EDUCATION INVESTMENT AND SKILL MISMATCH: UNDERSTANDING THEIR IMPACT ON EUROPEAN LABOUR MARKETS

PRESENTED BY
REVNA DEMIRKALE
ALI KUMRAL

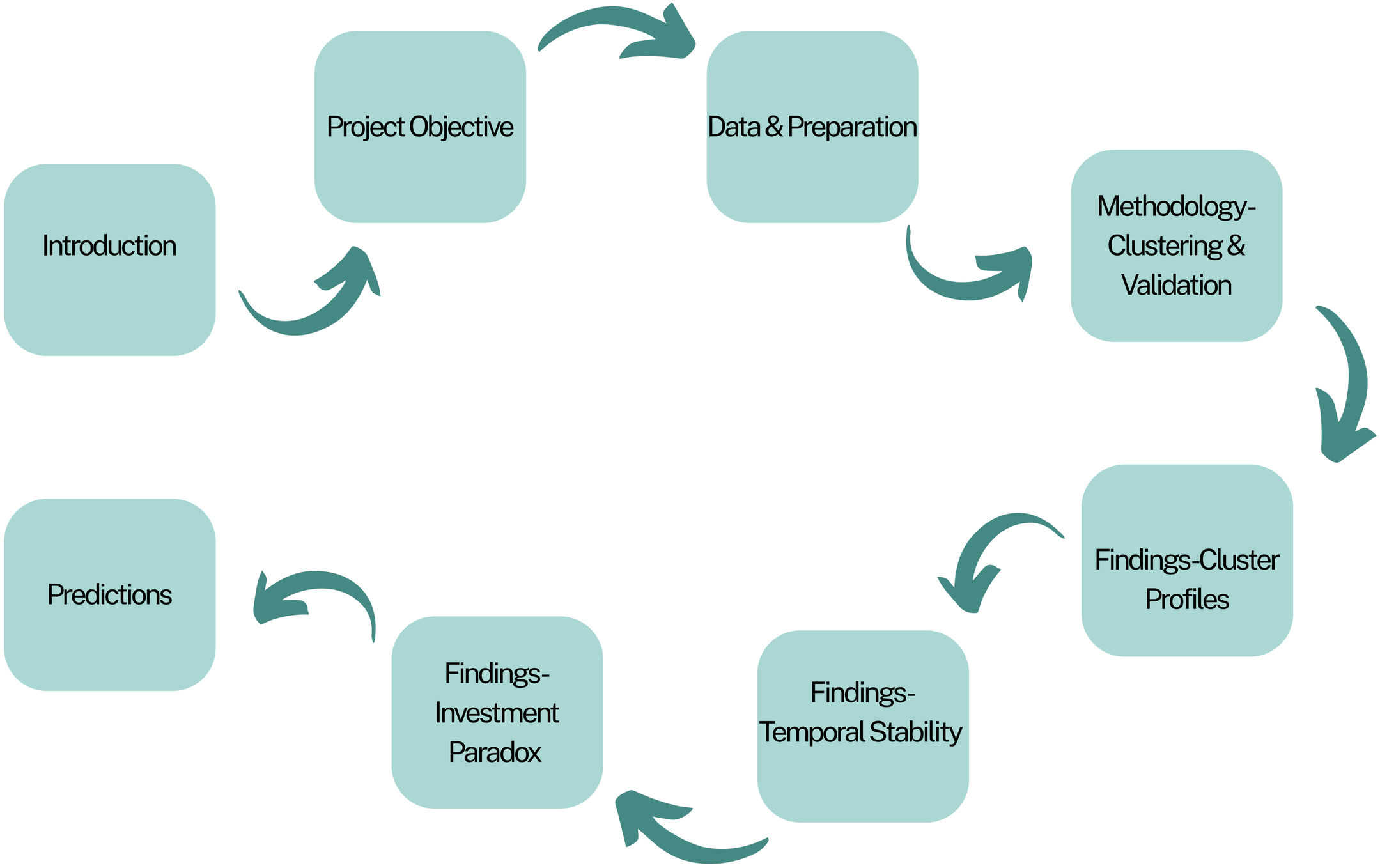
Introduction

Key Points:

- A disconnect often exists between the skills graduates possess and the demands of the labour market.

- This "mismatch" is a significant issue across Europe

- Consequences:
  - For Individuals: Unemployment, overqualification, lower wages.
  - For the Economy: Productivity loss, subdued growth potential, social costs.


Introduction
Project Objective
Data & Preparation
Methodology-Clustering & Validation
Findings-Cluster Profiles
Findings-Temporal Stability
Findings-Investment Paradox
Predictions

Goals and Scope of Our Analysis

Scope:

- European Countries (Specify the general set of countries included in the analysis)
- Period: 2012 - 2022
- Data Source: Eurostat

- To conduct an in-depth analysis of education-skill mismatch patterns among European countries.

Specific Goals:

Group countries based on similar mismatch profiles

Examine the evolution of these mismatch patterns over time

Understand the potential impact of policy interventions.

Derive policy implications from the analysis.

Our Data and Preparation Process

- Eurostat as the data source.
- List of key datasets used (e.g., GDP per capita, Employment by education, Overqualification, Youth unemployment, Education expenditure, Educational attainment).

Our Data and Preparation Process

Preprocessing Steps:

- Engineering new features for analysis (e.g., Youth Education Paradox Score, Employment Efficiency).
- Merging different datasets.
- Handling missing values (e.g., Imputation with median for some countries/years).

Quantifying Skill and Labor Market Mismatches

- **Education ROI Indicator:** Measures the return on investment in tertiary education in terms of employment.

- **Youth Education Paradox Score:** Highlights the challenge of youth unemployment even among highly educated individuals.

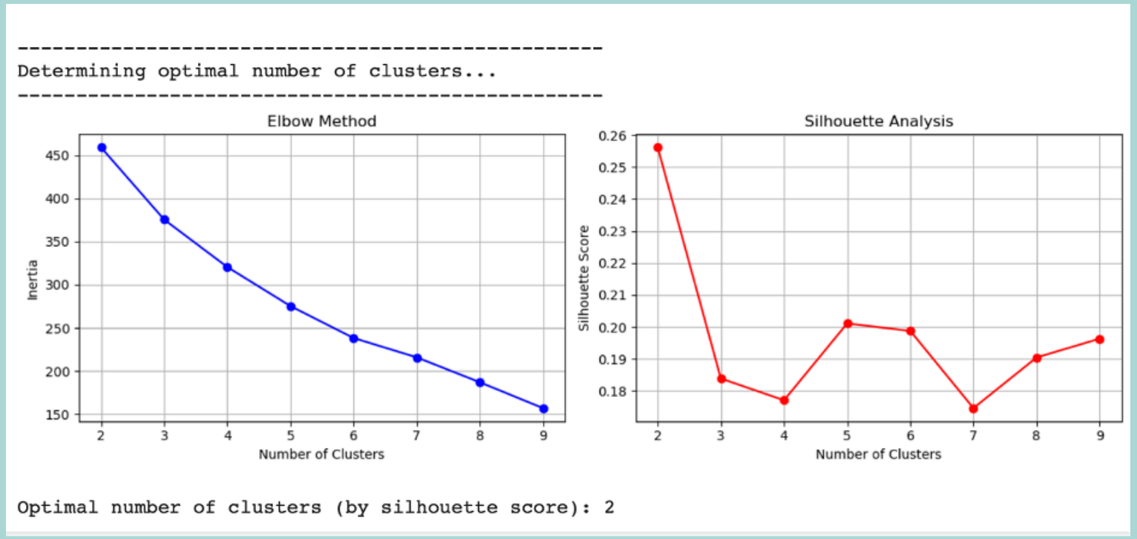
- **Employment Efficiency Score**: Evaluates how effectively countries translate high educational attainment into employed individuals, while considering over-qualification

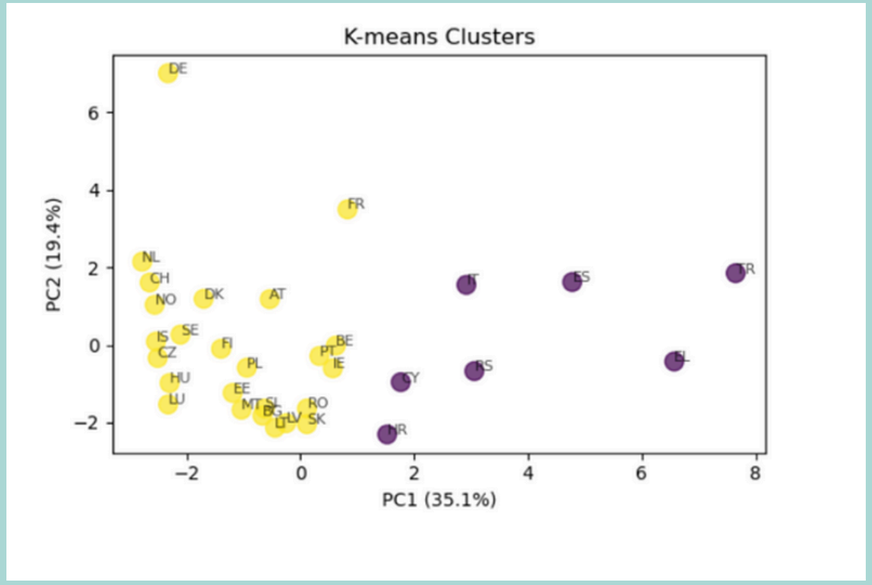
- **Skills Gap Indicator (High-Tech)**: Assesses the alignment between the supply of highly educated individuals and the demand in high-tech sectors.

- **Over-qualification Adjusted by Investment**: Combines the rate of over-qualification with the level of tertiary education investment.

Methodology - Clustering & Validation

- Method Used: K-Means Clustering Algorithm.
- The K-Means clustering algorithm was applied based on 19 input features.
- Various statistical metrics were used, including Silhouette Score, Elbow Method.





Standar scaling

Dimensionality Reduction (PCA):

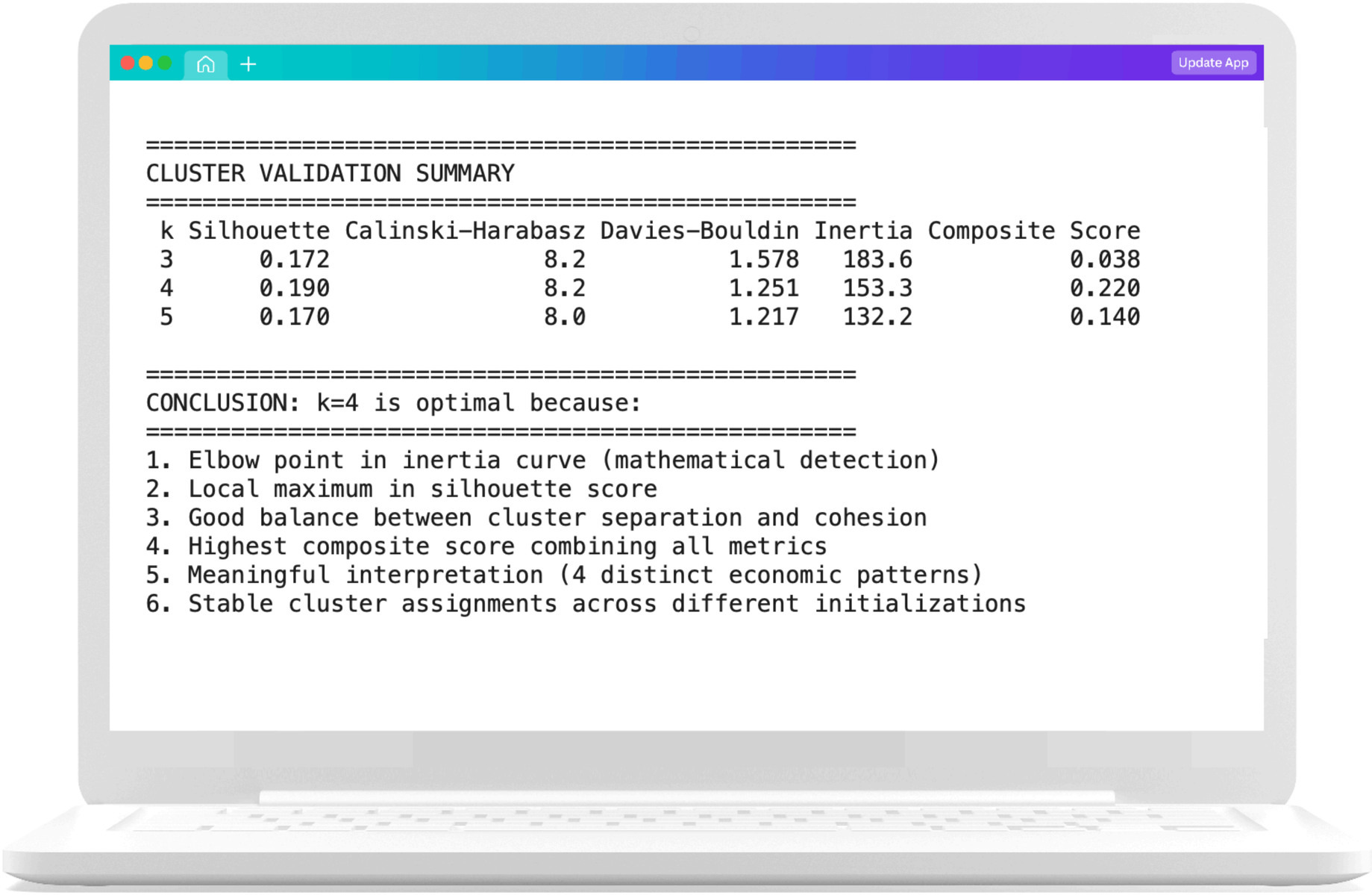
ENHANCING OUR CLUSTERING STRATEGY:

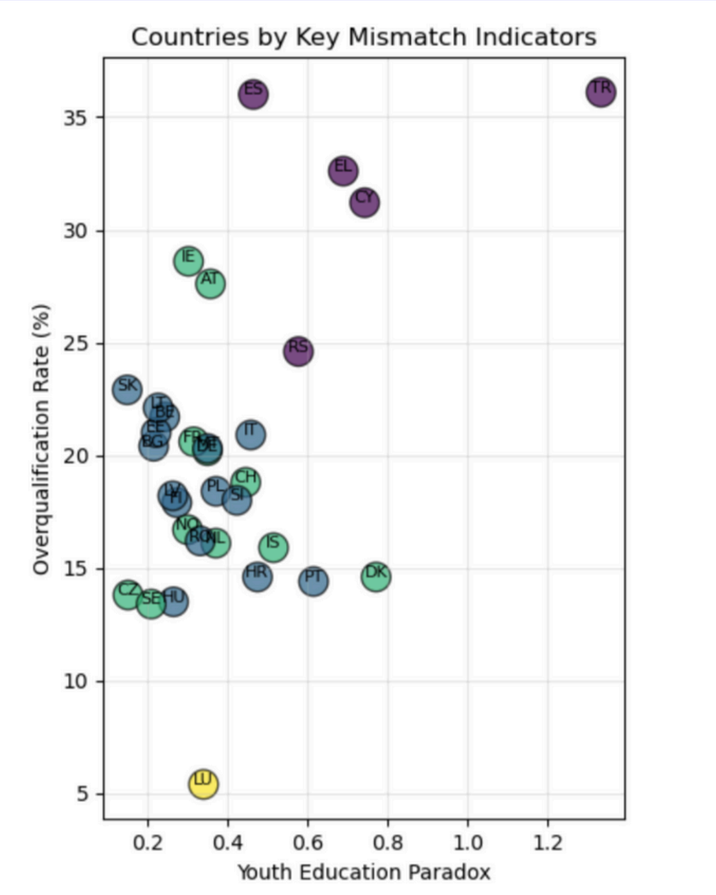
This process led to the identification of 4 distinct clusters, representing different country archetypes based on their skill and labor market indicators.

Hierarchical Clustering

DBSCAN

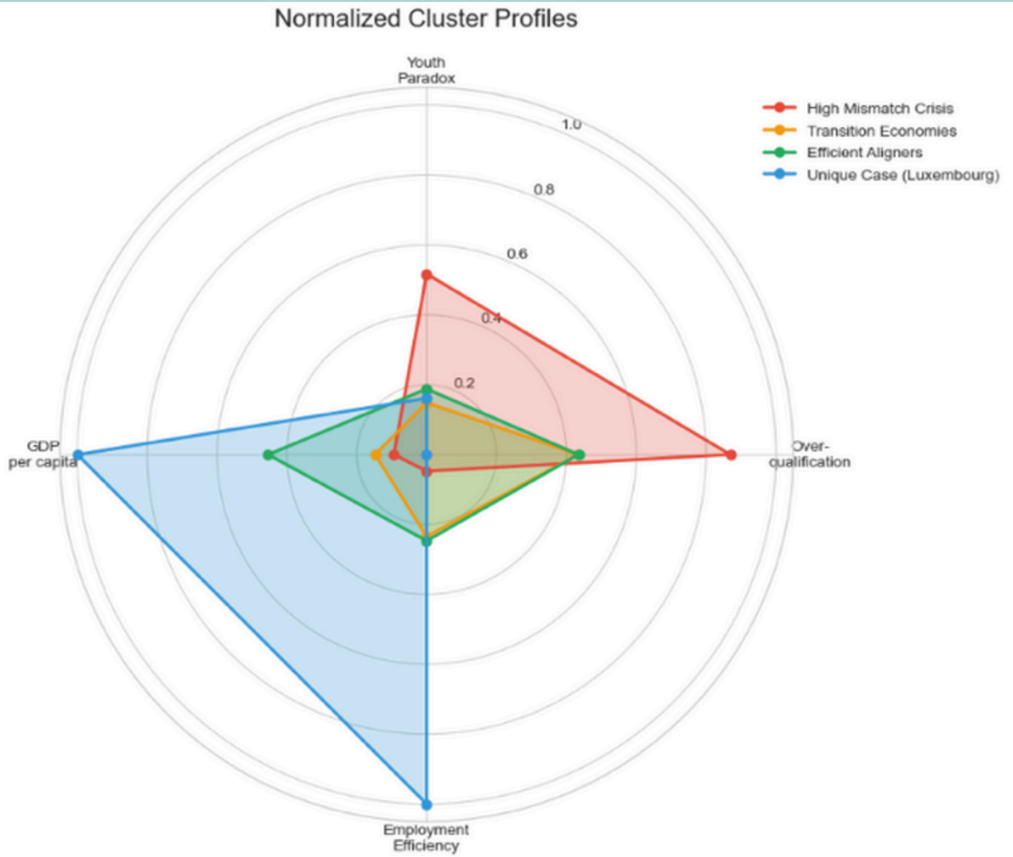
Why 4 Clusters?





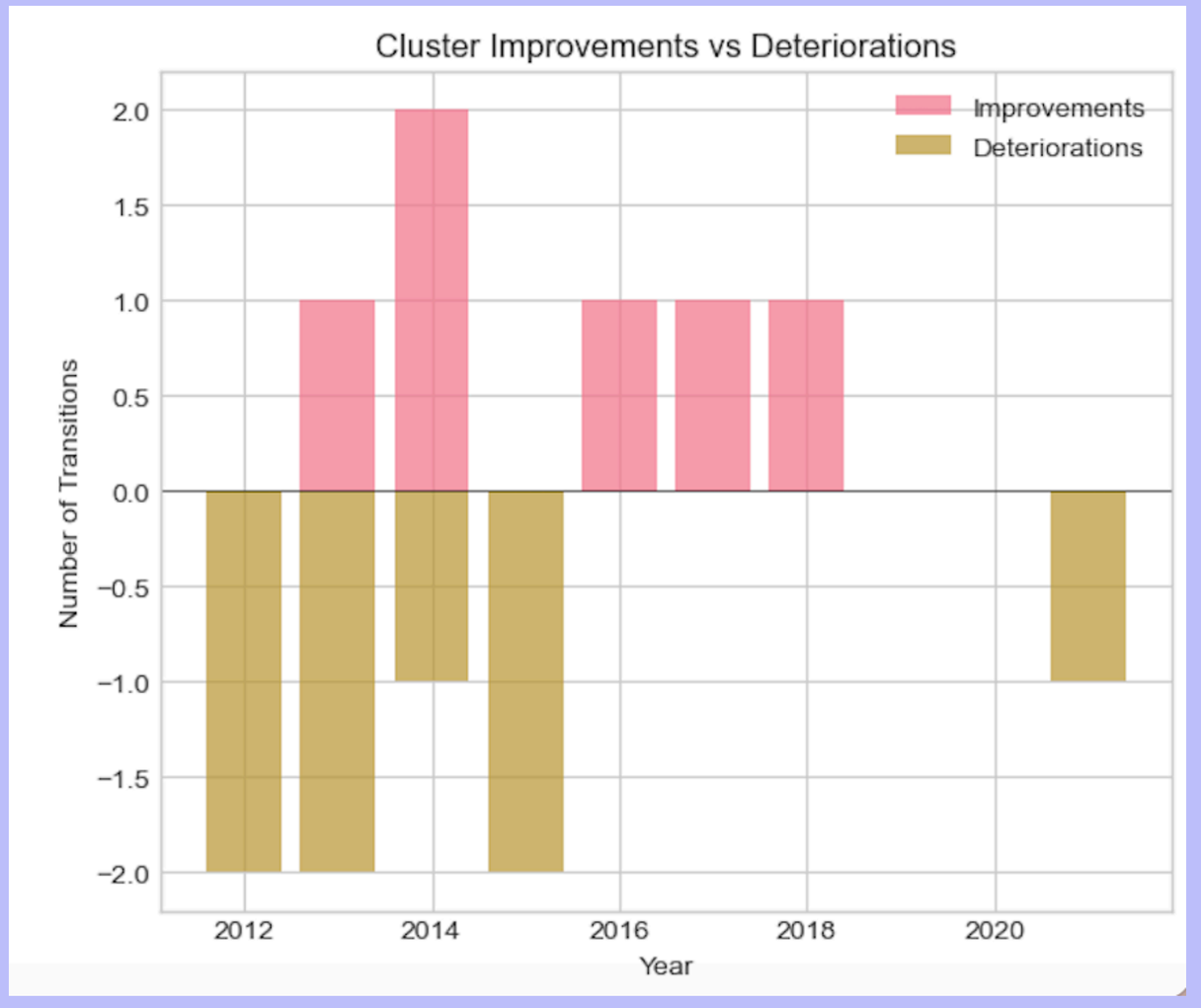
Findings – Cluster Profiles

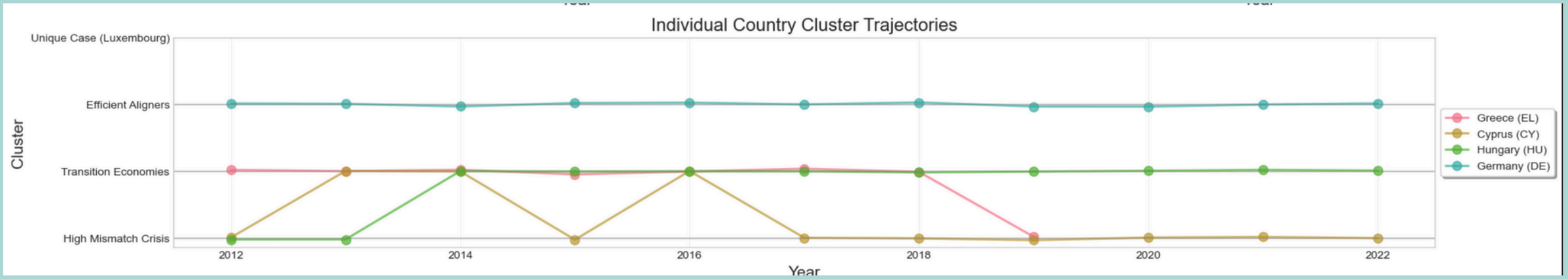
- Brief Profile of Each Cluster:
  - **Cluster 0:** High Mismatch Crisis: High overqualification, pronounced youth paradox. (Example countries: ES, EL, TR, CY)
  - **Cluster 1:** Transition Economies: Moderate mismatch, lower education investment. (Example countries: PL, RO, HU, HR)
  - **Cluster 2:** Efficient Aligners: Strong economies, good education-labour market matching, low mismatch. (Example countries: DE, FR, NL, SE)
  - **Cluster 3:** Unique Case (Luxembourg): Very high GDP, distinct profile.



Cluster Summary Statistics

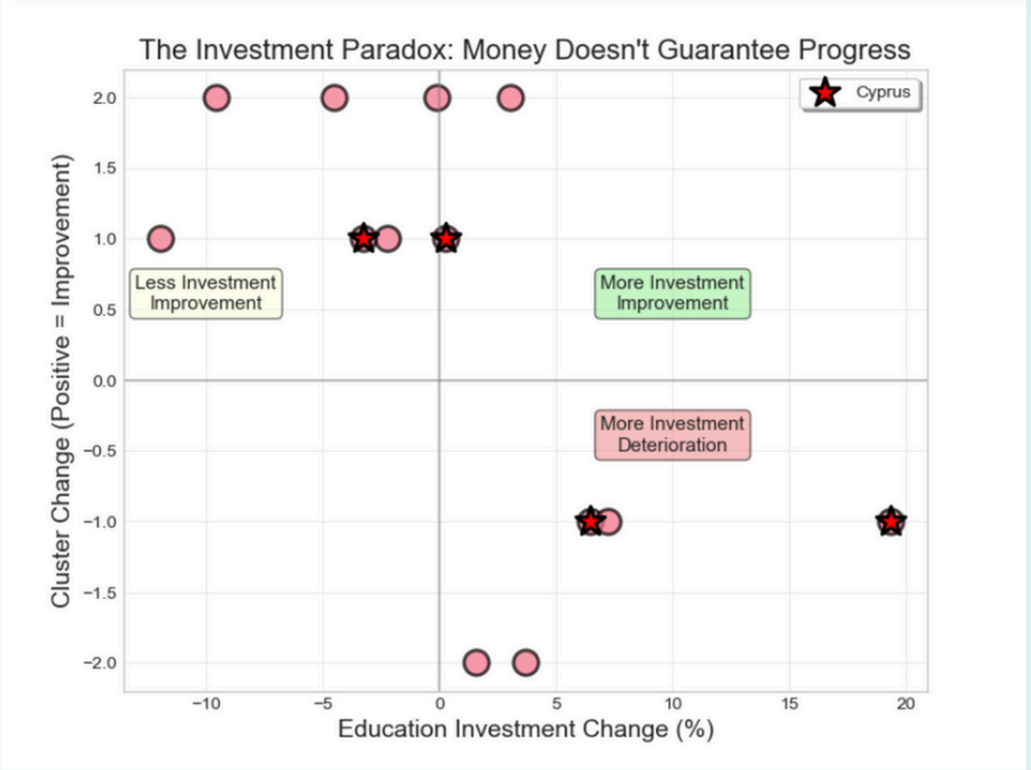
Cluster	N	Youth Paradox	Overqual Rate	Emp. Efficiency	Countries
High Mismatch Crisis	5	0.76	32.1%	2.4	CY, EL, ES, RS, TR
Transition Economies	15	0.32	18.7%	4.5	BE, BG, EE, FI, HR, HU, IT, LT, LV, MT, PL
Efficient Aligners	11	0.37	18.8%	4.7	AT, CH, CZ, DE, DK, FR, IE, IS, NL, NO, S
Unique Case (Luxembourg)	1	0.34	5.4%	13.1	LU


Cluster Improvements vs Deteriorations
Improvements
Deteriorations
Number of Transitions
2.0
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
−2.0
2012
2014
2016
2018
2020
Year


Individual Country Cluster Trajectories
Unique Case (Luxembourg)
Efficient Aligners
Transition Economies
High Mismatch Crisis
Cluster
2012
2014
2016
2018
2020
2022
Year
Greece (EL)
Cyprus (CY)
Hungary (HU)
Germany (DE)

The Investment Paradox

- **Finding**: Our data shows increasing education investment doesn't always lead to better skill matching.
- You can invest more money, but the mismatch situation might not improve, or could even get worse.



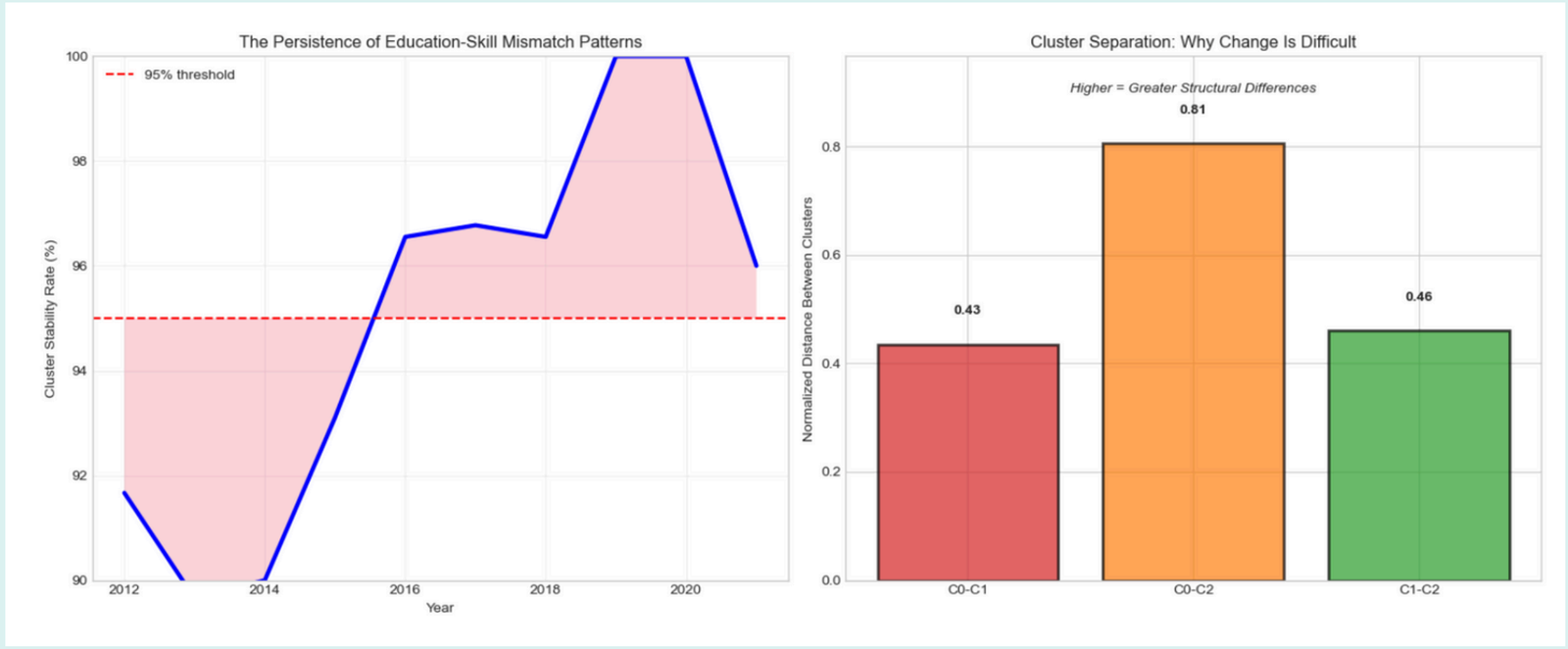
Forecasting the Future and Simulating Policy Impact

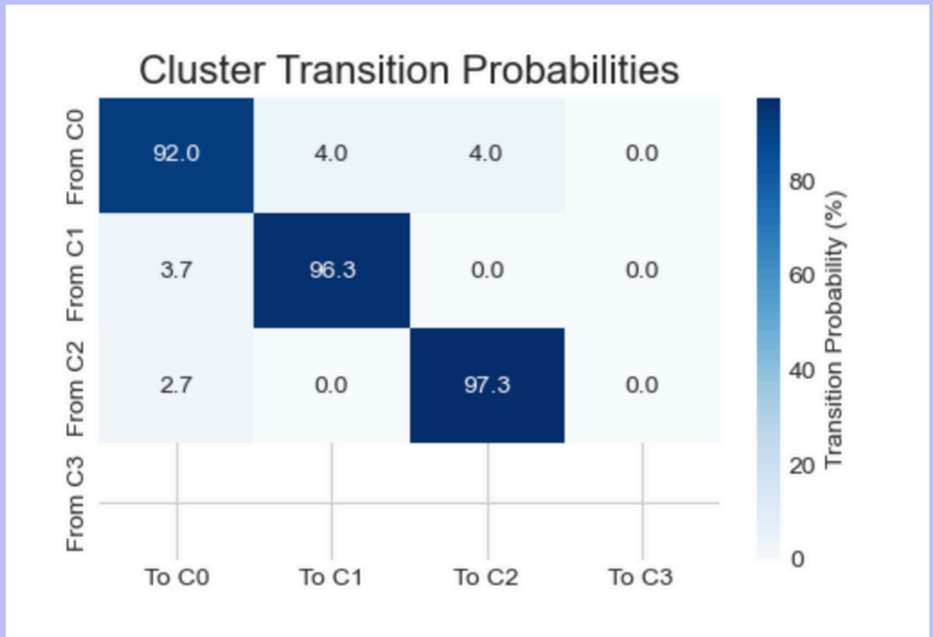
A model (**Random Forest**) was trained on historical data to predict future cluster membership based on a country's latest profile.

- **Finding**: The model predicted that *zero* countries (out of the 27 analysed) would change their cluster in the next 10 years (based on the latest data).

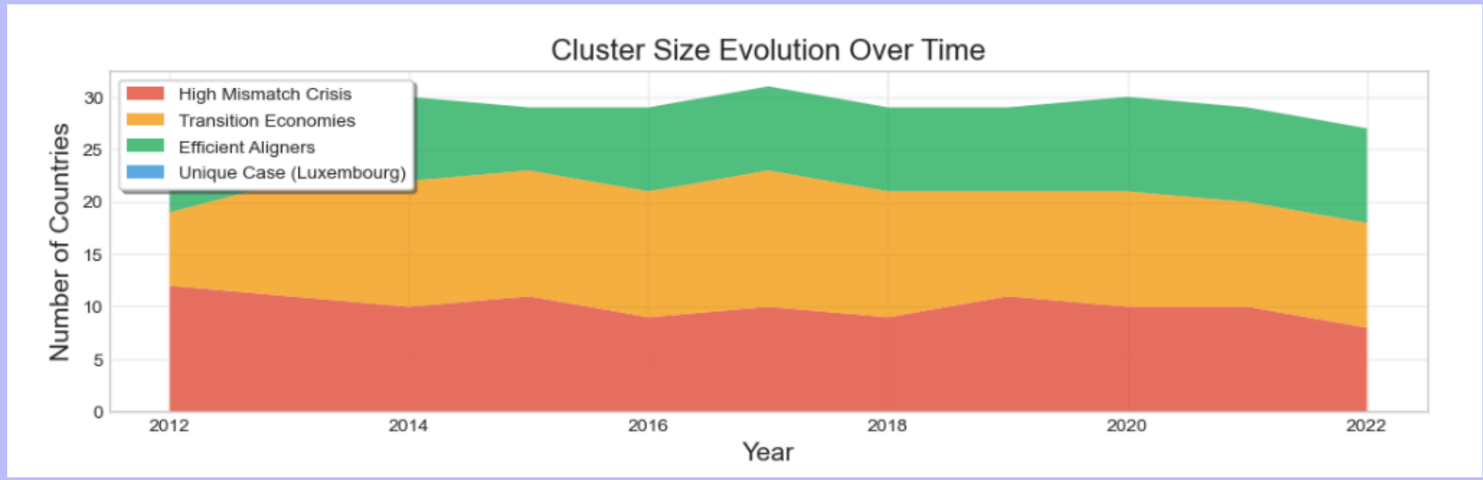
Why Countries Tend to Stay Trapped in Their Clusters

Different mismatch clusters are clearly separated in the space defined by key mismatch metrics (e.g., Overqualification, Youth Paradox)





Finding: Moving between clusters is very rare.

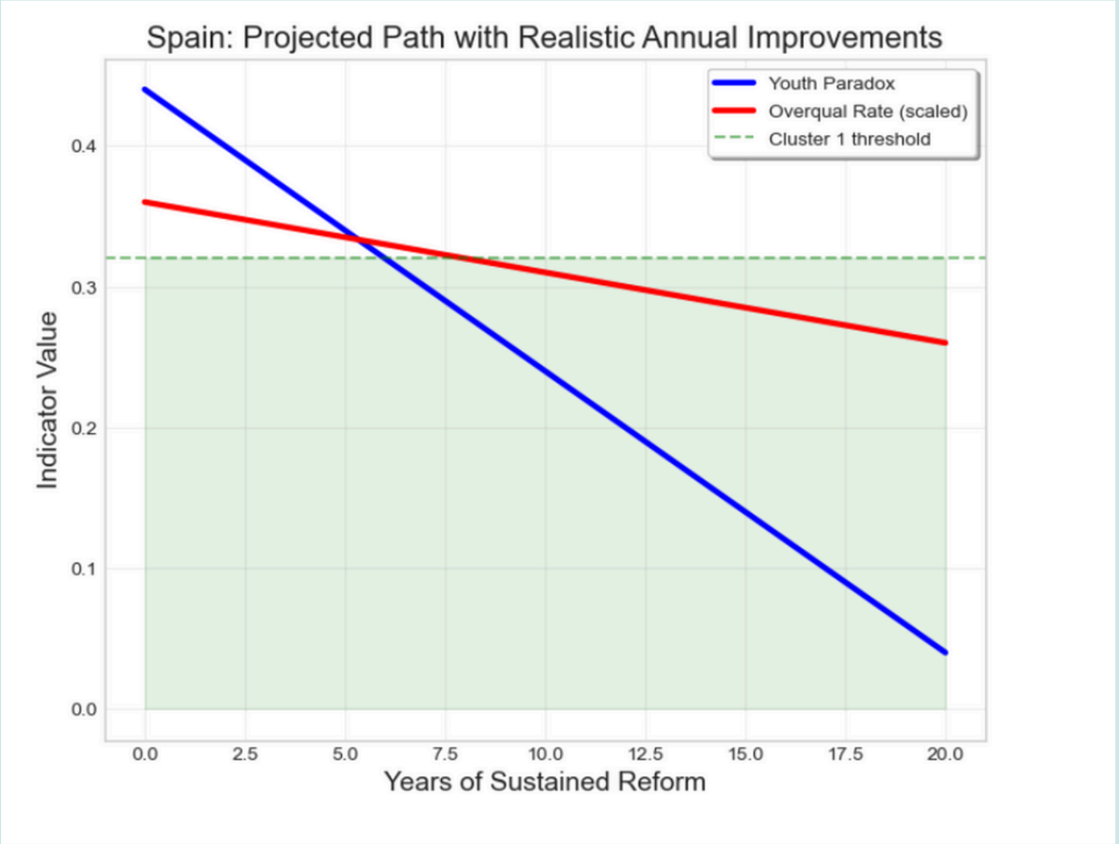


Finding: Mismatch clusters show remarkable stability in size over the decade.

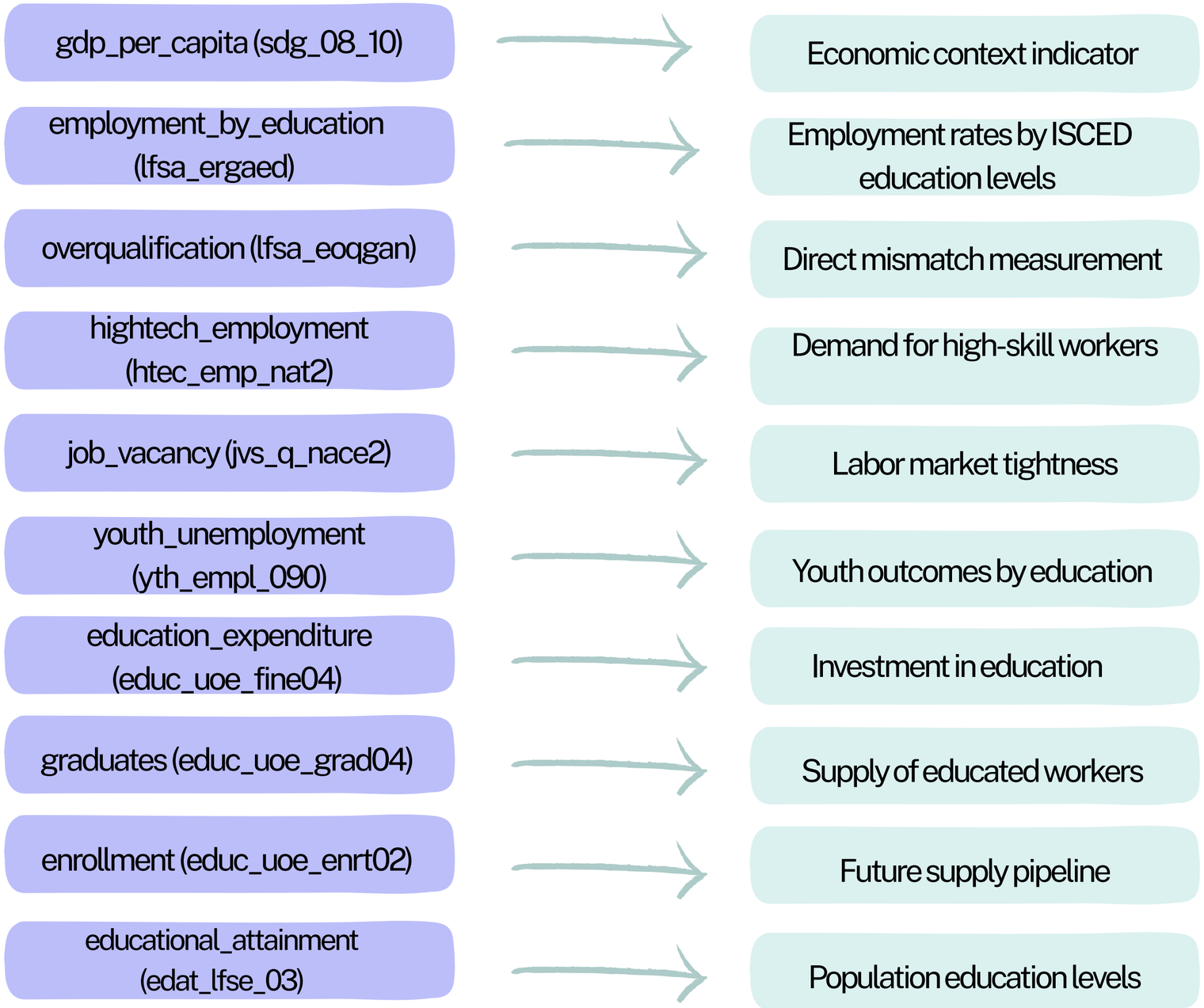
The Core Finding of Our Analysis

A what-if scenario: How would the trajectory of a struggling nation change if everything worked in its favor?

Education-skill mismatches are **STRUCTURAL TRAPS** requiring sustained, multi-dimensional interventions over 10+ years to escape.



Thank You


gdp_per_capita (sdg_08_10)
Economic context indicator
employment_by_education (lfsa_ergaed)
Employment rates by ISCED education levels
overqualification (lfsa_eoqgan)
Direct mismatch measurement
hightech_employment (htec_emp_nat2)
Demand for high-skill workers
job_vacancy (jvs_q_nace2)
Labor market tightness
youth_unemployment (yth_empl_090)
Youth outcomes by education
education_expenditure (educ_uoe_fine04)
Investment in education
graduates (educ_uoe_grad04)
Supply of educated workers
enrollment (educ_uoe_enrt02)
Future supply pipeline
educational_attainment (edat_lfse_03)
Population education levels

```
Feature importance for predicting transitions:
  edu_investment: 0.292
  employment_efficiency: 0.214
  overqualification_rate: 0.166
  gdp_per_capita: 0.127
  youth_edu_paradox: 0.105
  gdp_growth: 0.097

--------------------------------------------------
Identifying countries at risk of transition...
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No countries have >30% transition probability.

Top 10 countries by transition probability:
  FI: 5.2% (Cluster 2)
  CZ: 1.2% (Cluster 2)
  EE: 0.8% (Cluster 0)
  RO: 0.8% (Cluster 1)
  CH: 0.7% (Cluster 2)
  NO: 0.7% (Cluster 2)
  MT: 0.7% (Cluster 1)
  TR: 0.7% (Cluster 1)
  LT: 0.7% (Cluster 1)
  HU: 0.6% (Cluster 1)

Transition probability statistics:
  Max: 5.2%
  Mean: 0.6%
  Median: 0.4%
```