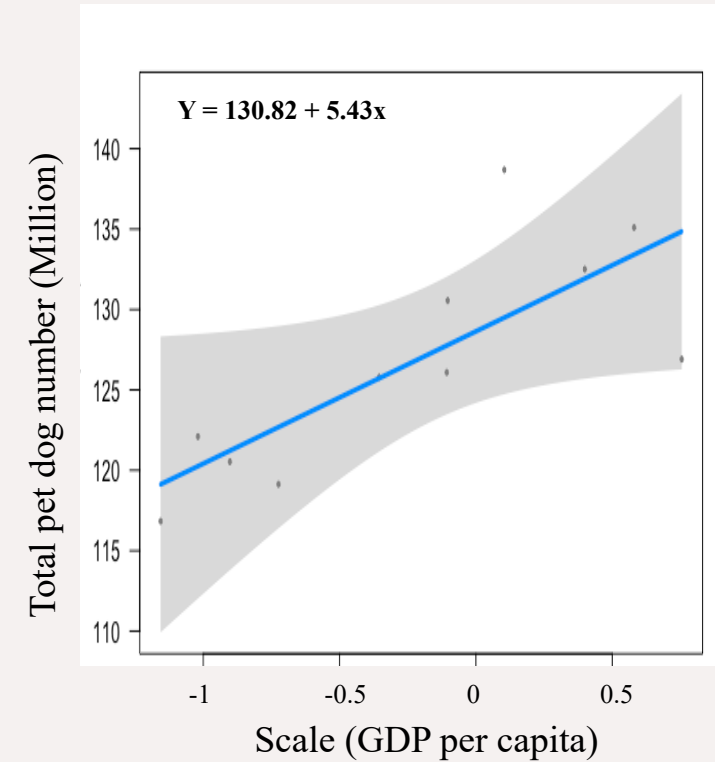
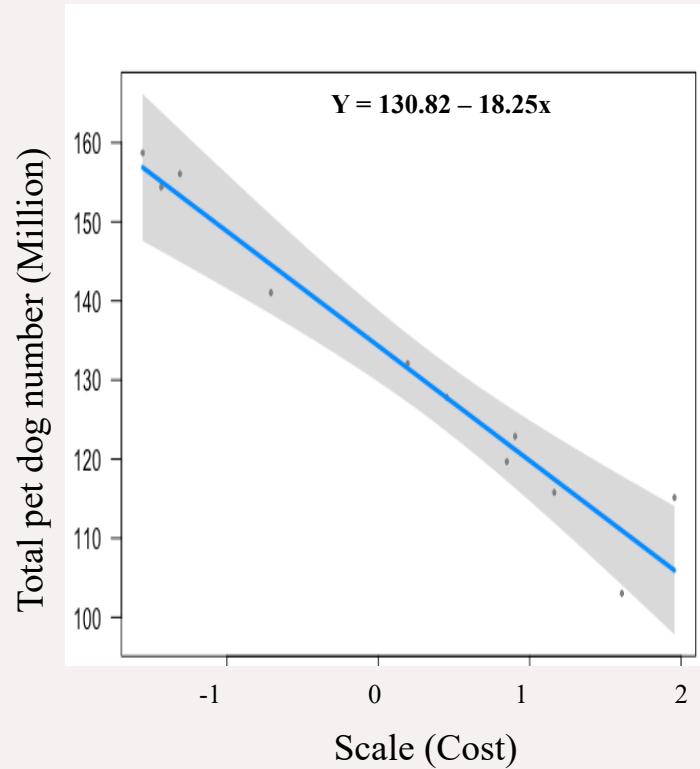
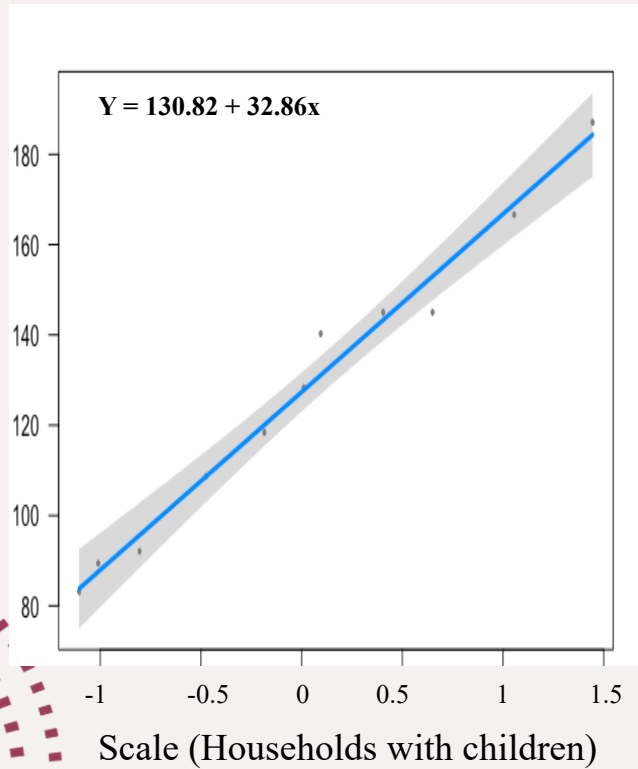
Results

Table 1. Summary of the multiple regression model with total pet dog number as the response variable

Coefficient	Estimate \pm SE	t-value	95%CI	p-value
(Intercept)	130.82 \pm 1.67	78.58	[126.74, 134.89]	<0.05 ***
Scale(Cost per dog)	-18.25 \pm 2.22	-8.23	[-23.68, -12.82]	<0.05 ***
Scale(households without children)	2.03 \pm 2.11	0.96	[-3.13, 7.19]	0.37
Scale(households with children)	32.86 \pm 2.13	15.47	[27.66, 38.05]	<0.05 ***
scale(GDP per capita)	5.43 \pm 2.20	2.47	[0.05, 10.82]	<0.05 *
Model equation: Total number (million) = 130.82 - 18.25* scale (Cost)+ 32.86 * scale (households with children) + 5.43 *scale (GDP)				

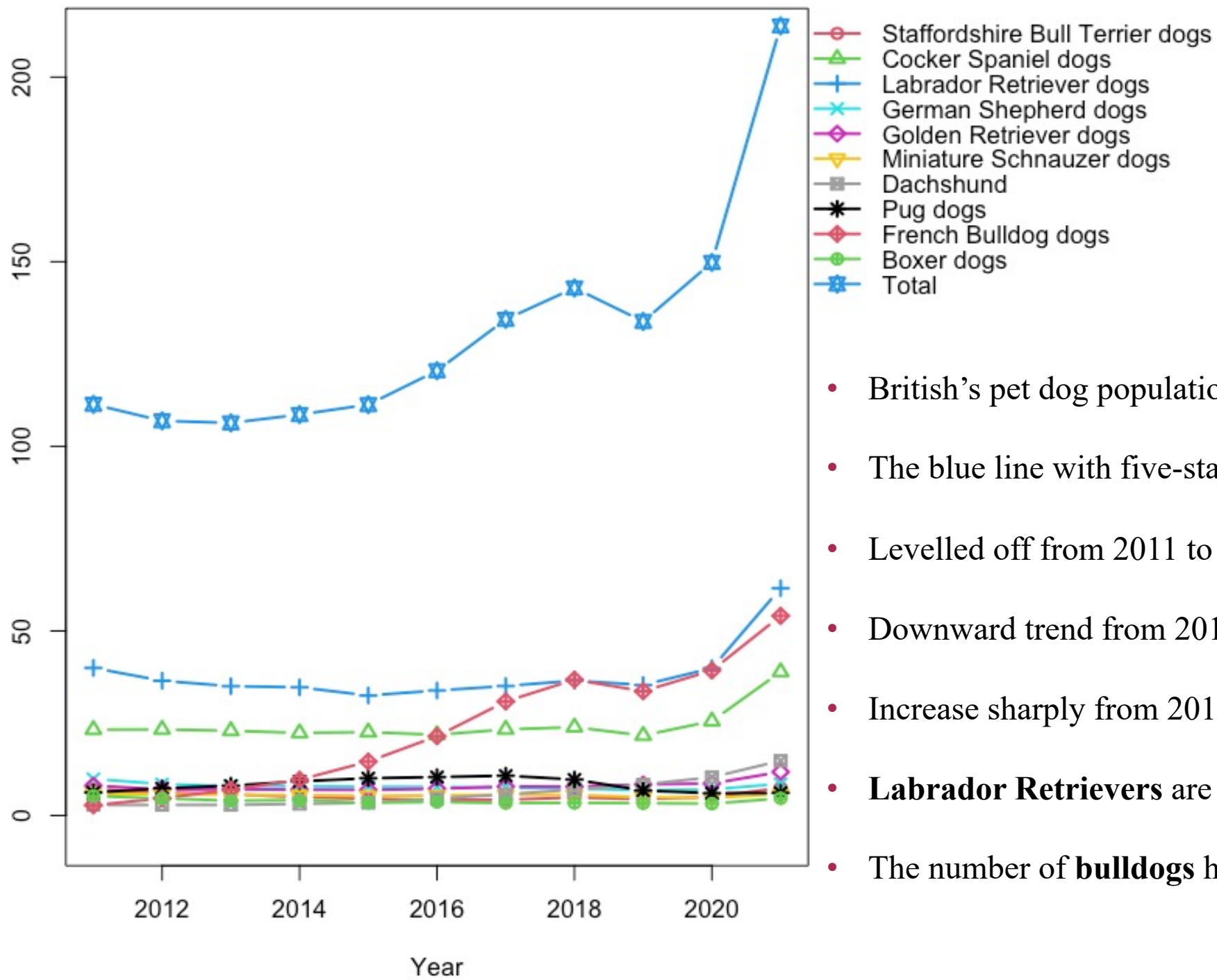
- The model explains a statistically significant and substantial proportion of variance (F-value= 108.4, df = (3, 7), p-value<0.01) with an adjusted R^2 of 0.97
- The annual number of households without children has no significant effect (p-value =0.37)
- The predictive power of households with children coefficient is relatively **reliable** (t-value = 15.47)
- The reliability of the GDP coefficient is **low** (t-value =2.47).

Total pet dog number (Million)



- Every 1SD increase in the annual number of child-rearing households
--- the annual total number of pet dogs *increase* by **32.86 million**
- Every 1SD increase in the annual cost of raising a dog
--- the annual total number of pet dogs *decrease* by **18.25 million**
- Every 1SD increase in the per capita GDP
--- the annual total number of pet dogs *increase* by **5.43 million**

The number of pet dogs (Million)



- British's pet dog population size changed from 2011 to 2021
- The blue line with five-star represents the total pet dog number
- Levelled off from 2011 to 2015
- Downward trend from 2018 to 2019
- Increase sharply from 2019
- **Labrador Retrievers** are the most popular pet dogs in the UK
- The number of **bulldogs** has increased dramatically since 2014

Discussion

- *The results partly support the first hypothesis*
- The **negative** relation between the annual average cost per dog and pet dog population size
- Other factors: GDP, the number of households with children **rather than** those without children
- Households with children are **more likely** to have dogs:
 1. Bring children necessary **companionship** (*Franti & Kraus, 1974*)
 2. Important for children's **emotional development**, such as self-esteem and compassion (*Poresky, 1996*)

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- *The results do not support the second hypothesis*
 - In addition to explanatory variables, **specific events** that occurred in the year will also affect.
 - England legislated that all pet dogs must have microchips in 2016 -- **Increasing**
 - Covid-19 in 2020 --- **Increasing**

Pet dogs can protect against the negative psychological and physical effects of lockdowns (Holland et al., 2021)

Limitation

- The **small** amount of data and sample size (only eleven data for each independent variable)
 - Leading to **poor** reliability and validity (*Faber & Fonseca, 2014*)
- The number of registered dogs in just **ten kinds** does **not** represent the total number of the pet dog
 - There are even many **unregistered** dogs

Future

- Check the reliability and generality of the conclusions or use a **large sample size** from different sources
- **Other affected factors** include annual human psychological state, annual average earning, education level etc.
- **Other countries**, such as Europe, Asia
- The relation between explanatory variables (causal relationships)
- **Predict** the future pet dog population size by modelling

Essential for the formulation of public health policies, animal disease control and stray dog population management

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