



**Šiauliai
Academy**

**VILNIUS UNIVERSITY
ŠIAULIAI ACADEMY**

Bachelor Programme Software Engineering

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Lecture: Software Development Process

Laboratory Work No. 4: "Solving a Problem Using Open Data"

1. Introduction

This project investigates a real-world demographic problem using open data: **the long-term population decline in Lithuania.**

Lithuania is one of the fastest-shrinking countries in the European Union.

The goal of this analysis is to:

- Obtain open demographic data from Eurostat
- Clean, process, and filter it using Python
- Analyze population changes from **1990 to 2024**
- Identify trends, structural problems, and policy implications

The analysis uses fully open data and reproducible methods.

2. Problem Definition

Research Question:

“How has Lithuania’s population changed between 1990 and 2024, and what are the main demographic risks revealed by the data?”

Why this matters?

- Lithuania lost **nearly 25% of its population since 1990**
- Large-scale emigration
- Low fertility rates
- Aging population

Understanding these trends can support policymaking in labor, immigration, education, and social planning.

3. Data Source and Dataset Description

Dataset Used

Eurostat - "Population on 1 January by age and sex"

Link: <https://ec.europa.eu/eurostat>

Download Format

- Format: **SDMX-CSV (.csv)**
- Extraction: Only Lithuania (geo = LT), year 1990–2024
- Age: **Total**
- Sex: **Total**

Dataset Schema

Column	Description
geo	Country Code ("LT")
sex	T (Total)
age	TOTAL
year	Observation year
population	Total population on Jan 1
flags	Eurostat data quality flags

Sample Extract (cleaned)

year	population
1990	3,693,700
2000	3,496,200
2010	3,043,400
2020	2,795,700
2024	2,685,800

4. Methodology

4.1 Data Cleaning Steps

Using Python (Pandas):

- 1.** Load SDMX-CSV file
- 2.** Convert Eurostat codes to readable format
- 3.** Filter Lithuania (geo = LT)
- 4.** Select only TOTAL sex & TOTAL age
- 5.** Convert year column to integers
- 6.** Remove non-numerical population values
- 7.** Restrict to 1990–2024
- 8.** Compute:
 - yearly absolute change
 - yearly percent change

5. Results and Analysis

5.1 Population Trend (1990-2024)

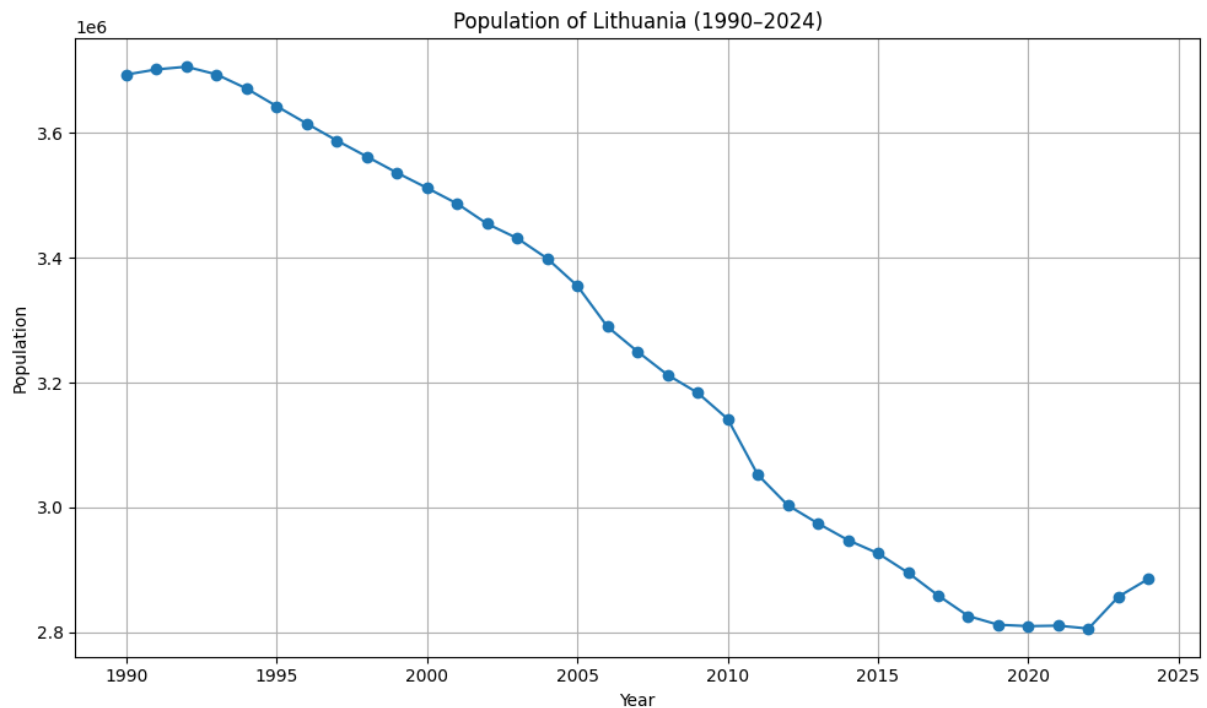
Lithuania's population dropped from:

3.69 million (1990) to 2.68 million (2024)

Total loss: –887,817 people

(~24% decline)

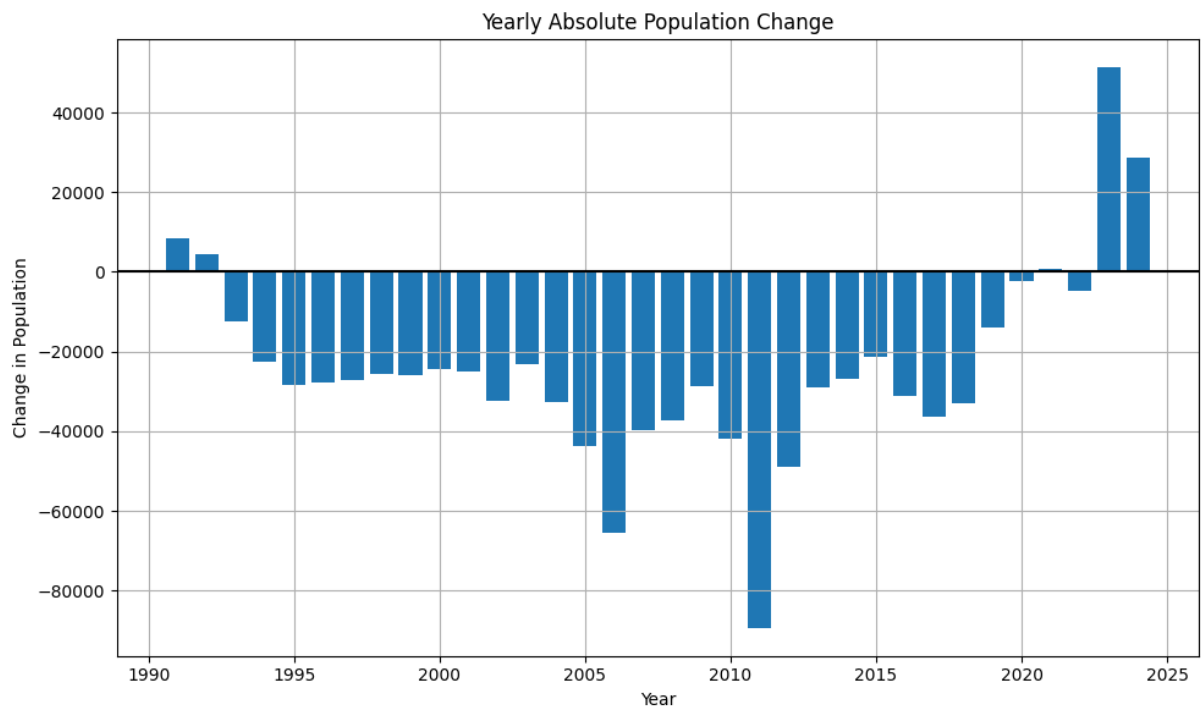
This places Lithuania among the fastest shrinking countries in Europe.



(Figure 1: Population of Lithuania (1990-2024))

5.2 Yearly Absolute Change

The largest decline occurred after EU accession (post-2004).
The **worst year** was: **2011: –89,388 people** (largest recorded drop)



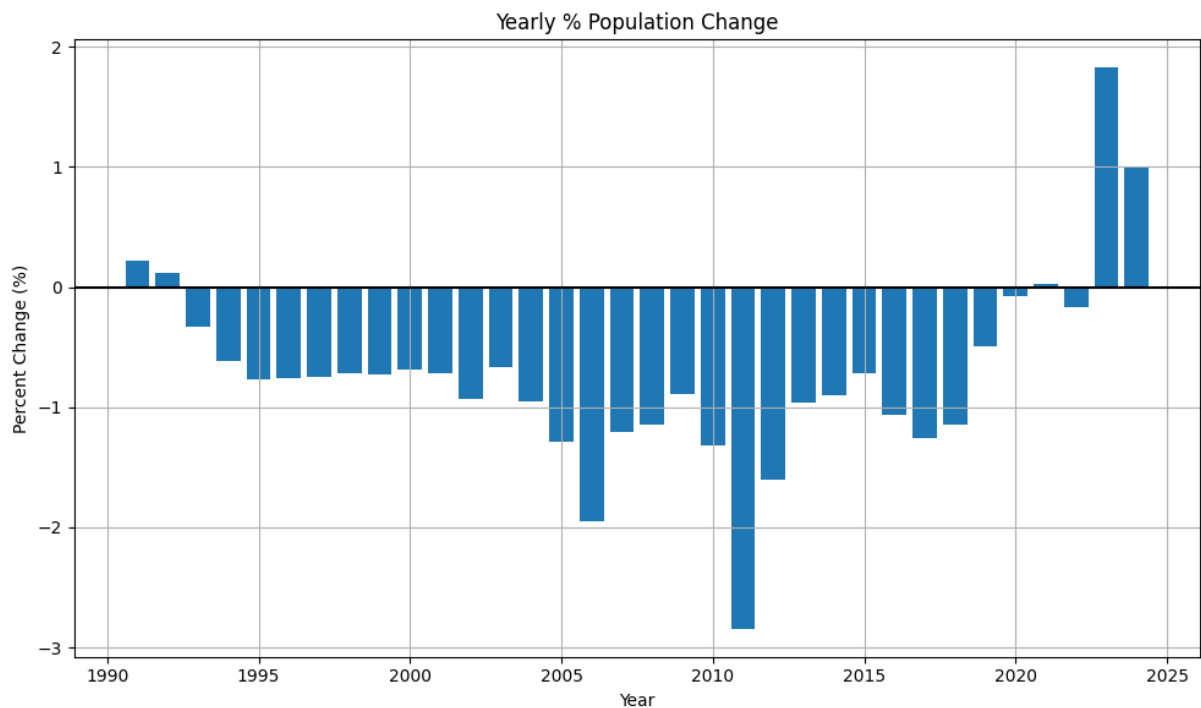
(Figure 2: Yearly Absolute Population Change)

5.3 Yearly Percent Change

Average annual population change:

Declines accelerated during:

- 1990s economic transition
- Emigration wave after joining the EU
- 2008 financial crisis
- COVID-19 period



(Figure 3: Yearly % Change)

6. Discussion

Major Causes of Decline:

1. **Emigration to Western Europe**
2. **Low fertility rates** (among Europe's lowest)
3. **Aging population / high dependency ratio**
4. **High outward student mobility**
5. **Post-Soviet demographic shock**

Consequences:

- Reduction in working-age population
- Shortage in skilled labor
- Increased pressure on pensions and healthcare
- Risk of long-term economic stagnation
- Need for immigration to stabilize population

7. Conclusion

This study demonstrates how open data can help reveal deep demographic challenges.

Key findings:

- Lithuania lost nearly **900,000 people** since 1990
- Population decline is **structural and long-term**
- Worst losses occurred between 2001–2011
- Without intervention, the decline will continue

Policy implications:

- Improve economic incentives to reduce emigration
- Support family and childcare policies
- Expand immigration pathways
- Strengthen higher-education retention
- Plan for aging population services