



# **Rust Belt Challenge**

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# BACKGROUND

*zinc* attempts to deliver targeted solutions for 'left-behind' people in "rust belt" areas beyond the US context

Therefore, we need to understand what "rust belt" areas are to begin with?

## Predominant Identifiers of "Rust Belt" Areas in the US:

- Decline of traditional industries during the 1970s, 1980s and 1990s
- Massive loss of jobs and emigration
- Old industrial areas within the US, UK and Europe (eg the Ruhr region of Germany)

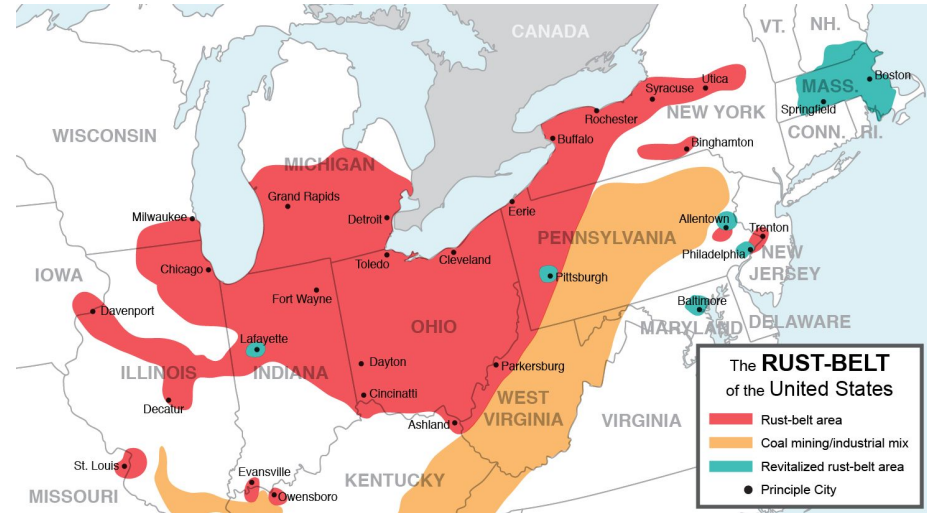


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# OBJECTIVES

Our analysis attempts to answer the following questions:

- What are “Rust Belt” regions?
- What are shared characteristics across “Rust Belt” regions?
- Can we predict “Rust Belt” status?
- What is the applicability of the US “Rust Belt” model across different international contexts?



# RESEARCH FOCUS & DATA USED

## Three Levels of Analysis

1. Similarities and differences across “Rust Belt” regions
2. Comparing UK/US cases with continental European cases
3. Predicting “Rust Belt” status in Europe using the US model

## Compiled Datasets

- Two Datasets:
  1. OECD Regional: all regions for countries with at least one “Rust Belt” region
  2. OECD Metropolitan: all metropolitan regions, “Rust Belt” or not (466 unique observations)

# RESULTS

# Similarities and Differences between Rust Belt and Non-Rust Belt Areas

## United States

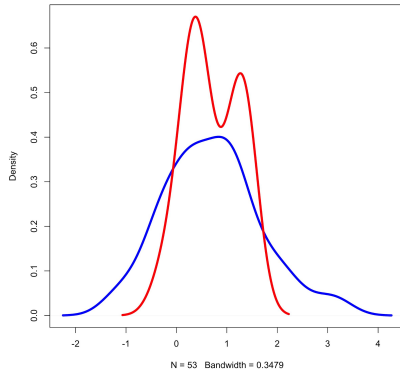
GDP per Cap  
Change

Unemployment Rate

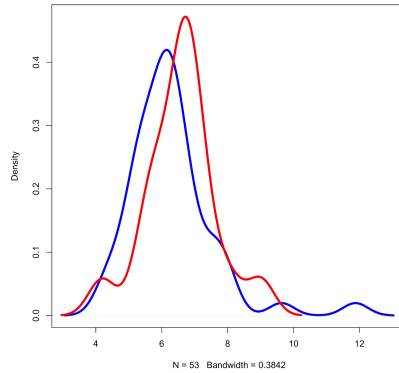
Dependency Ratio Elderly

Population Change

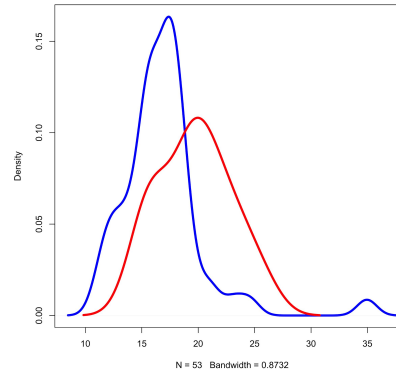
gdp\_pc\_ach



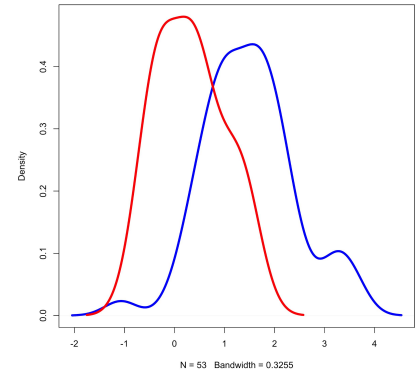
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pop\_dep\_ratio\_old



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— Rust Belt — Non-Rust Belt

# Similarities and Differences between Rust Belt and Non-Rust Belt Areas *Germany*

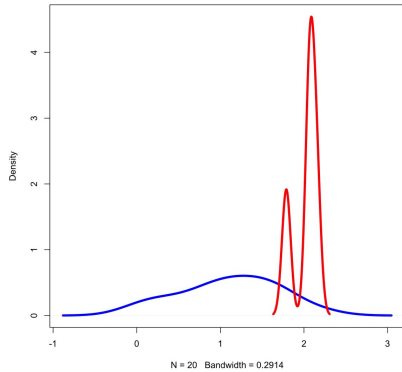
GDP per Cap  
Change

Unemployment Rate

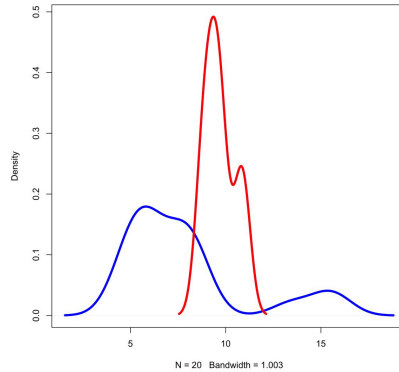
Dependency Ratio Elderly

Population Change

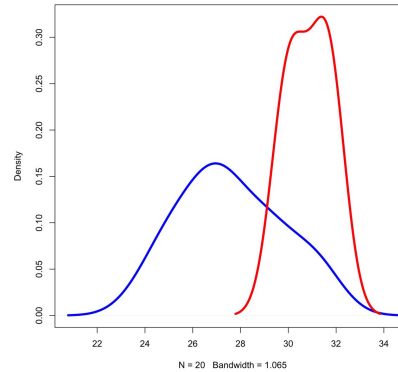
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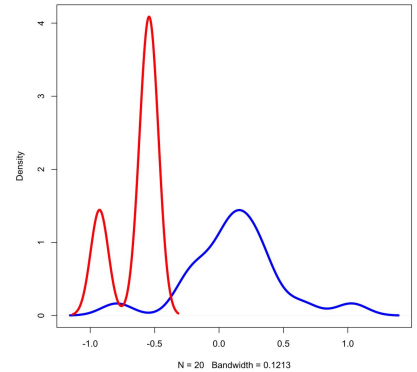
unemp\_R



pop\_dep\_ratio\_old



pop\_ach



— Rust Belt — Non-Rust Belt

## Differences between Rust Belt and Non-Rust Belt Areas *Internationally*

Country	Estimate	std.error	lower	upper	Variable
DE	-7587.082	2861.041	-12418.293	-3099.260	GDP_PC
UK	-5725.119	2491.048	-10019.698	-1823.535	GDP_PC
PL	-10.779	4.302	-17.643	-4.021	EMP_R
FR	3.750	2.045	0.800	7.280	UNEMP_R
PL	4.760	2.203	1.361	8.548	UNEMP_R
PL	-8.993	3.968	-15.368	-2.893	PART_R
DE	751.737	368.183	158.541	1328.249	POP_DENS
DE	3.619	1.803	0.729	6.576	POP_DEP_RATIO_OLD
IT	7.114	3.332	2.094	13.164	POP_DEP_RATIO_OLD
US	2.462	1.004	0.802	4.095	POP_DEP_RATIO_OLD

When we consider more than 23 metropolitan variables across 26 countries only a few are significantly different across rust-belt and non-rust-belt metros within countries



# Similarities and differences across Rust Belt Areas

To find **similarities** across Rust Belt Areas: *Principal Components Analysis*

The metropolitan rust belt areas are more similar in terms of population structure (total and old population, labour force, dependency ratio) than in terms of economic activity (GDP per capita, labour productivity, unemployment).

To see if there are **differences** between Rust Belt Areas: *k-means clustering*

US / UK / EU metropolitan areas are not clustered into different categories.  
→ No evidence for clear differences between geographies\*

*(Metropolitan data used; \*37 rust belt observations)*

# Regional Data Analysis

## What we had planned to do

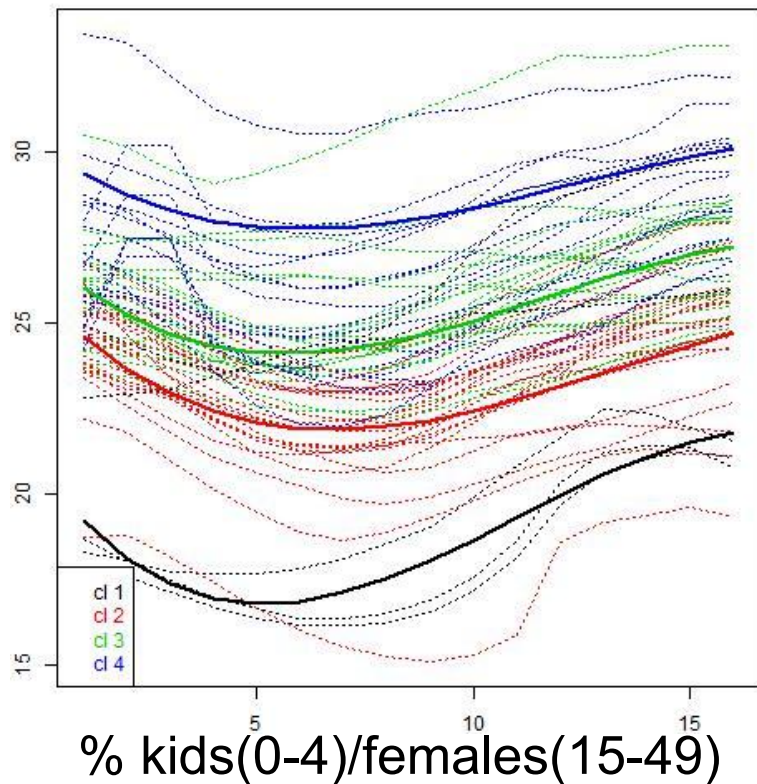
- Download OECD regional data
- Combine different indicators
- Remove multi-correlated data (`R.caret::findCorrelation`)
- Dimensionality reduction (PCA)
- Choose variables, by loadings
- Functional clustering (`R.funcy`)
- Identify #Clusters
- Check similarity of mainland regions with UK, USA
- Check identification of left behind areas

# PCA Variables

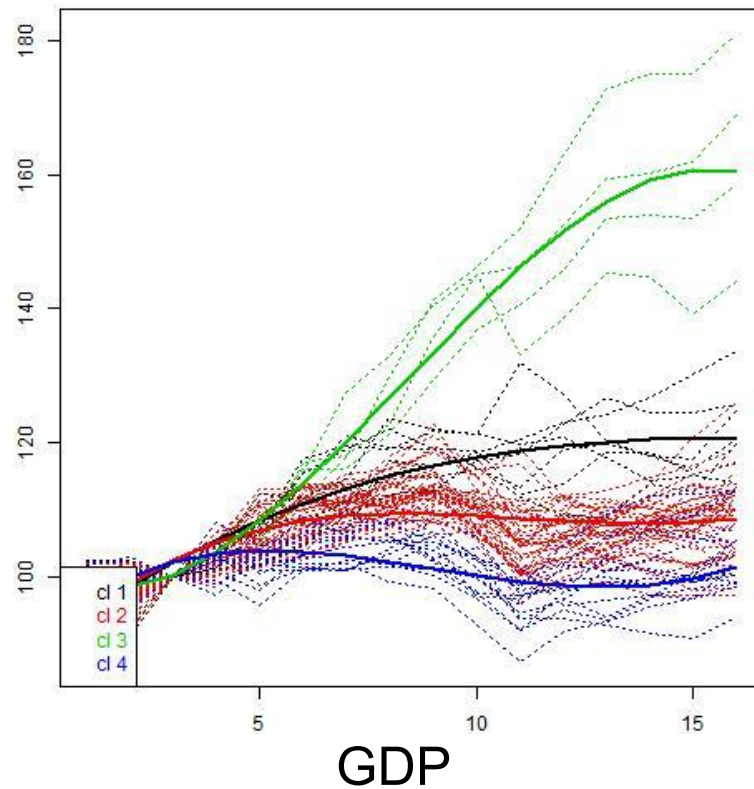
- Dependency Ratio (% -15 plus 65+ over population 15-64)
- Employment in agriculture, forestry and fishing
- Employment Rate
- Employment Rate Growth
- GDP
- GVA:
  - distributive trade, repairs, transport, accommod., food serv. activities
  - information and communication
  - financial and insurance activities
  - prof., scientific, techn. activities, admin., support service activities
  - public admin., compulsory s.s., education, human health
- Child-to-Woman Ratio
- Participation Rate
- Sex Ratio in the Elderly Population

# Functional clustering showcase

fitfclust



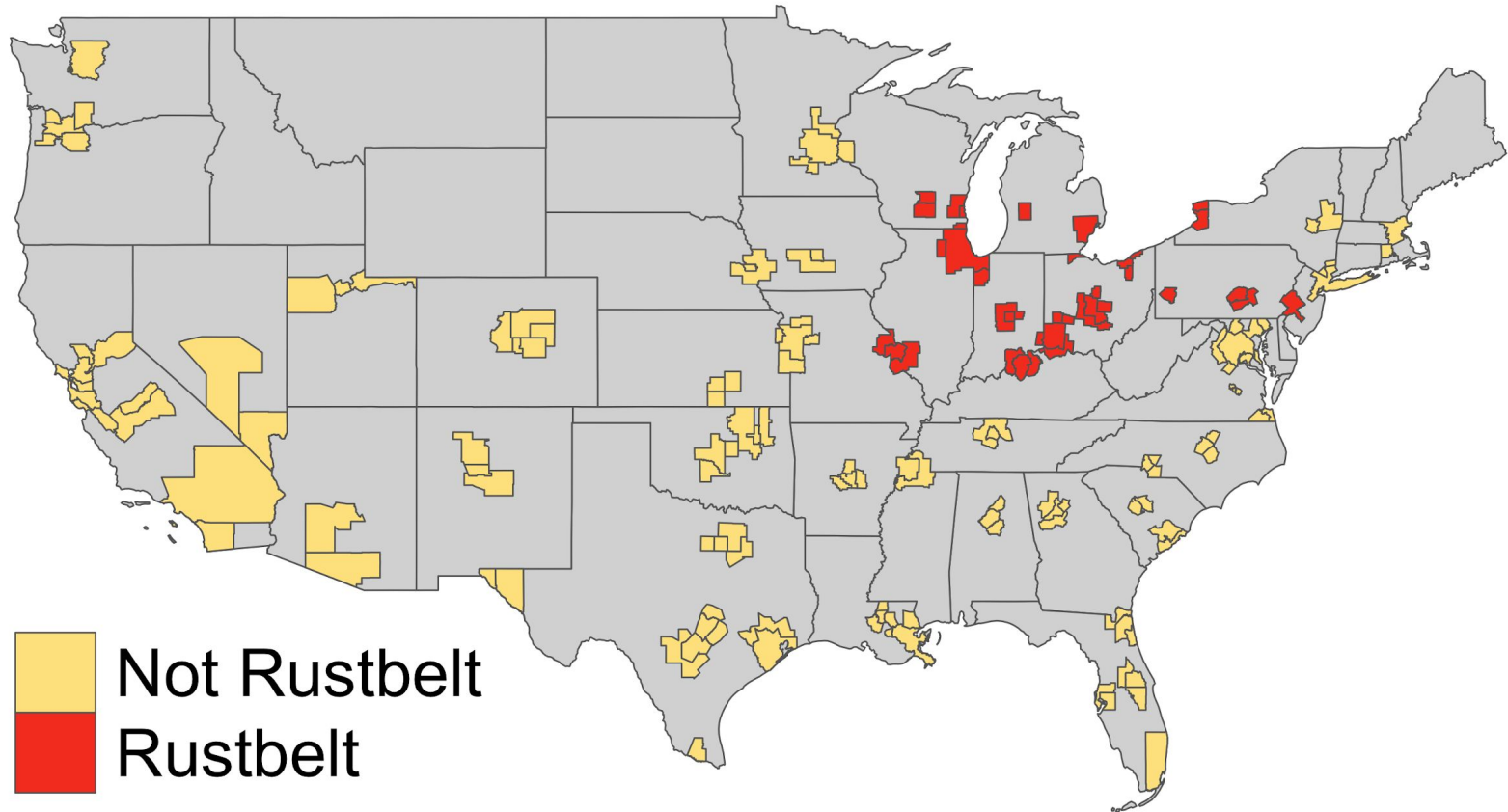
fitfclust



# Predicting Rust Belt Status

We have a good idea of where rust belt is in US...

# USA Rust Belt



# **RESULTS - Metropolitan areas**

1. Can we predict rust belt status in the US?
2. What areas do we identify if US model applied to Europe?

# Model Fitting in US

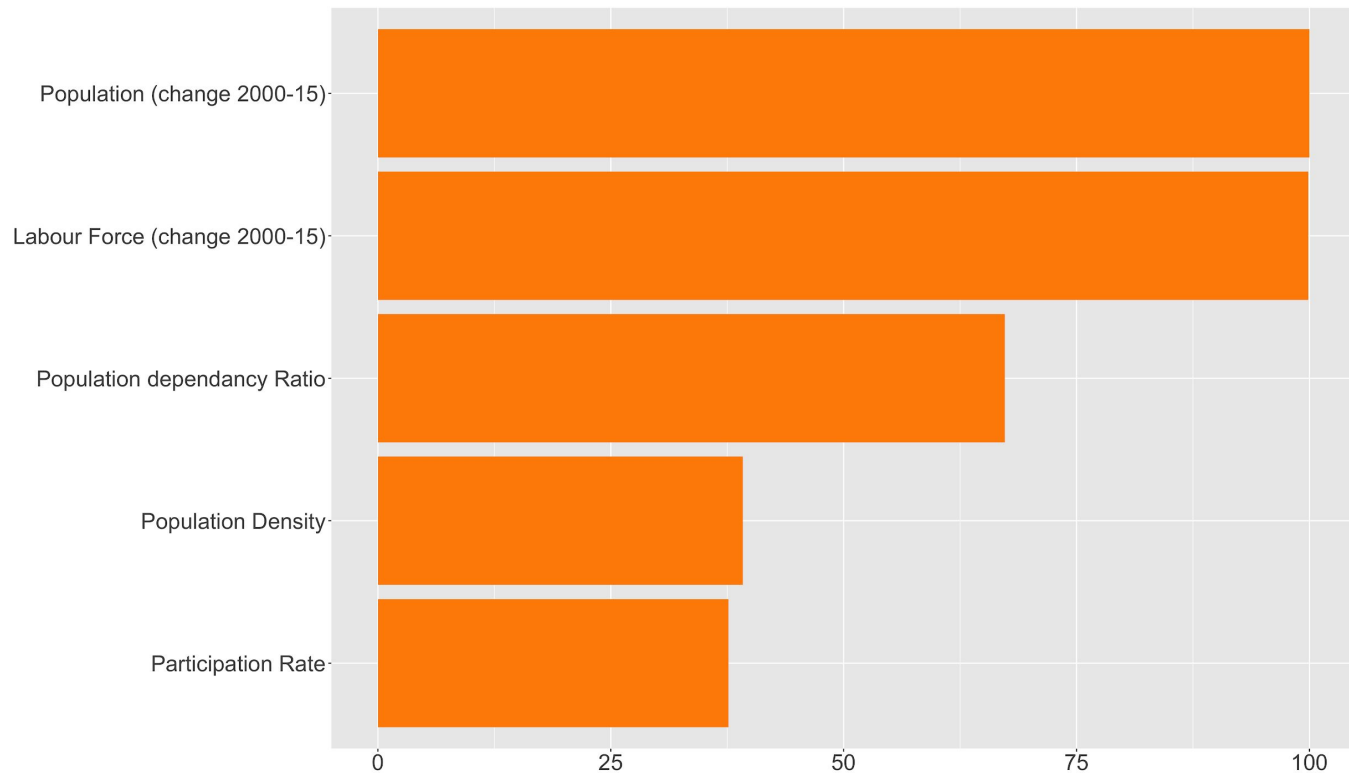
- Classification Problem
- OECD Metropolitan Area variables
  - Demographics
  - Employment
- Three types of models:
  - Logit
  - Elastic Net
  - Random Forest
- Class imbalance - upsampling



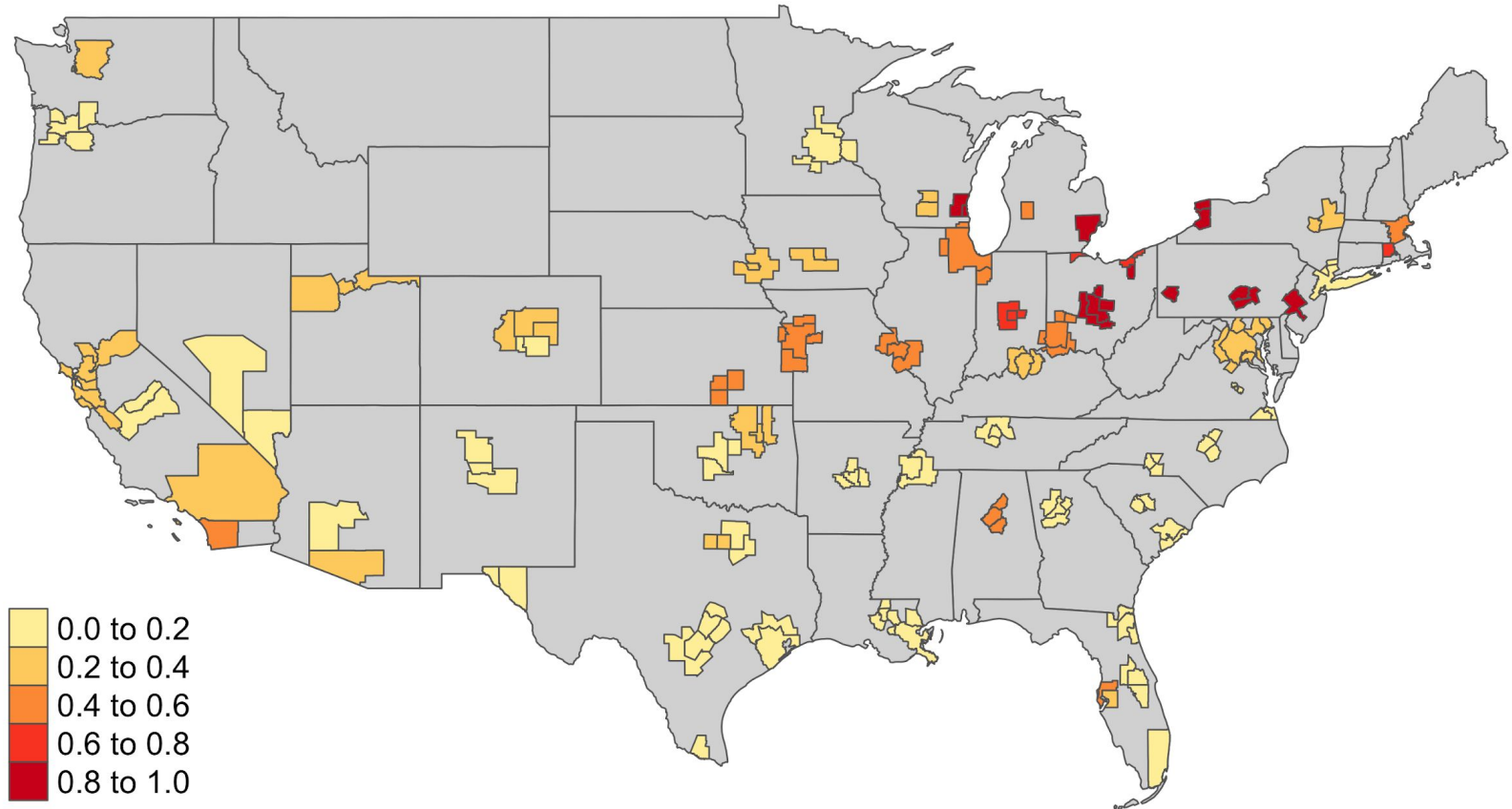
# Model Fitting in US - Performance

- Logit
  - Kappa = 0.155
- Elastic Net
  - Kappa = 0.451
- Random Forest
  - Kappa = 0.495

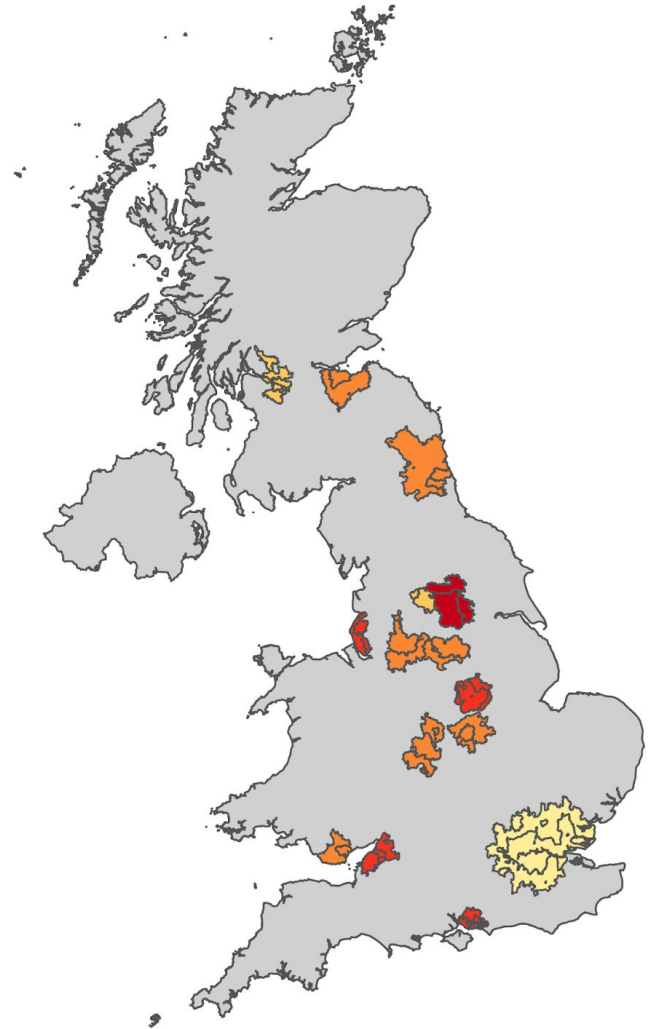
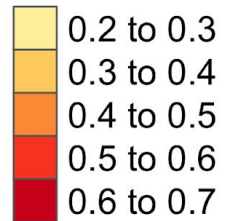
# Variable Importance (Top 5)



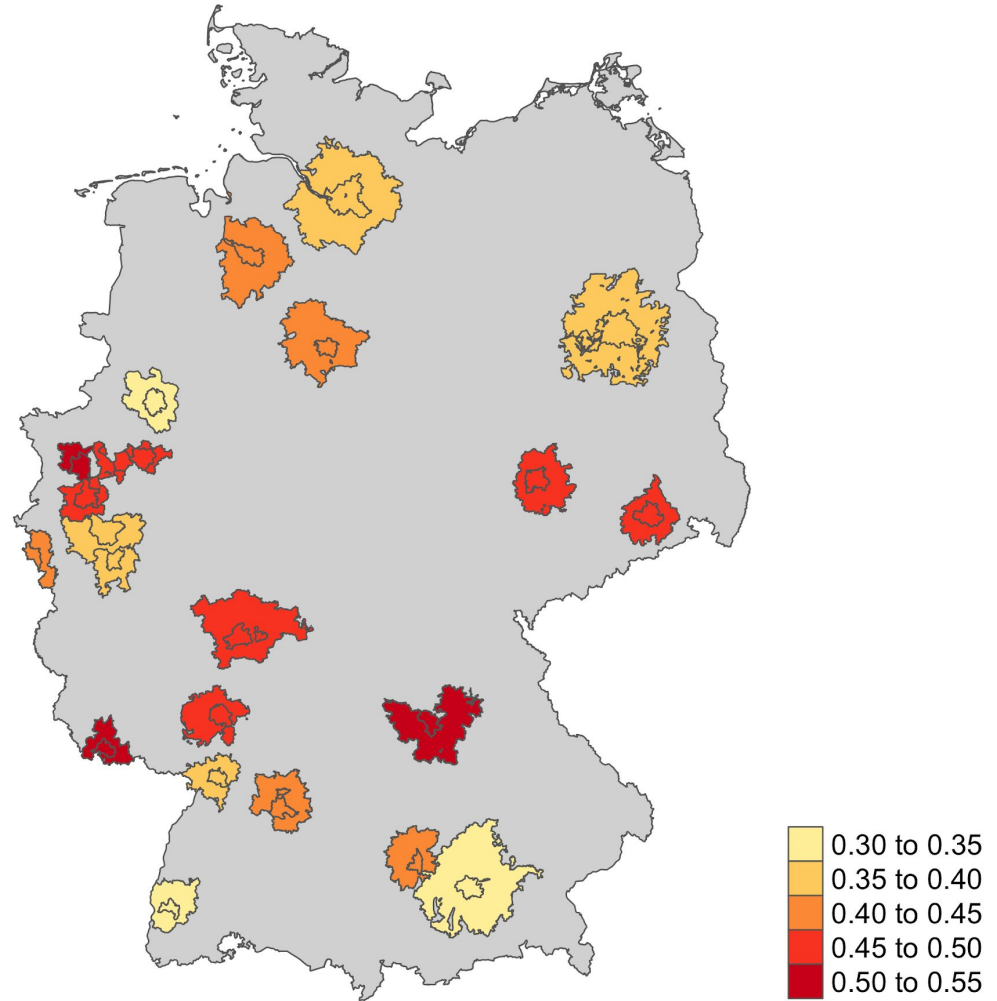
# Predicted Rust Belt - USA



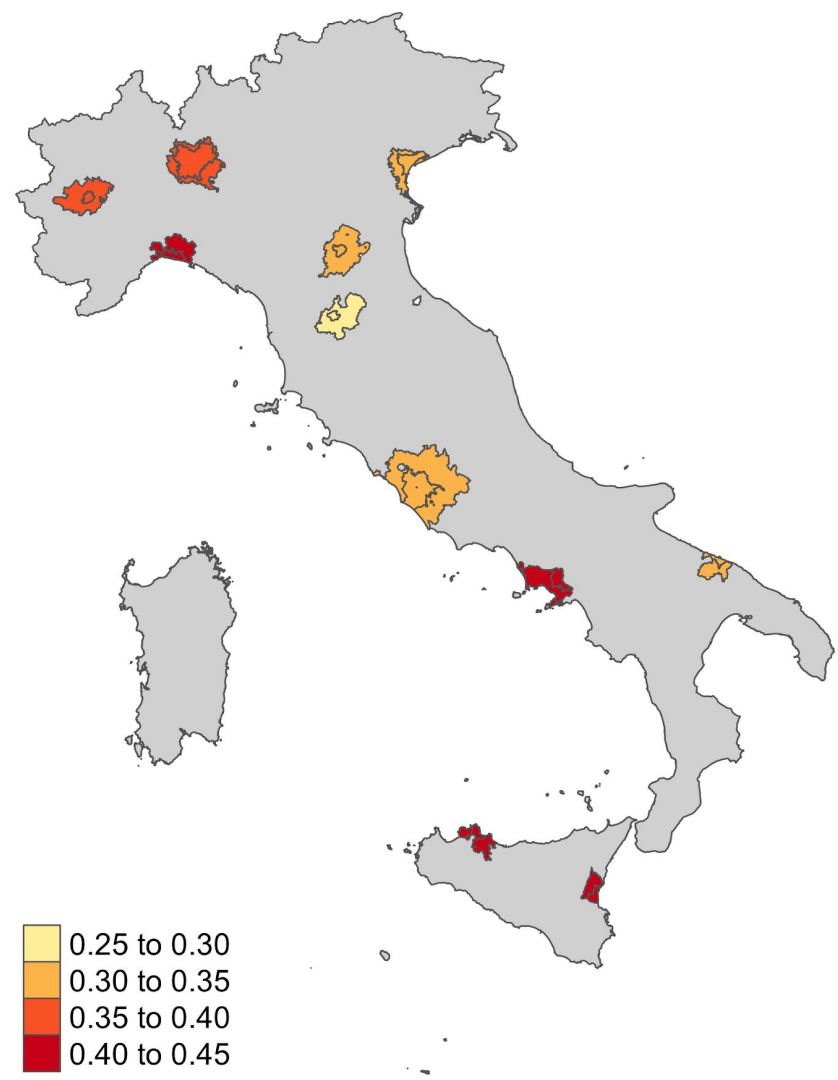
# Predicted Rust Belt - UK



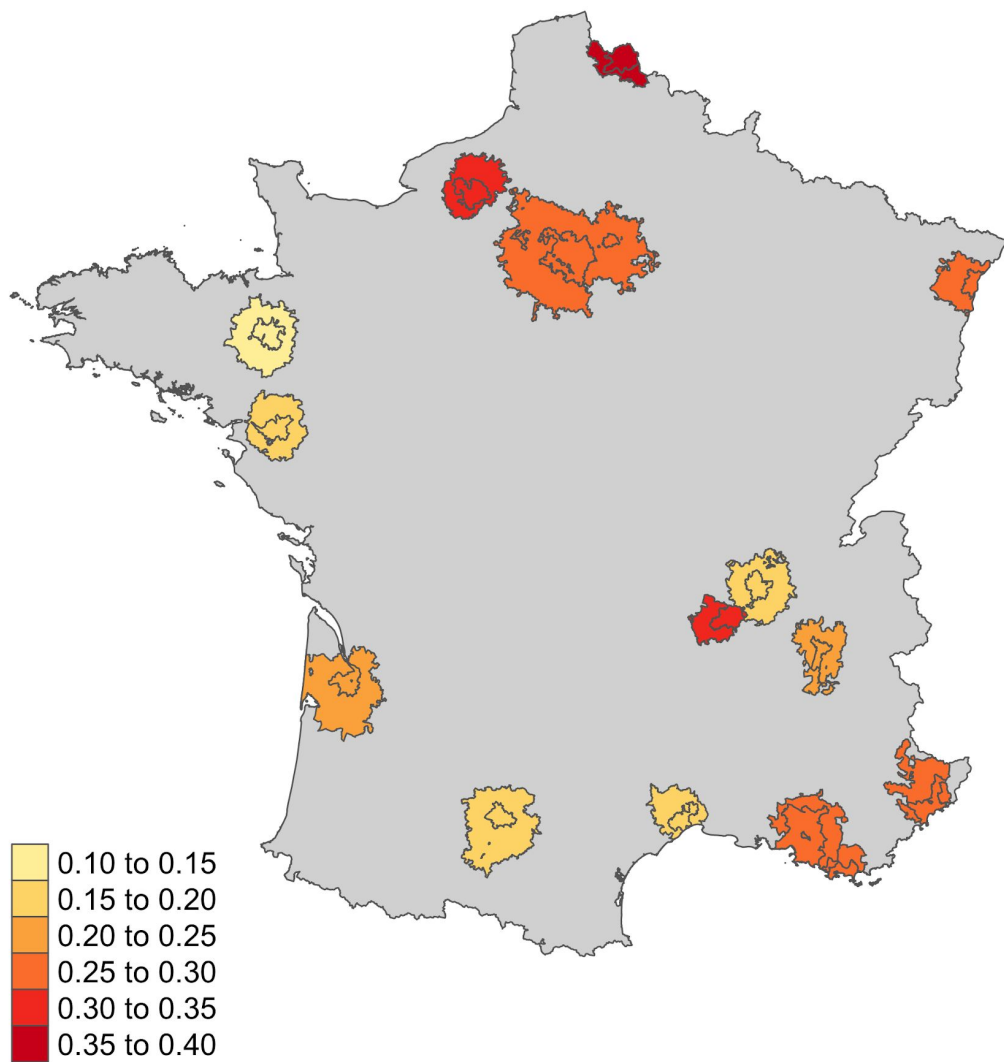
# Predicted Rust Belt - Germany



## Predicted Rust Belt - Italy



## Predicted Rust Belt - France



# DISCUSSION & FUTURE OUTLOOK

- Based on population and economic variables, there is no clear difference across Rust Belt areas internationally (i.e. no clear US / UK / EU divide).
- It's hard to find differences between rust and non-rust regions
- However, additional variables (i.e. race, quality of life, education, social mobility) need to be tested across time.



# Thanks!

Check out our code: [https://github.com/jackblun/lse\\_css\\_leftbehind](https://github.com/jackblun/lse_css_leftbehind)

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