

# Forecasting the Teaching Workforce in Italy

*Project public brief*

**Technical Support Instrument**

*Supporting reforms in 27 Member States*



Funded by  
the European Union



Ministero dell'Istruzione e del Merito

This document was produced with the financial assistance of the European Union. Its content is the sole responsibility of the author(s). The views expressed herein can in no way be taken to reflect the official opinion of the European Union.

The project is funded by the European Union via the Technical Support Instrument, managed by the European Commission Reform and Investment Task Force (SG REFORM).

This report has been delivered in February 2025, under the EC Contract No. 300063670. It has been delivered as part of the project “Forecasting the Teaching Workforce in Italy”.

© European Union, 2025



The Commission's reuse policy is implemented by Commission Decision 2011/833/EU of 12 December 2011 on the reuse of Commission documents (OJ L 330, 14.12.2011, p. 39 – <https://eur-lex.europa.eu/eli/dec/2011/833/oj>).

Unless otherwise noted, the reuse of this document is authorised under the Creative Commons Attribution 4.0 International (CC BY 4.0) licence (<https://creativecommons.org/licenses/by/4.0/>). This means that reuse is allowed, provided that appropriate credit is given and any changes are indicated.

**Reform and Investment Task Force**  
+32 2 299 11 11 (Commission switchboard)  
European Commission  
Rue de la Loi 170 / Wetstraat 170  
1049 Brussels, Belgium

## Table of Contents

|                                                     |    |
|-----------------------------------------------------|----|
| Context of the project .....                        | 4  |
| Presentation of the Beneficiary Authority.....      | 4  |
| Description of the needs .....                      | 4  |
| Methodology .....                                   | 4  |
| Key deliverables and activities of the project..... | 5  |
| Consultation with stakeholders and workshops .....  | 21 |
| Main findings and lessons learnt .....              | 21 |
| Expected results .....                              | 21 |
| Expected impact .....                               | 21 |

## Context of the project

The “Forecasting the Teaching Workforce in Italy” project supported the Italian Ministry of Education and Merit (*Ministero dell’istruzione e del merito* - MIM) in gaining a deeper understanding of the main challenges related to the teaching workforce and in developing a forecasting model to accurately estimate the demand and supply of teachers in Italy.

The project is funded by the European Union via the Technical Support Instrument managed by the European Commission Reform and Investment Task Force (SG REFORM).

## Presentation of the Beneficiary Authority

The TSI project “Forecasting the Teaching Workforce in Italy” supported the Italian Ministry of Education and Merit in developing a forecasting model to provide accurate estimates of the demand and supply of teachers in Italy.

The Ministry of education and Merit is responsible for the general governance and administration at national level of early childhood education and care, school education, higher technical education and adult education.

## Description of the needs

The Italian education system faces two main challenges: a shortage of teachers in some regions and an oversupply in others. Other significant issues include the uneven distribution of teachers across the country, an aging teaching workforce, a decline in the school population, and lower salaries and career opportunities compared to other European countries.

In this context, the project provided the Italian authorities with:

- An in-depth understanding of the key challenges faced by the Italian educational context, as well as relevant international best practices for forecasting and planning the teaching workforce (**Outcome 1**).
- A predictive model capable of providing estimates of the demand and supply of teachers in Italy (**Outcome 2**).

## Methodology

The project team has conducted the research that included **a thorough review of existing literature, field surveys, and questionnaires**, with the aim of better understanding the current state of the teaching profession in Italy. This multidimensional approach was designed to ensure a detailed analysis of the various factors influencing teachers and to provide a solid foundation for the subsequent phases of the project.

Based on the agreement with the MIM, the analysis focused solely on data concerning students and teaching staff in primary, lower secondary, and upper secondary schools. As a result, the project documents do not include information on nursery schools or higher education institutions, such as universities and similar entities.

# Key deliverables and activities of the project

## 1. Challenges to teacher workforce planning in Italy

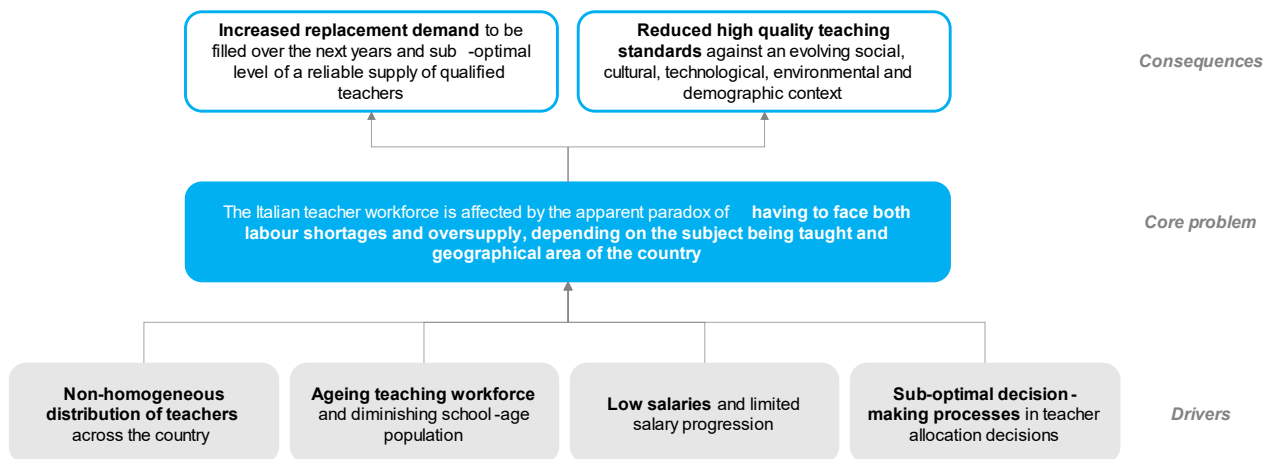
The analysis revealed that, based on the overview of the teaching staff in Italy (**Figure 1**), the **education system is facing significant challenges, such as a shortage of teachers in some regions and subject-specific imbalances**. These issues could lead to disparities in the levels of educational quality and access to adequate learning opportunities.

Figure 1 – The situation of teachers in Italy

- **Increase in teaching staff:** the number of teachers has seen a significant increase of 16% compared to the 2015-16 school year, reaching a total of 856,131 teachers in the 2021-22 year. This trend is confirmed across all levels of education examined. Only one-fifth (18,7%) of these teachers are male.
- **Decline in the student population:** despite the increase in teachers, there is a decline in the number of students over the same period (an average of -6,4%). This trend is particularly pronounced in the southern regions of Italy for all school grades under analysis.
- **Gender gap in teaching staff:** there is evidence of a gender gap in the teaching staff, which is more pronounced in primary schools where women make up 94.6% of the total.
- **Geographical disparities in the distribution of teachers:** Lombardy is positioned as the region with the highest number of teachers, counting 131,593 (15.4% of the total for the Academic year 2023-24). A higher concentration of teachers is observed in the North.
- **Contract type:** In the southern regions, most teachers have permanent contracts. On the contrary, in the northern regions, fixed-term contract types prevail.
- **Age of teachers:** the predominant age group among teachers is over 45 years old, which represents more than 60% of the total number of teachers. This prevalence is particularly marked in primary schools. Moreover, in the southern regions, there is a considerable concentration of teachers aged over 45 years.
- **Support teachers and disabilities:** in recent years, there has been an increase in the number of support teachers (24.4% of the total for the 2023-24 school year compared to 2015-2016 data). This growth has been partly driven by the rise in the number of students with disabilities in Italian schools, with the 2022/2023 academic year presenting a 7% increase in students with disabilities compared to the previous school year.

The analysis has indicated that **socioeconomic factors and individual choices are influencing teachers' career paths**, with issues such as non-competitive salaries, limited career opportunities, and daily challenges hindering recruitment and retention. Furthermore, the aging teaching workforce and the demographic decline in students further exacerbate the situation, disrupting the balance between the demand and supply of teachers. These factors, as shown in **Figure 2**, may directly impact the quality of education and contribute to the instability of the teaching workforce.

Figure 2 - Problem Tree



**Teacher recruitment in Italy is increasingly facing challenges due to mismatching, as highlighted by the number of vacant positions and the increase in fixed-term contracts.** Targeted planning of teacher demand should be based on student enrolment numbers and the specific needs of schools in different regions. Accelerating these processes would allow schools and the Regional School Offices (USR) to more effectively identify the actual staffing needs. Furthermore, it is crucial to reduce delays in the pension process by the National Institute of Social Security (INPS) to facilitate teacher mobility and the assignment of positions.

**To improve the teaching profession, it is essential to strengthen aspects such as motivation, responsibility, well-being, training, work environment, and social respect.** Stimulating career paths based on merit and inclusive decision-making processes can attract and retain high-quality teachers. Additionally, it is crucial to enhance the profession from an economic and contractual perspective to ensure high-quality standards and achieve the set goals.

**Advanced predictive models are considered useful in an attempt to synchronise the entry of new teachers with actual demand, avoiding shortages or surpluses of teaching staff at the regional level or for specific subjects.** Local experiences from Lithuania, Norway, Sweden, and Portugal have demonstrated the effectiveness of a forecasting model for the demand and supply of teachers, useful for addressing Italy's challenges, optimising planning, and reducing resource waste.

## ***2. International good practices in managing teacher shortages and other challenges of teaching profession***

At the European and international levels, desk and field research activities were carried out, leading to the initial identification of 22 implemented good practices. These practices were subsequently selected, with a particular focus on countries such as Portugal, Norway, Iceland, and Lithuania. The activities included 11 interviews with academic experts and international professionals, as well as 2 workshops with specialists.

The practices were evaluated in terms of relevance (high, medium, low) with respect to the study's objectives and were subsequently grouped into the following **two macro-clusters**:

- **Models and forecasting studies of the demand and supply of teaching staff.** This cluster focuses on forecasting models and predictive studies conducted in several countries and is the most directly relevant to the continuation of the project (*Outcome 2*);
- **Good practices aimed at the professional development of teachers.** This cluster includes a range of practices, which can be further divided into different sub-clusters. In particular:

- **Good practices related to the attractiveness of the profession.** This category considers initiatives aimed at improving the appeal of the teaching profession, through actions focused on encouraging young people to pursue teaching, rather than reducing attrition from the profession;
- **Good practices related to the recruitment of new teaching staff.** This category includes practices adopted to increase the supply of teachers through initiatives aimed at making recruitment processes more efficient;
- **Good practices related to teachers' education and professional development.** This sub-cluster includes initiatives aimed at the professional development of current teachers or aspiring future educators.

This analysis revealed that **the educational landscape in Portugal faces challenges similar to those in Italy**, particularly the aging teaching population, recruitment difficulties in specialised disciplines such as Science, Technology, Engineering, and Mathematics (STEM), and the widespread use of fixed-term contracts for teaching positions.

The following table ([Table 1](#)) provides a detailed summary of the key characteristics of the two countries.

Table 1 - Comparison of the education system in Italy and Portugal<sup>1</sup>

| Key info                                                                    | Italy                                                                                                                                                                                                                                                                                                                                | Portugal                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-----------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>General overview of the educational systems</b>                          |                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <i>Population (2022)</i>                                                    | 58,94 millions                                                                                                                                                                                                                                                                                                                       | 10,41 millions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <i>Number of teachers (all grades excluding early childhood)</i>            | 856.131 (2023/24)                                                                                                                                                                                                                                                                                                                    | 150.649 (2021/22)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <i>Number of students (all grades)</i>                                      | 7.194.400 (2023/24)                                                                                                                                                                                                                                                                                                                  | 1.591.865 (2021/22)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <i>Students/teachers ratio (2023)</i>                                       | <b>Primary schools:</b> 11,2<br><b>Secondary schools:</b> 10,4 <sup>2</sup>                                                                                                                                                                                                                                                          | <b>Primary schools:</b> 12,1<br><b>Secondary schools:</b> 8,8                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <i>Students/teachers population trend</i>                                   | It is expected that the Italian school-age population will decrease by 15,4% by 2040 (EU average 9,7%). <sup>3</sup> , resulting in a long-term decrease in the demand for teachers                                                                                                                                                  | It is anticipated that the <b>shortage of teachers will worsen in upcoming years</b> , particularly for certain subjects (Portuguese, mathematics, computer science) and in specific regions (the Lisbon metropolitan area, and the Algarve <sup>4</sup> ). It will be necessary to recruit an average of 3.450 new teachers annually over the next 10 years.<br><br>In the 2021/2022 school year, the number of students in primary and secondary schools increased by 15.662 compared to the previous period |
| <i>Classes dimension (indicative number of students per class)</i>          | <b>Primary schools:</b> 19<br><b>Lower secondary schools:</b> min. 18, max. 27<br><b>Upper secondary schools:</b> min. 27                                                                                                                                                                                                            | <b>Primary schools:</b> 21<br><b>Secondary schools:</b> 15-25                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <i>Territorial level of assignment of competencies in education matters</i> | <b>Centralised and decentralised:</b> the central government has exclusive legislative competence for "general rules on education" to determine the essential levels of performance and defines the fundamental principles that must be adhered to. The <u>Regions</u> have concurrent legislative power in matters of education and | <b>Centralised:</b> the Ministry of Education, together with the Ministry of Science, Technology and Higher Education set the guidelines for national programmes                                                                                                                                                                                                                                                                                                                                               |

<sup>1</sup> Internal elaboration<sup>2</sup> OECD, Students per teaching staff, Primary and Secondary school. Available at this [link](#).<sup>3</sup> Education and Training Monitor 2023. Available at this [link](#).<sup>4</sup> Nunes et al., 2021

| Key info                                                                        | Italy                                                                                                                                                                                                                                             | Portugal                                                                                                                                                                                                                            |
|---------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                 | exclusive power in matters of vocational education and training                                                                                                                                                                                   |                                                                                                                                                                                                                                     |
| <i>Structure of the educational system (duration)</i>                           | <b>Primary school:</b> 5 years<br><b>Lower secondary school:</b> 3 years<br><b>Upper secondary school:</b> 5 years                                                                                                                                | <b>Primary school:</b> 9 years<br><b>Secondary school:</b> 3 years                                                                                                                                                                  |
| <i>Need for teachers' trend</i>                                                 | Shortage, surplus or ageing of teachers                                                                                                                                                                                                           | Shortage, surplus or ageing of teachers                                                                                                                                                                                             |
| <i>Distribution of teachers by age group (2020)</i>                             | <b>Primary schools:</b><br>≥50 years: 58,24%<br>40-49 years: 30,46%<br>30-39 years: 9,56%<br><30 years: 1,74%<br><br><b>Secondary schools:</b><br>≥50 years: 56,84%<br>40-49 years: 27,3%<br>30-39 years: 13,57%<br><30 years: 2,27% <sup>5</sup> | <b>Primary schools:</b><br>≥50 years: 46,63%<br>40-49 years: 39,79%<br>30-39 years: 12%<br><30 years: 1,57%<br><br><b>Secondary schools:</b><br>≥50 years: 49,56%<br>40-49 years: 37,21%<br>30-39 years: 11,66%<br><30 years: 1,55% |
| <i>Retirement age<sup>6</sup></i>                                               | <b>67 years</b> (both males and females)                                                                                                                                                                                                          | <b>66 years 4 months</b> (both males and female) with <b>40 years</b> of contributions                                                                                                                                              |
| <i>Salaries (annual average values in PPS<sup>7</sup>, 2022/23)<sup>8</sup></i> | PPS 31.273                                                                                                                                                                                                                                        | PPS 36.684                                                                                                                                                                                                                          |
| <i>Type of contract</i>                                                         | <b>Permanent contract:</b> 75,3%<br><b>Fixed-term contract</b> 24,7 %<br>(All school grades excluding early childhood, 2023/24)                                                                                                                   | <b>Permanent contract:</b> 73,8%<br><b>Fixed-term contract:</b> 26,2%<br>(Lower secondary schools, 2018)                                                                                                                            |
| <i>Initial Training (Lower Secondary Schools)</i>                               | <b>12 months of practice</b><br><b>300 hours</b> - Initial Teacher Education (ITE) duration                                                                                                                                                       | <b>12 months of practice</b><br><b>300 hours</b> - Initial Teacher Education (ITE) duration                                                                                                                                         |

<sup>5</sup> OECD, Teachers by age, Primary and Secondary school. Available at this [link](#).

<sup>6</sup> Regarding the clusters related to age and teacher training, where the reference year is not explicitly stated, it refers to the data updated as of November 27, 2023.

<sup>7</sup> The Purchasing Power Standard (PPS) is the technical term used by Eurostat for the common currency in which national accounts aggregates are expressed when adjusted for price level differences using Purchasing Power Standard (PPP). Thus, PPPs can be interpreted as the exchange rate of the PPS against the euro.

<sup>8</sup> Eurydice, Teachers' and school heads' salaries and allowances – Datasets. Available at this [link](#).

| Key info                   | Italy                                                                                                                                                                                                                                                                                                                                                  | Portugal                                                                                                                                                                                        |
|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Continuing training</i> | <b>Five days</b> of continuing professional development are provided <b>per year</b>                                                                                                                                                                                                                                                                   | <b>Fifty hours</b> of continuing professional development are provided over <b>four years</b>                                                                                                   |
| <i>Recruiting</i>          | Teacher recruitment is carried out using three different types of ranking lists following the <b>national public competition</b> held on a regional basis: <ul style="list-style-type: none"> <li>- Exhaustive ranking list</li> <li>- Merit ranking list</li> <li>- Provincial ranking lists</li> <li>- School ranking lists (source: MIM)</li> </ul> | Local authorities are the sole employer of teachers. Fully qualified teachers are selected through <b>open recruitment</b> where vacancies are managed directly by schools or local authorities |
| <i>Career</i>              | <b>Single level</b> <sup>9</sup> career structure                                                                                                                                                                                                                                                                                                      | <b>Single level</b> career structure                                                                                                                                                            |

In response to a **significant need for teaching staff**, the Portuguese Ministry of Education adopted a proactive measure by commissioning a forecasting study titled "*Estudo de diagnóstico de necessidades docentes de 2021 a 2030*"<sup>10</sup>.

This study, conducted by the *General Directorate for Education and Science Statistics* (DGEEC) in collaboration with the *Nova School of Business and Economics* (NOVASBE), is based on a student progression model that follows the educational path, considering the various education and training programs. It uses demographic projections published by the Portuguese National Institute of Statistics (INE) and EUROSTAT.

To explore the solutions adopted in the country to improve the planning of teacher demand and supply, **a study visit with Steering Committee of the project was organised in September 2024**. Portugal was chosen as the destination due to the similarities with the Italian context and the value of the identified good practice, offering useful insights for adapting these solutions to the national educational system.

The table below ([Table 2](#)) provides a detailed summary of the key characteristics of the analysed Portuguese practice.

Table 2 – Portuguese good practice

|  <b>Portugal</b> |                                                     |
|-----------------------------------------------------------------------------------------------------|-----------------------------------------------------|
| <i>Estudo de diagnóstico de necessidades docentes de 2021 a 2030</i>                                |                                                     |
|                  | Direção-Geral de Estatísticas da Educação e Ciência |

<sup>9</sup> Such a structure does not have formal career levels, and career progression coincides with salary progression.

<sup>10</sup> *Estudo de diagnóstico de necessidades docentes de 2021 a 2030*. Available at this [link](#).



|                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|---------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Name of pertinent institution(s)</i>                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <br><i>Territorial level of implementation</i> | National                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <br><i>Kind of Good Practice</i>               | Forecasting model of teacher supply and demand needs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <br><i>Implementation status</i>               | Implemented                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <br><i>Involved stakeholders</i>             | Nova School of Business and Economics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <br><i>Motivations and objectives</i>        | The main purpose of this forecasting study is to develop reliable projections for the recruitment of new teachers in Portuguese public educational structures up to 2030/31. The intention is to enable Portugal to plan ahead for teacher staffing needs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <br><i>Brief description</i>                 | <p>The study offers annual projections, from 2021/22 to 2030/31, by organisational unit and recruitment group in various school grades. Projections of new teacher recruitment needs are based on cross-analysis between the number of students per course and school level/year and the evolution of current teachers in terms of hourly availability and retirement. The projected teacher needs are calculated by differentiating the total needs per unit and recruitment group from the existing number of teachers. These projections are based on student progression models and demographic data provided by INE/EUROSTAT.</p> <p>According to the study, the number of students enrolled in Portuguese public schools is expected to decrease significantly, with a projected decline of 15 percent by 2030/31. It is estimated that an average of 3,450 new teachers per year will need to be recruited, for a total of 34,508 new teachers over the period, or 29 percent of the total number of teachers in</p> |

|  Portugal                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|---------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                       | service in 2018/19. The accuracy of the forecast will only be assessable over time                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <br><b>Relevance of the Good Practice</b>            | The Portuguese study " <i>Estudo de diagnóstico de necessidades docentes de 2021 a 2030</i> " is relevant for its analytical and forecasting approach in determining teacher needs. It provides accurate forecasts based on demographic and educational variables, such as student numbers and teacher retirement trends. This study supports policy and educational decision-making by providing essential data for long-term planning in the educational sector, including teacher recruitment and training. It also reveals significant trends, such as declining student numbers in public schools, and presents a methodological model that can be adapted to other national contexts, demonstrating its usefulness and transferability |
| <br><b>Potential transferability of the practice</b> | The Portuguese study model can be easily adapted to the Italian context, as long as the methods used in Portugal are followed and adapted to the specifics of the Italian educational system. It is essential to have comparable data and access to official databases to develop a similar model in Italy.                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <br><b>Sources used</b>                             | Source: <a href="#">Estudo de diagnóstico de necessidades docentes de 2021 a 2030</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

The study visit to Portugal provided valuable insights for addressing the teacher shortage in Italy, also highlighting how this issue is common across several European countries. In particular, Portuguese policies, which include **administrative simplification**, included reducing bureaucratic hurdles, such as simplifying the processes for registration, hiring, and assigning teachers to schools and **financial incentives** introduced to make teaching positions in these high-demand regions more appealing, have shown positive results, although the full effects will be seen in the long term. Furthermore, the need **to review** initial teacher education to better align it with labour market demands emerged. **The Portuguese forecasting model proved reliable, and the visit facilitated the creation of a network of contacts between Italian and Portuguese experts**, paving the way for future collaborations. In summary, this meeting represented an important step towards finding practical solutions to improve the education system in Italy.

### 3. Teacher Workforce Forecasting Model

As part of the second outcome, **a forecasting model was developed, identifying the key variables to include and designing the corresponding framework. The model is designed to forecast the future demand for teachers by analysing student enrollment projections and the existing teaching workforce.** The projected teacher demand for a given year is calculated by subtracting the number of active teachers (supply) from the expected demand for that year. The supply projection will account for retirements and other factors influencing job cessation, as well as the flow of teachers due to mobility or transfers.

**The model is based on data from the official MIM database and public sources, primarily from ISTAT** (Italian National Institute of Statistics). The analysis considered several crucial dimensions to assess the future demand for teachers, including geographic factors (province/region), educational levels (primary, lower secondary, and upper secondary), and specialisations (e.g., teachers of literature, language, or STEM). **Additionally, the model considered temporal factors, such as year-on-year changes, and the relationship between the number of enrollments and the teaching hours required per student.**

The analysis also included data on the labor supply, such as the number of active teachers, expected retirements, and other factors that could influence the availability of teachers in different geographic areas and subjects, including mobility between schools. **The initial proposal for the model was to make forecasts for the entire teaching workforce; however, due to difficulties in collecting detailed data on each teacher, the project team, with the approval of the Steering Committee, decided to limit the forecast to the statutory teaching workforce, which was considered more reliable.**

Future teachers can be determined through a statistical method, aggregating data for each profile  $j$  (which may include province, school, study program, and year of study).

In agreement with the MIM, the teacher forecasting is done at the provincial and school-institution level. A preliminary check revealed that it is not possible to use a deterministic model based on teachers FTE (Full-Time Equivalent).

Therefore, the teacher forecasting model is based on the projected series of students and the other covariates previously listed. From a statistical perspective, the model replicates the forecast for students, and thus, for methodological aspects, reference is made to the earlier sections of this document and Deliverable 5.

With the estimated model, interested stakeholders can identify the forecasted figures for each horizon:

- **The demand for teachers and students for primary and lower secondary schools within a specific province**, a single school institution, or various groupings, such as a region or multiple schools that are hypothesised to be unified;
- **The demand for teachers and students for upper secondary schools in a province, a specific institution, or in different groupings.**

**The approach based on the historical series of teachers makes the model more efficient**, as it considers the dynamics of the teaching staff over the years, including mobility and retirements, without the need for additional estimates. This method is applied to all three educational levels, with an average **regional error for the 2023/24 period between 1% and 2%.**

The final forecasting step required **distinguishing the need for teachers for the subject areas present in the schools.** For example, if in year  $t$  a school has 3 subject areas (Italian, mathematics, and art) with a distribution of 40% for Italian, 40% for mathematics, and 20% for art, and the forecasts indicate that 300 teachers will be needed in year  $t+1$ , the breakdown will be: 120 for Italian, 120 for mathematics, and 60 for art.

This method has proven effective, with a lower percentage error where the demand for teachers is higher. On average, **the error remains within 2% even for each subject area.**

The two graphs below illustrate the forecast error (Y-axis) relative to the volume of teachers required (X-axis) for each subject category and region. Additionally, two reference lines are included, representing a  $\pm 2\%$  error margin.

The graphs illustrate **the forecast error (Y-axis) against the volume of teachers required (X-axis)** for various subjects and regions. The key points include:

- **Forecast Error** represents the difference between predicted and actual teacher needs, expressed as a percentage. Smaller errors indicate more accurate forecasts.
- **Volume of Teachers Required** varies by subject and region, reflecting differences in demand based on factors like student enrolment and curriculum needs.

The graphs distinguish **between subject categories** (e.g., math, science) **and regions** (e.g., urban vs. rural), showing how forecast accuracy varies.

**±2% error margin lines represent acceptable forecasting accuracy.** Errors within this range are considered acceptable, while those outside indicate significant discrepancies—overestimation (>+2%) or underestimation (<-2%).

The graphs reveal trends in forecast accuracy, helping identify areas for improvement in forecasting methods. **Subject and region considerations highlight variability in teacher demand**, with core subjects and urban areas generally being more predictable, while specialized subjects and rural regions may have more fluctuation.

Figure 1- Lower Secondary Schools: % Error by Subject Category Volume

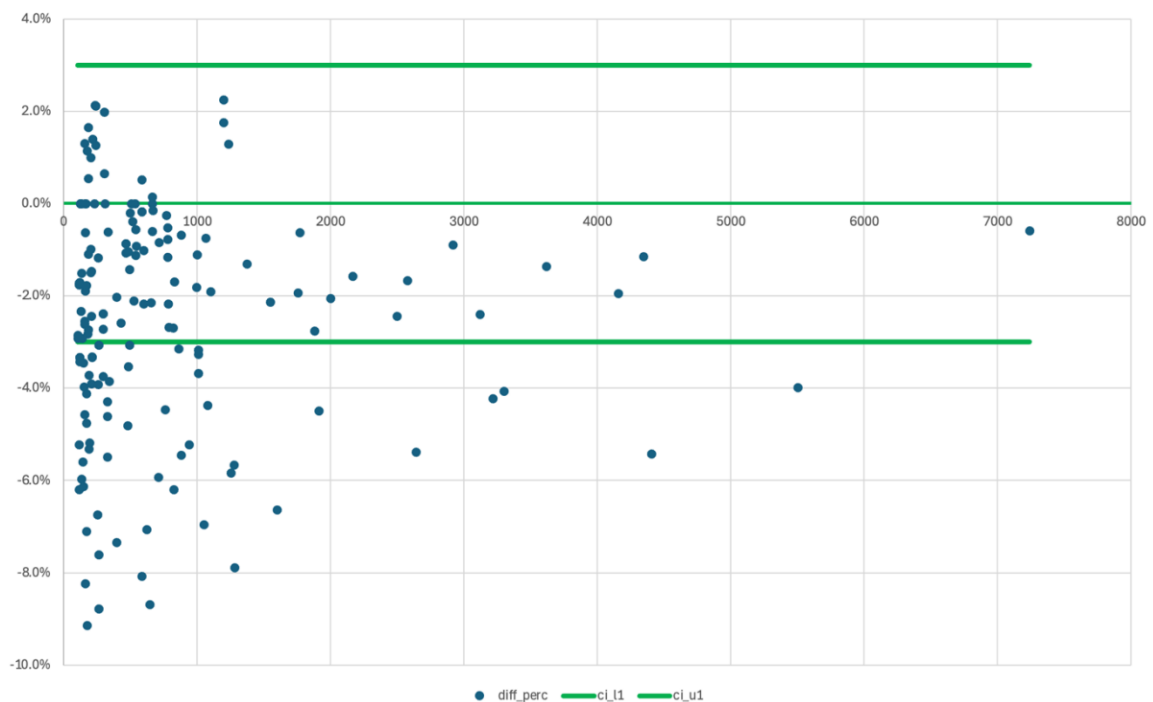
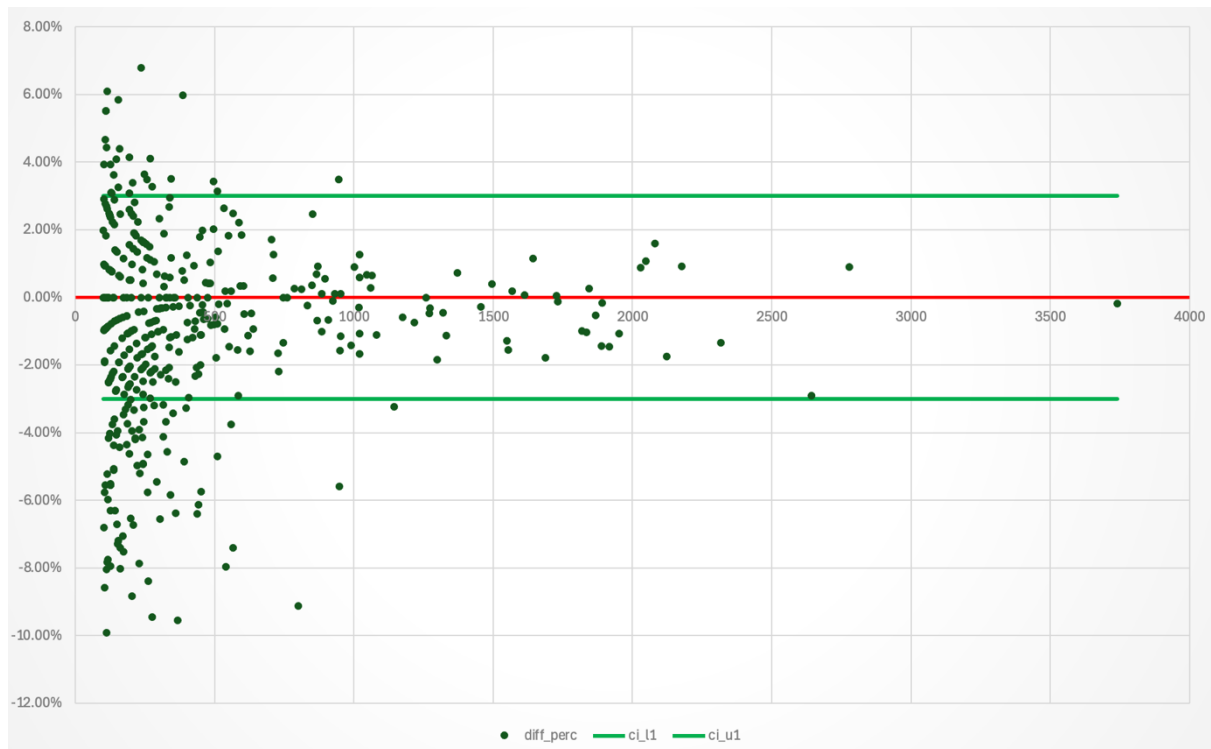


Figure 2 - Upper Secondary Schools: % Error by Subject Category Volume



The following figures showcase some of the forecasts on students' demand for primary, lower secondary, and upper secondary schools provided by the model in its test phase. As it can be seen, **the previsions are relatively close to the observed data**, underlining the accuracy of the forecasting tool.

Figure 3 – Students' forecasts – Lazio, primary school

### LAZIO – PRIMARY SCHOOL

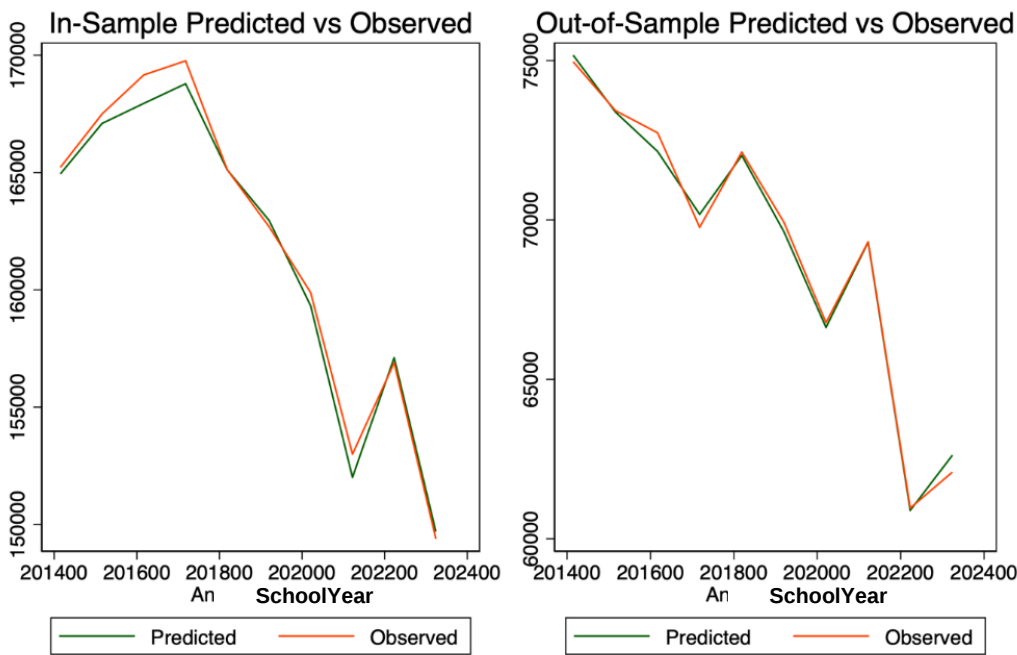


Figure 4 - Students' forecasts – Lombardy, primary school

### LOMBARDY – PRIMARY SCHOOL

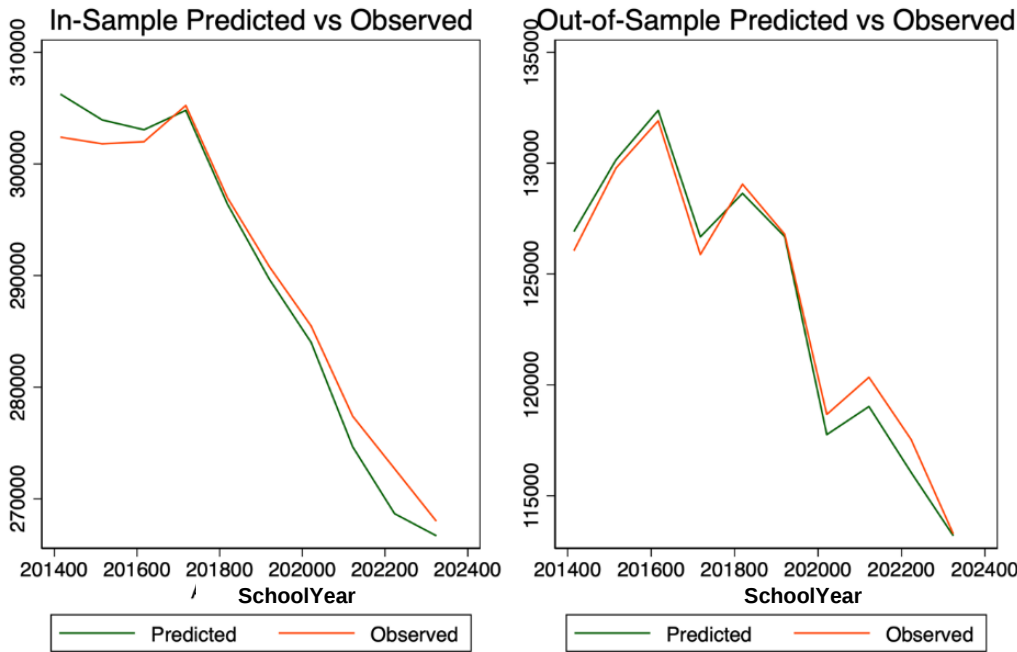


Figure 5 - Students' forecasts – Apulia, lower secondary – Ordinary School Time

APULIA Lower Secondary – Ordinary School Time

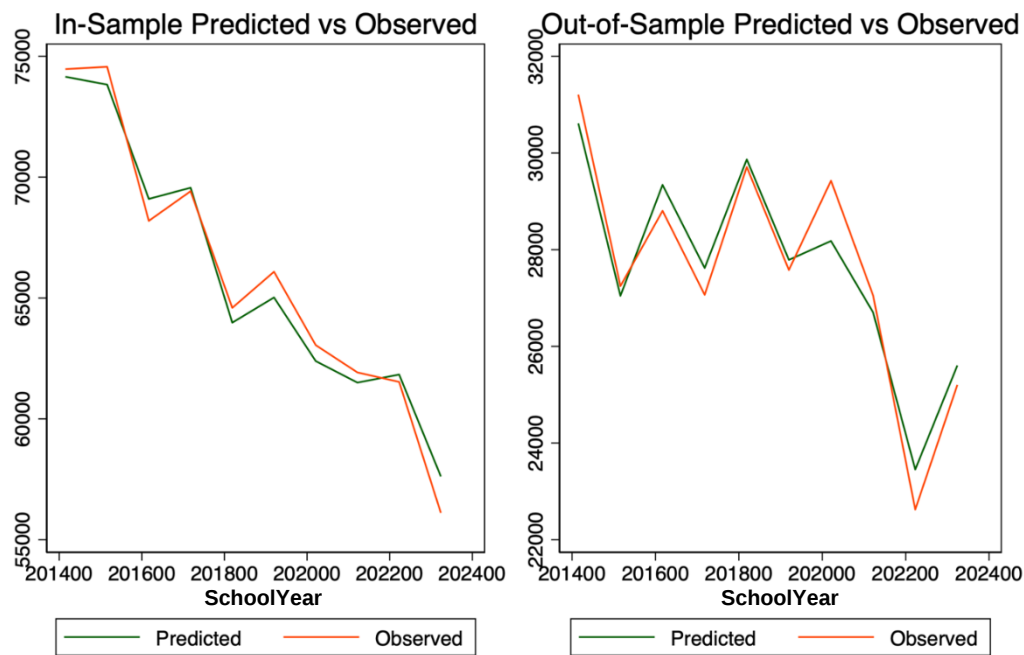


Figure 6 - Students' forecasts – Tuscany, lower secondary – Extended School Time

TUSCANY Lower Secondary – Extended School Time

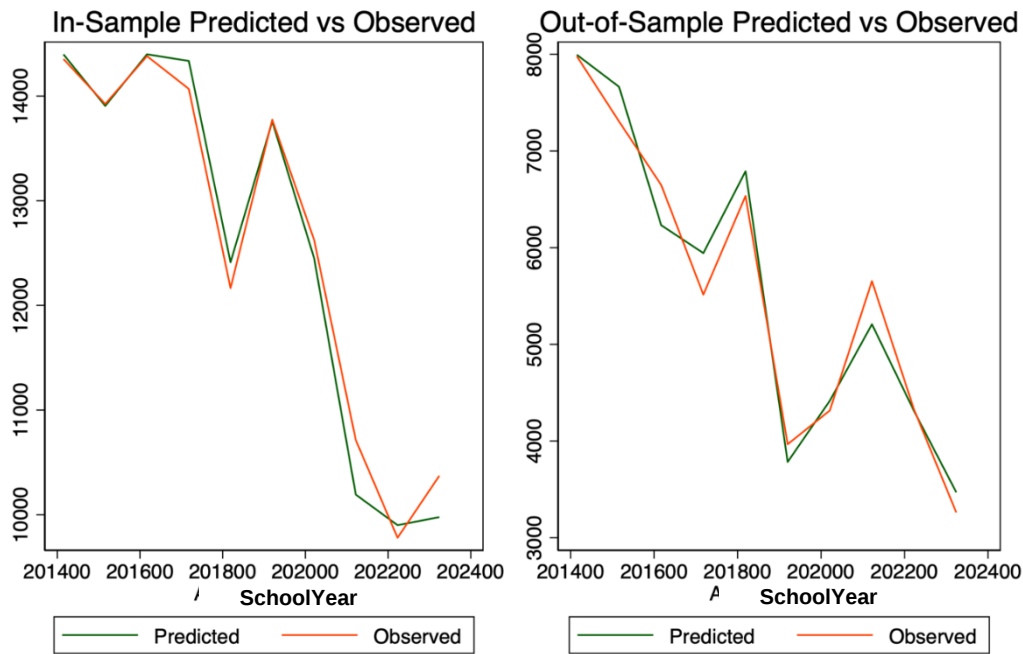


Figure 7 - Students' forecasts – Piedmont, upper secondary – Classic educational track

## PIEDMONT Upper Secondary – CLASSIC educational track

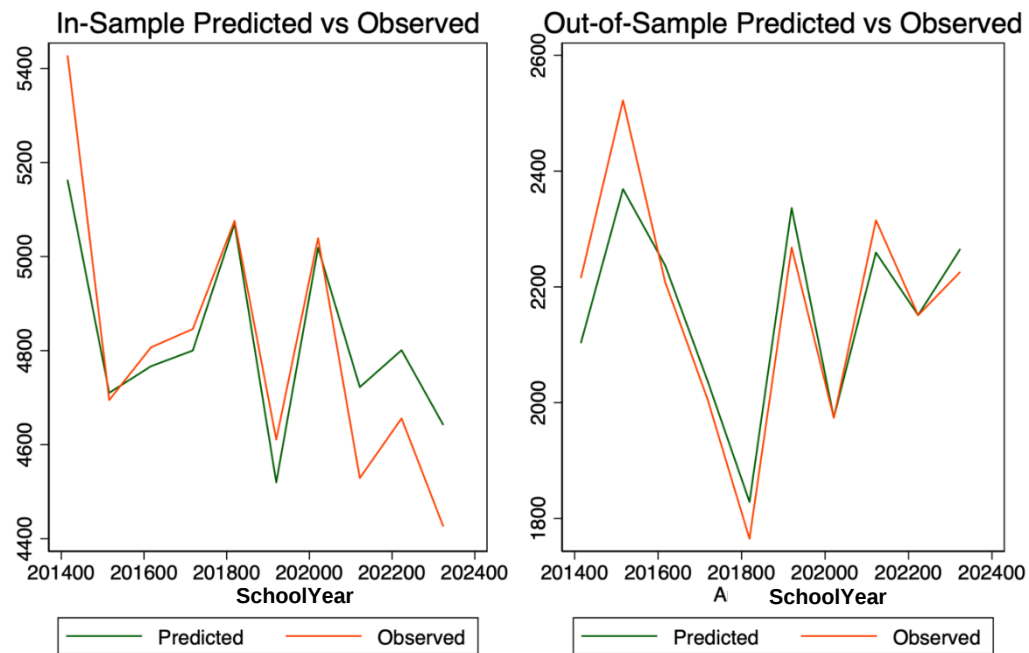
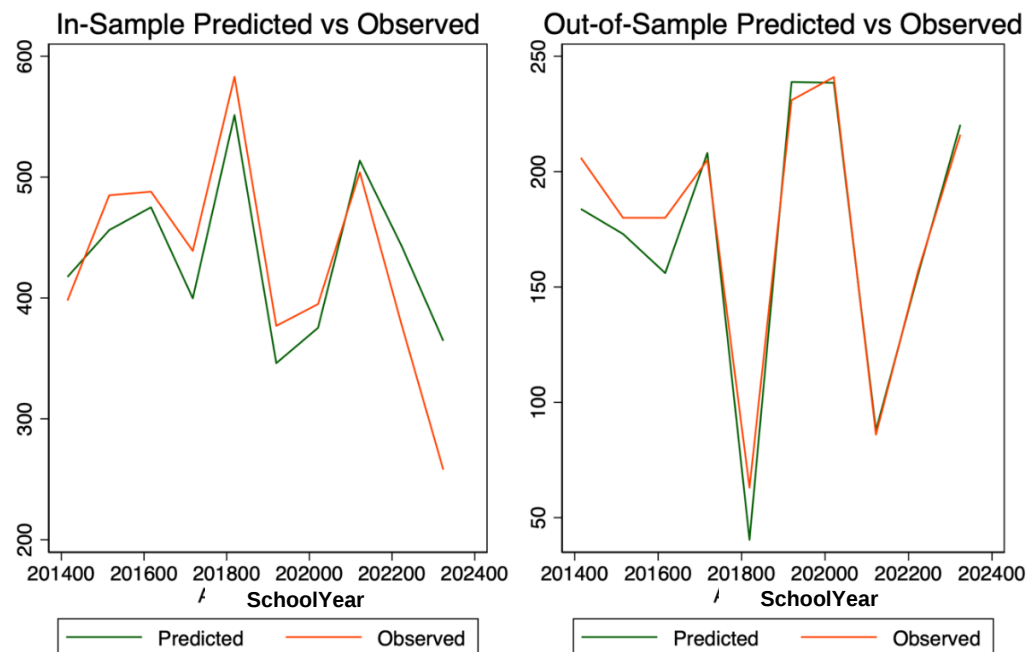


Figure 8 – Students' forecasts – Pisa, lower secondary – Tourism educational track

## PISA Lower Secondary – TOURISM educational track



The same accuracy can be found in predictions concerning the future teachers' availability, as shown in the below figures.

Figure 9 – Teachers' forecasts - Rome, upper secondary - Classic educational track

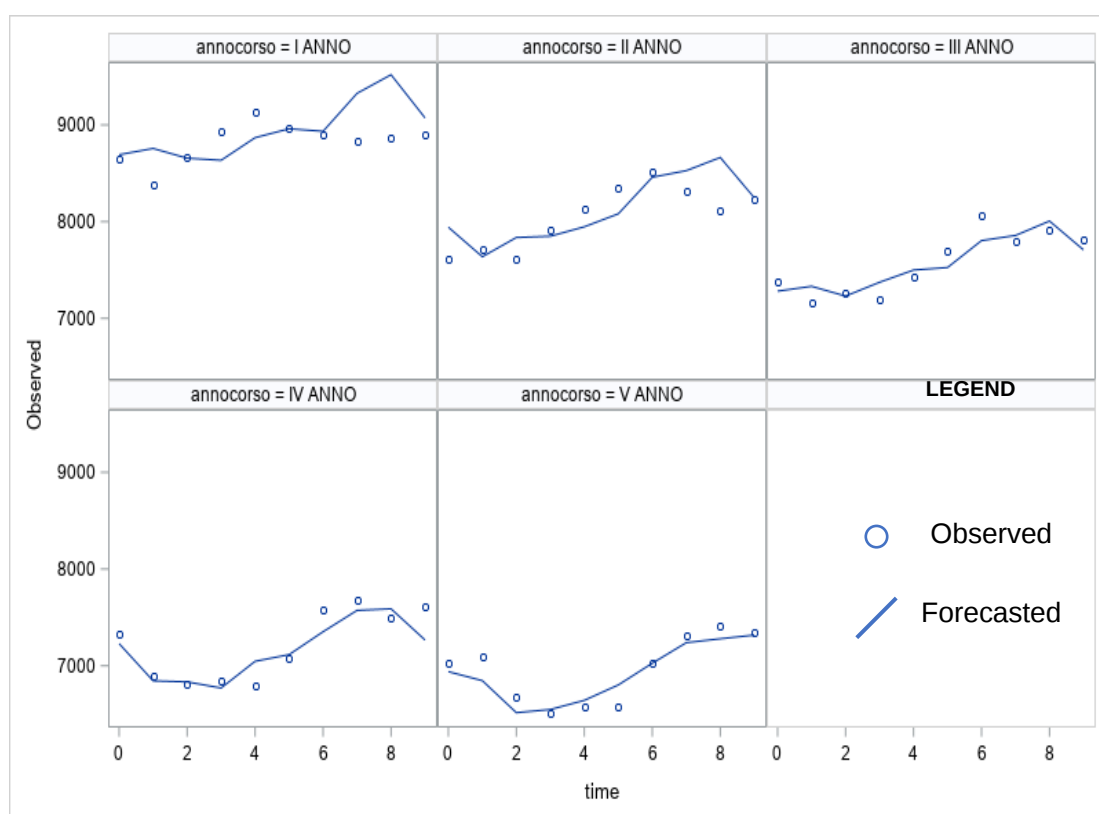


Figure 10 - Teachers' forecasts - Milan, upper secondary - Linguistic educational track

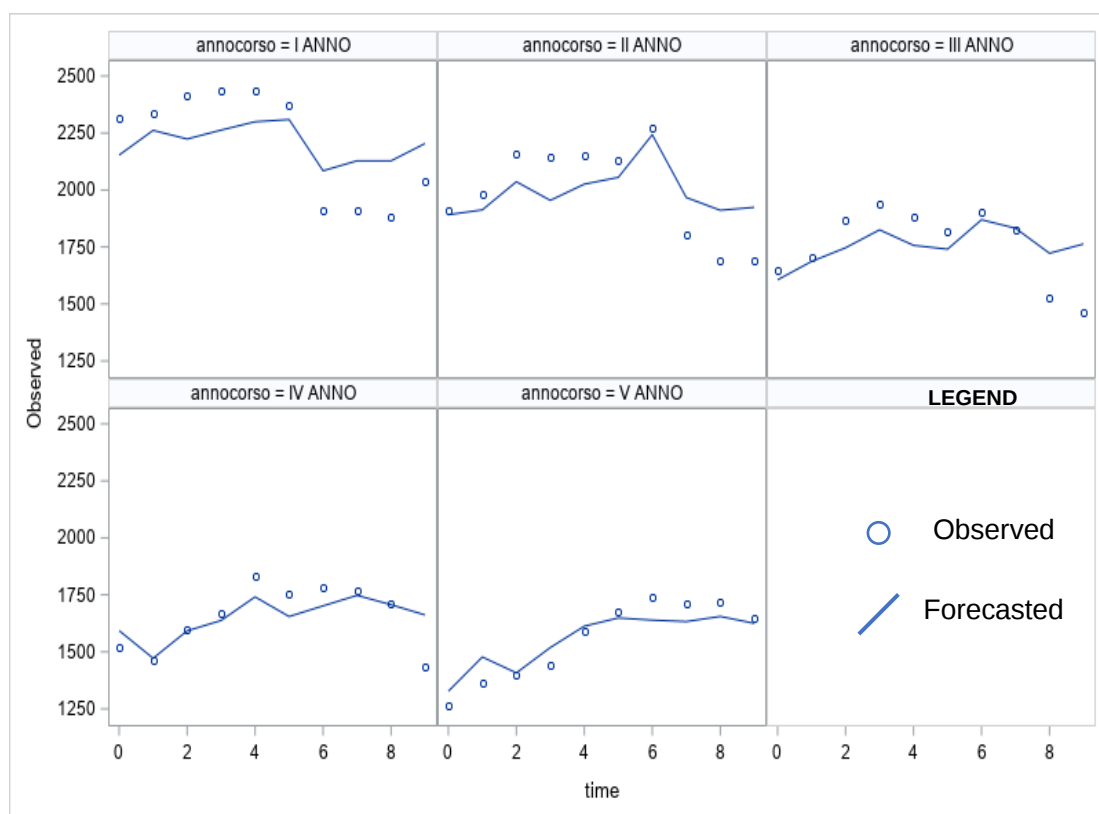


Figure 11 - Teachers' forecasts - Naples, upper secondary – Mechanic/mechatronic educational track

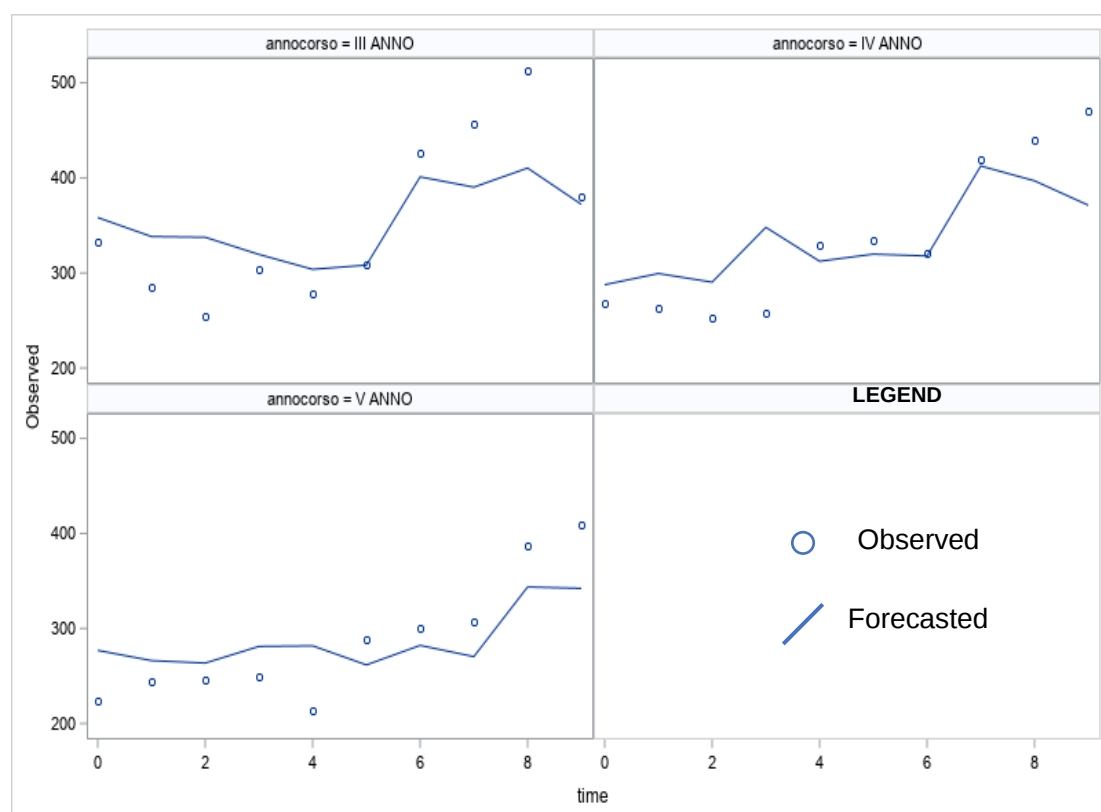
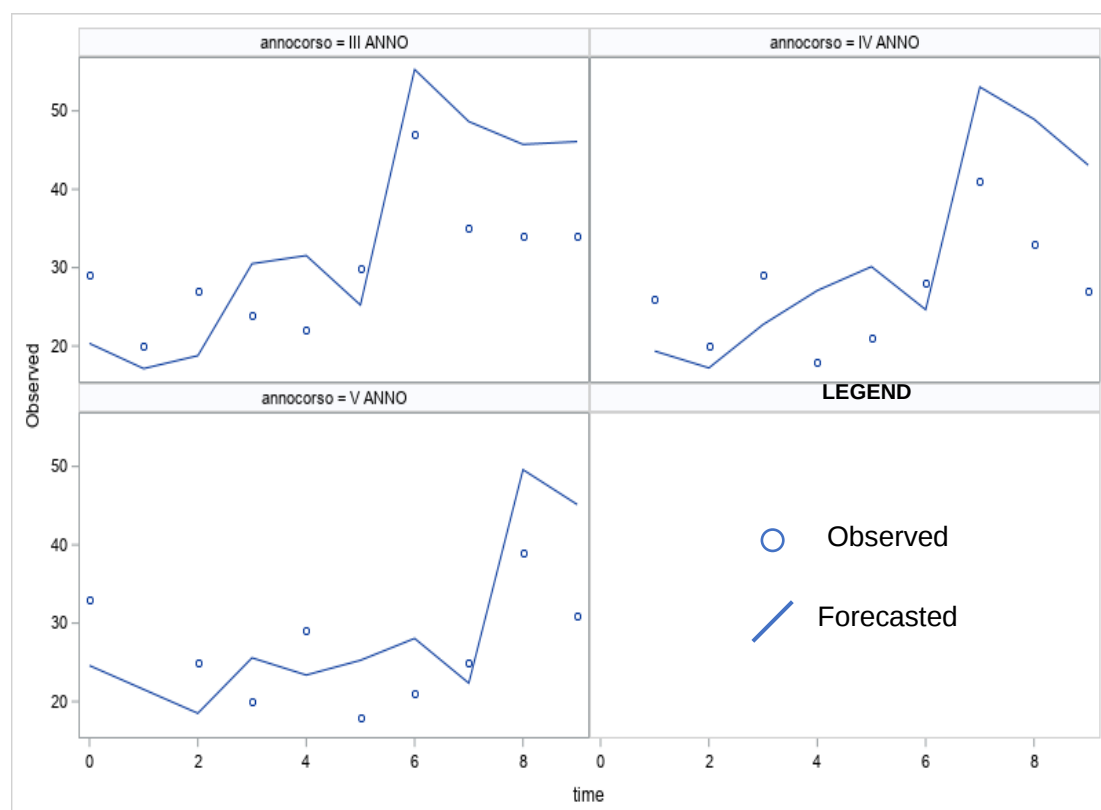


Figure 12 - Teachers' forecasts - Ancona, upper secondary – Production and transformation educational track



## Consultation with stakeholders and workshops

The project included activities such as workshops, interviews with national stakeholders and international experts, and a study visit to Portugal.

To ensure effective monitoring and support the implementation of the project, a broader Steering Committee was established, including the representatives from the Ministry of Education and Merit, the National Institute for Documentation, Innovation, and Educational Research (INDIRE), and the National Institute for the Evaluation of the Education System (INVALSI).

## Main findings and lessons learnt

The activities under **Outcome 1** highlighted critical issues in the Italian education system, particularly **teacher shortages and unequal distribution across regions**. The research, which included a **literature review, interviews with MIM, and a survey of Regional School Offices**, identified structural challenges such as, recruitment difficulties, an ageing teaching workforce and a growing reliance on temporary contracts. At an international level, 22 good practices were identified, including the **predictive model adopted by Portugal**, "*Estudo de diagnóstico de necessidades docentes*" to address the shortage of teachers, particularly in STEM disciplines. A study visit to Portugal in September 2024 provided insights for Italy, suggesting the adaptation of similar solutions to improve teacher workforce planning and university training.

Under **Output 2**, the project developed a **forecasting model** to estimate the future demand for teachers and optimise resource planning. The model analyses demand based on **student enrolment projections**, compares demand with **available teacher supply**, considering factors like retirements and mobility and focuses on **key subject areas**, such as STEM. Considering the complexity of the Italian school system, the model's predictions were restricted to standard teaching positions. A **multi-level statistical approach** was adopted and validated, achieving an **error margin of just 1–2%**.

To support MIM in using the forecasting model effectively, **training sessions** were organised for Ministry staff. These sessions aimed to **transfer technical skills and strengthen decision-making capabilities**, ensuring a more effective response to the challenges facing the Italian education system.

## Expected results

The project provided the Italian authorities with improved understanding of the key challenges faced by the Italian educational context, as well as relevant international best practices for forecasting and planning the teaching workforce.

It also provided the Ministry of the Italian and Merit with a predictive model enabling accurate forecasts on teacher demand and supply in Italy.

## Expected impact

Over the longer-term the project is expected to contribute towards more informed, sound and evidence-based decision-making in educational planning and management.

Visit our website:



Find out more  
about the Technical  
Support Instrument:

