Factors Affecting Foreign-Born Population Make-up In the United States

INTRODUCTION

-Immigrants make up a vital part of the American population, boosting the economy, & driving innovation & competition in important fields like STEM (Heinrich, 2022).
-67% of US population growth in 2023 was made up of immigrants (Schneider & Salomon, 2024).
-Political polarization has contributed to Republicans condemning illegal immigration while Democrats opposing deportation (Oliphant & Cerda, 2022).
-Immigrants are drawn to job and educational opportunities (USAFacts, 2018).
-Important to investigate what factors drive immigration by examining the **foreign-born percentages** of US state populations.

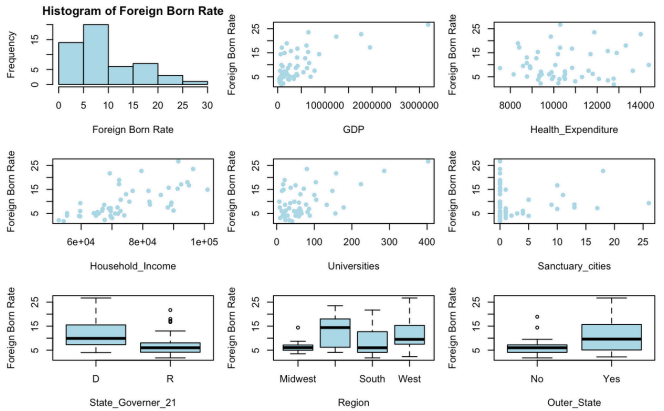
RESEARCH QUESTIONS

1. Do states with a republican governor have a lower foreign born pct of state population?
2. Do states with a higher GDP/capita have a higher foreign born pct of state population?
3. Do states with more universities have a higher foreign born pct of state population?

DATA SUMMARY

Variable	Description	Unit
Foreign Born Percentage = FBP	percentage of individuals living in a US state in 2022 who were not US citizens from birth	percentage - quantitative
Gross Domestic Product per capita = GDP	total value of goods and services produced and sold in each state in 2022 divided by population	dollars - quantitative
Outer State = OS	states on the outer edges of US touching Canada, Mexico, or an exterior body of water	Yes or No - qualitative
State Governor = GOV	political party of US state governors in 2021	Republican (R) or Democrat. (D) - qualitative
Healthcare Expenditure per capita = HLTH	spending on personal healthcare care services and products divided by state population	dollars - quantitative
Household Income = HI	median yearly amount of money made through employment in 2022	dollars - quantitative
Universities = UNI	number of postsecondary institutions in the US by state in 2022	number of universities - quantitative
Sanctuary Cities = SAN	total number of sanctuary counties and cities (locations that have authoritative practices that obstruct Immigration and Customs Enforcement) in each state	number of sanctuary cities/counties - quantitative
Region = REG	geographic area of each state	West, Midwest, Northeast, or South - qualitative

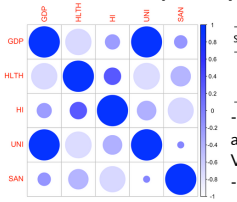
EXPLORATORY DATA ANALYSIS



-histogram of foreign born rates is unimodal, but right skewed; the log of the response variable was eventually taken in our analysis

MULTIPLE LINEAR REGRESSION ANALYSIS

Multicollinearity & Stepwise Regression Variable Screening



Stepwise Summary

Step	Variable	AIC	SBC	SBIC	R2	Adj. R2
0	Base Model	334.282	338.146	NA	0.00000	0.00000
1	GDP (+)	307.573	313.369	NA	0.43045	0.41883
2	Household_Income (+)	276.127	283.854	NA	0.70439	0.69208

-multicollinearity between GDP and UNI: individual VIF >10 and mean VIF >3; once UNI was removed, individual VIFs < 10 and mean VIF < 3
-stepwise analysis removed UNI and HI

Stage 1: Add Quantitative Variables to Model

-Initial: $FBP = \beta_0+\beta_1 GDP+\beta_2 HLTH+\beta_3 HI+\beta_4 UN$

-Revised: $FBP = \beta_0+\beta_1 GDP+\beta_2 HI$

Stage 2: Add Qualitative Variables to Model

-Initial: $FBP=\beta_0+\beta_1 GDP+\beta_2 HLTH+\beta_3 HI+\beta_4 UNI+\beta_5 OS+\beta_6 GOV+\beta_7 SAN+\beta_8 REG$

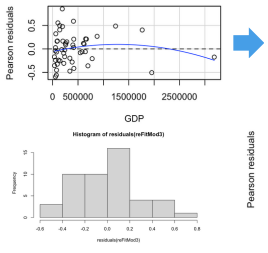
-Revised: $FBP = \beta_0+\beta_1 GDP+\beta_2 HI+\beta_3 GOV$ where GOV = {1 if GOV="R", 0 if GOV = "D"}

Stage 3: Consider Interactions

$FBP = \beta_0+\beta_1 GDP+\beta_2 HI+\beta_3 GOV+\beta_3 GOV*GDP$

-Initially, the interaction between GDP and GOV was found to significant. However, concerns regarding the regression assumptions prompted modifications to the model (shown below) that led to removing the interaction as it was no longer significant.

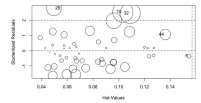
Model Modifications & Regression Assumptions



-Initial GDP Residual Plot: Including interaction (Stage 3 Model) - violates constant variance assumption
Modification: remove interaction, add log(FBP), log(GDP), sqrt(HI)
-Final log(GDP) Residual Plot: meets constant variance assumption

- Mean Zero
- Homoscedasticity
- Normality
- Independence

Outliers and Influential Observations



influential observation 29 and outliers 10 and 44 were removed

Final Model

$E(\log(FBP)) = \beta_0+\beta_1 \log(GDP)+\beta_2 sqrt(HI)+\beta_3 GOV$
where GOV = {1 if GOV="R", 0 if GOV = "D"}

ADDITIONAL TECHNIQUE: EXTERNAL VALIDATION (PRESS)

-PRESS (**4.86**) was slightly larger than RSS (**4.07**)
-Our model is more likely to be adequate at prediction

CONCLUSION

Prediction Equation

$$\widehat{log(FBP)} = -5.57 + 0.231 log(GDP) + 0.0178\sqrt{HI} - 0.224 GOV$$

-where GOV = {1 if GOV = "R", 0 if GOV = "D"}

-Multiple R-squared: **0.7898** -Adjusted R-Squared: **0.7754**

Interpretation of Analysis

-Adjusted R-squared indicates 77.54% of error is explained by the model and it is a good fit

-Global F-test indicates we can reject the null hypothesis ($p<0.0001$). The model is adequate at predicting the foreign born pct of an American state.

-For every one unit increase in log(GDP), the FBP increases by e^0.231 = 1.260, for every one unit increase in sqrt(HI), the FBP increases by e^0.0178 = 1.018, and the average FBP is e^0.224 = 1.251 lower when the state governor is Republican as opposed to Democrat, assuming all other variables remain constant.

-Example: We used our model to predict FBP for states Wyoming and Virginia. For Wyoming, the model predicted a FBP of 3.86% while the actual FBP was 3.1%. For Virginia, the model predicted a FBP of 15.03%, while the actual was 12.7%. Our actuals were contained within prediction intervals and close in value to the predicted.

LIMITATIONS + IMPROVEMENTS

-Since our final model includes a logarithm of the response variable, it is only suitable for prediction, not estimation.
Most of our variables were removed by the screening process, so we have a relatively low number of explanatory variables.
-In the future, we should consider variables politically and economically related, as our significant variables were of that nature.

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