Title: Rethinking Degrees - Labour Shortages and Educational Requirements in Belgium's Key Sectors

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Academic Year 2024-2025

In order to obtain the Joint Degree

Master 120 en Sciences économiques, Orientation générale, Finalité approfondie (UCL/UNamur)

and

Laurea specialistica in Discipline Economiche e Sociali (Bocconi)

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Rethinking Degrees: Labor Shortages and Educational Requirements in Belgium's Key Sectors

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Abstract

In the last few decades, labor shortages in Belgium's healthcare and education sectors have increased, opening questions about how employers modify their hiring practices, particularly regarding educational requirements. This thesis wants to examine the "degree resetting" phenomenon, the reduction of formal qualification criteria in response to the growing shortage of qualified workers. This fact has been observed in the U.S., however, it remains not well explored in the European context. Focusing on Belgium between 2010 and 2023, the current study investigates whether such adjustments reflect short-term responses to labor market pressure or structural changes in recruitment behavior. Through the combined use of job vacancy data (OECD, Eurostat), administrative microdata (Statbel) and PISA school data, the analysis integrates descriptive and econometric approaches. The results provide new evidence on how skills shortages and mismatches affect qualification standards. Despite the use of rigorous methodologies, the heterogeneity and limitations of data quality, coverage, and comparability partly reduce the scope of the conclusions. However, the analysis shows that the reduction of formal requirements can be observed in both sectors, particularly in education, where rigid wage and professional regulations make formal qualifications one of the few areas of flexibility for addressing structural shortages of skilled labor.

Keywords: Degree resetting, labour shortages, formal qualification, education sector, healthcare sector, Belgium, recruitment practices, credential inflation, institutional requirements, job vacancy rate, labour market adjustment, skill mismatch, policy response.

1 Introduction

In recent years, the healthcare and education sectors in Belgium have faced intensifying labor shortages (EURES - European Labour Authority, 2024), raising questions about how employers are adapting their hiring practices, particularly with regard to educational requirements. This thesis, entitled "Rethinking Degrees: Labor Shortages and Educational Requirements in Belgium's Key Sectors," examines the phenomenon of "degree resetting," i.e., the systematic reduction of formal hiring criteria in response to the growing shortage of qualified workers. The research aims to determine whether this phenomenon, already observed in the United States (Fuller et al., 2022), is also present in the Belgian context and to understand whether these adjustments represent short-term responses to labor market pressures or structural and lasting changes in recruitment behavior. Specifically, the study focuses on the education and health sectors, which together account for about 55% of total public employment in

Belgium, making them a critical testing ground for analyzing hiring practices in contexts with strong institutional constraints (Hindriks and Lamfalussy, 2024). To be more precise, the research questions are the following:

1. **Is degree resetting observable in Belgium's education and healthcare sectors?**
2. **If so, are these adjustments merely conjunctural responses or do they signal more structural shifts in recruitment behaviour?**

The thesis, in order to reach its purposes, uses a mixed methodological approach, alternating between descriptive and econometric analysis. The research is based on the combined use of several data sources, including:

- Data on job vacancies (OECD, Eurostat)
- Administrative microdata (Statbel)
- PISA school data

The analysis is structured in two core sections, dedicated respectively to the education and health sectors.

Education sector. The analysis is divided into two phases. Initially, a macroscopic perspective is adopted using PISA data to examine the relationship between teacher shortages and the composition of staff qualifications and certifications. Next, the thesis moves to a micro-level analysis with disaggregated data from the Wallonia-Brussels Federation, using ordinal regression models to study subject-specific dynamics.

Healthcare sector. The research focuses on the nursing profession and it is structured around national and regional analyses. Due to the scarcity of microdata, internal shortage indicators are constructed and a 'Difference-in-Differences' (DiD) analysis is implemented to assess the impact of the 2016 reform on the flows of nurses trained abroad. Specifically, the 2016 reform in the nursing sector, implemented from the 2016/2017 academic year in the French-speaking community, extended the duration of the nursing degree course from three to four years. This change led to a sharp drop in the number of new graduates in 2019, causing a temporary but significant shock in the supply of qualified healthcare personnel. It is used as an exogenous event that has reduced the number of available nurses and has been useful for studying whether this shortage of workers has been offset by hiring non-EU external personnel.

This dual analytical framework offers a comprehensive view of degree resetting across two fundamental Belgian sectors, shedding light on how employers recalibrate educational requirements when faced with labour-market pressures.

2 Literature Review

This section reviews the literature on labor market imbalances and skills shortages in order to construct a solid conceptual basis to understand and interpret the "degree resetting" phenomenon.

Existing research has mostly focused on the mechanisms by which the labor market reacts and adjusts to these imbalances, for example through wage adaptation, technological substitution and the redefinition of occupational roles. However, less attention has been paid to how these dynamics can influence the levels of educational requirements in job vacancies, a phenomenon noted as "Degree Resetting" (Fuller et al., 2022), the systematic lowering of the formal qualifications requested by employers.

2.1 Mismatch and Labour Market Imbalances: Concepts, Measures and Persistence

Mismatch and over-education are central themes in labour-market research. A key distinction must be drawn between *educational mismatch*, defined as "a situation in which the educational qualifications possessed by a worker differ from those perceived as necessary by the employer" (Desjardins and Rubenson (2011), p.11), and *skills mismatch*, which refers more directly to whether a worker actually possesses the skills required for the task. The theoretical complexity of these phenomena is also due to the implicit difficulty in analyzing them. Verhaest and Omey (2005) identify four main techniques:

- **Direct Self-Assessment (DSA)**,
- **Indirect Self-Assessment (ISA)**,
- **Job Analysis (JA)**,
- **Realised Matches (RM)**.

Each method has notable limitations: DSA is inherently subjective; ISA, JA and RM may be biased by employer screening strategies, inconsistent occupational classifications, or a simplistic representation of market frictions. Institutional practice reflects these trade-offs: Eurostat and CEDEFOP predominantly rely on JA and RM-based measures, whereas the OECD favours DSA.

The persistence of mismatch arises from multiple sources, including labour market frictions, misalignment between education systems and labour market needs, and employers' reliance on educational credentials as screening tools [1] (Desjardins and Rubenson, 2011). However, the explanation that resonates most closely with the aim of this research concerns the relationship between labour shortages and employers' hiring behaviour. The flexibility adopted by employers to fill vacant positions can fuel an increase in mismatch indicators, particularly in the health and education sectors, where rigid wage regulations prevent any wage - premium response. Unable to change or adapt wages, public employers tend to reduce the formal requirements and, as a consequence, workers who are not fully certified or trained for a specific role are assigned to it.

These outcomes are fundamentally driven by information and search frictions.
The Diamond–Mortensen–Pissarides (DMP) search-and-matching framework supplies the microfoundations: unemployment and vacancies coexist because matching is costly and time-consuming, and wages result from bargaining over the match surplus. The empirical strategy adopted in the next chapters is grounded in this framework, modelling the employers' hiring decision as a discrete choice that responds to market frictions in the labour market. However, two important limitations to the model considered should be noted:

[1] Regulated professions illustrate this complexity. In teaching, for example, the *ideal match* requires both an academic degree (e.g. a Master's in mathematics) and a professional qualification certifying pedagogical competence; mismatch occurs when only one of these components is present (Fédération Wallonie-Bruxelles, 2024).

- Wage rigidity in the public sector: in healthcare and education, wages are set by collective agreements and are not adjusted to Nash equilibrium: the wage margin on which the DMP is based is effectively frozen and the risk of unemployment for nurses and teachers is minimal
- Labor supply regulation: in the healthcare sector, policies such as numerus clausus limit the flow of new graduates upstream, accentuating the shortage of qualified profiles and further reducing the employer's ability to rebalance supply and demand through wage incentives.

As a result, the DMP model is mainly used here to analyze the non-wage margin of adjustment, the modulation of formal hiring requirements, which becomes the residual channel through which public employers seek to reduce search costs and fill vacancies in the presence of structural shortages.

2.2 The Weakening Value of Formal Qualifications

A key theme strictly related to the degree resetting phenomenon is the progressive reduction of the graduate premium, the real difference between graduate and non-graduate salaries.
Several studies, most of them discussed by Willetts (2025) in his report "Are Universities Worth It?", highlight that degrees are becoming less valuable economically, specifically in public sectors such as healthcare and education, where salaries are often constrained by wage policies(Nathwani, 2024).

In addition, the increase in minimum wages in some key sectors has improved the economic conditions of many non-graduate workers, directly contributing to the reduction of the salary gap between the two groups (Blundell et al. (2022); Stansbury et al. (2023)).
This dynamic can increase employers' propensity to hire candidates without any formal degree, particularly in contexts that are experiencing a structural labour shortage. As a consequence, the signaling value of the university degree is becoming less relevant (Spence, 1973), and formal criteria are progressively revised downwards, thus fueling the phenomenon of degree resetting.

2.3 From Structural Imbalances to Hiring Adjustments: The Role of Labour Shortages

The relationship between workers' qualifications and business needs is influenced by a constant tension between long-term structural trends and cyclical responses to changes in the labour market. Understanding this duality is essential to framing the phenomenon of "degree resetting."

On the one hand, the literature documents a profound and persistent structural "upskilling" of the economy. Analyzing the transformation of the US market, Carnevale et al. (2015) argue that the shift to a service economy has generated a systemic and lasting increase in the demand for workers with post-secondary education. This trend is driven by strong changes in consumption patterns, skill-biased technologies and production recipes, which today require higher levels of quality, innovation and customization.

This long-term view contrasts with the analysis of cyclical dynamics. Studying the US labour market, Modestino et al. (2016) show that the skill requirements demanded by companies are not static at all, but vary with the economic cycle. During recessions, companies implement "strategic upskilling," taking advantage of the abundance of candidates to raise requirements. Conversely, when the labour market strengthens and unemployment falls, companies engage in "downskilling," relaxing education

and experience requirements to cope with hiring difficulties. Their quantitative analysis shows, for example, that a one percentage point reduction in unemployment is associated with a significant decrease in the likelihood that a job advertisement will require a college degree.

In addition to these hiring strategies, the market also manages imbalances through post-hiring mechanisms. In a cross-national analysis of OECD countries, Cervantes and Cooper (2020) focus on educational mismatch at the individual level (e.g., people with high skills but low education). Their study shows that on-the-job training is a fundamental mechanism that, depending on national institutions, can correct or perpetuate the initial mismatch throughout a worker's career, with significantly different outcomes across countries (e.g., the mismatch tends to persist in Japan, while it is more often resolved in Germany, Italy and the US).

These academic dynamics manifest themselves in the concept of labour shortage, that is, a situation in which the demand for workers consistently exceeds the supply. The distinction proposed by Handel (2024) between cyclical shortages, linked to economic growth and which ease during recessions and structural shortages, due to long-term demographic or skills gaps, is central. The latter, in particular, have been identified by EURES - European Labour Authority (2024) as a chronic problem in Europe in key sectors such as healthcare and software, due to demographic trends and a structural skills gap.

It is precisely the interaction between these forces that creates the conditions for "degree resetting." In a context of growing structural demand for qualifications (Carnevale et al., 2015), a labour shortage, especially if structural, acts as a catalyst. As demonstrated by the cyclical mechanism of "downskilling" (Modestino et al., 2016), it pushes employers to reconsider their standards, prioritising the operational need to fill a vacancy over strict adherence to formal requirements, while alternative mechanisms such as training (Cervantes and Cooper, 2020) act in parallel to adjust the balance.

2.4 Contribution of this Study

Building on the literature discussed above, this study aims to examine how the phenomenon of degree resetting has emerged in Belgium's healthcare and education sectors, two areas that are going through structural changes. Together, these two sectors account for the vast majority of public-sector jobs in Belgium (around 55% of total public employment, (Hindriks and Lamfalussy, 2024)), which makes them a critical testing ground for any analysis of hiring practices under institutional constraints. The objective is to understand whether, in the face of persistent shortages of personnel, employers have responded by changing formal hiring criteria, in particular by lowering the educational requirements for access to open positions. This adjustment can take place explicitly, through a revision of the qualifications required in job offers, or implicitly, through more flexible hiring practices and the selection of profiles with qualifications that do not fully comply with those initially required.

An important reference point for this analysis is the report published in 2022 by the Burning Glass Institute in collaboration with Harvard Business School (Fuller et al., 2022). The study analyzes over 51 million job offers in the United States and documents a growing phenomenon: the tendency for companies to remove a university degree as a formal requirement for many positions, especially after two major employment shocks, the 2008 crisis and the COVID-19 pandemic. In response to recruitment difficulties, many organizations have prioritized work experience and actual skills over

academic qualifications, revealing a significant shift in how employers evaluate candidates. However, it's fundamental to note that the present analysis focuses on the education and health sectors in Belgium, where the vast majority of institutions operate according to public rules and collective agreements (Hindriks and Lamfalussy, 2024). Since these sectors are subject to statutory wage scales and strict accreditation requirements, a relaxation of formal qualification criteria tends to occur more gradually and less noticeably than in contexts regulated entirely by the private market. Distinguishing these rigidities specific to the public sector from the greater flexibility observed in US private labor markets is therefore essential for correctly interpreting the results.

Despite growing interest in this topic internationally, **the European literature on degree resetting is still extremely limited.** In particular, there is a lack of systematic empirical analysis to verify whether, and to what extent, similar phenomena have also taken place in the institutional contexts of the European Union. This knowledge gap concerns not only the identification of the phenomenon, but also the understanding of its causes, its implementation and its implications for job quality, the fairness of the selection system and social mobility. It is precisely in this area that the original contribution of this dissertation lies. Combining descriptive analysis and econometric tools, the thesis aims to rigorously test whether, in the Belgian context, the pressure exerted by structural staff shortages in the education and health sectors has led to a de facto revision of educational requirements, with observable effects on the composition of the workforce in terms of formal qualifications. In this way, the thesis not only introduces the concept of 'degree resetting' into the European debate for the first time, but also helps to strengthen the bridge between labor policies, skills analysis and education system design, offering useful insights for strategic workforce planning in essential public services.

3 Motivation

In recent years, labor shortages in the healthcare and education sectors in Belgium have become more pronounced, generating renewed attention to how employers are adapting their recruitment strategies in the face of persistent staff shortages (EURES - European Labour Authority, 2024). One potential channel of adjustment involves the softening of formal qualification requirements during hiring processes (Fuller et al., 2022). Rather than insisting on predefined educational credentials, institutions may increasingly prioritise availability and immediate suitability for the role. This dissertation investigates whether such patterns, over the period 2010–2023, reflect short-term responses to cyclical labour market pressure or more structural shifts in recruitment behaviour. This research question represents a particularly important issue for several reasons.

First of all, as already mentioned, this adaptation mechanism, also called degree resetting, is not clearly studied in the European context, while there is substantial evidence in the American one. For example, there is evidence that the share of U.S. job postings requiring at least a bachelor's degree fell from 38% to 33% between 2019 and 2020 for Registered Nurses and from 35% to 23% for Intensive/Critical Care Nurses. By contrast, similarly detailed evidence for the education sector is far scarcer, leaving a significant gap in the literature (Fuller et al., 2022).

Second, in the past decade, especially after the COVID-19 pandemic, the job vacancy rate has increased considerably. This rate, which measures the number of unfilled positions over total demand

for labour[2] (Eurostat, 2024), suggests that employers are constantly seeking new workers, but the demand for labour is growing faster than supply. This brings us to the central question of the study: given the intense demand pressure, is it possible that the requirements once asked for certain job positions are now changing? Are specific degrees or credentials still essential for employers, or are they lowering the threshold to attract more candidates?

This hypothesis is supported by a CEDEFOP study, which highlights that, in the Belgian context, most vacancies are concentrated in a some key occupational groups, including healthcare and teaching professions (CEDEFOP, 2016). Precisely, the healthcare sector is affected by a severe shortage of personnel. According to the Cedefop Labour and Skills Shortage Index, which assesses the intensity of the shortage on a scale from 1 (no shortage or surplus) to 4 (very intense shortage), healthcare professions in Belgium have an overall score of 2.7, indicating significant recruitment difficulties.

In contrast, the education sector has a lower overall score of 1.3. In this case, the shortage of demand is 2.0, while both supply and mismatch are 1.0. This imbalance, albeit moderate in the education sector, may nonetheless lead to a redefinition of hiring standards in order to maintain staffing levels (CEDEFOP, 2024). However, this aggregate score is not able to entirely capture the gravity of the structural issues regarding the teaching profession. As highlighted by Witte and Hindriks (2018), the education sector is facing a "triple challenge": difficulty in attracting new candidates, an impending generational gap due to an aging teaching workforce and an exceptionally high dropout rate among younger teachers. These dynamics create constant pressure on staffing levels, pressure that a simple shortage index cannot adequately reflect, thus reinforcing the hypothesis that schools may resort to lowering their hiring standards as a compensatory mechanism.

3.1 Education Sector

The analysis starts with the education sector, focusing on schools up to the secondary level. The universities are excluded, as requirements for academic positions tend to be much more rigid and non-negotiable.

Using data from the *Indicateurs de l'enseignement* published by the Fédération Wallonie-Bruxelles, it was possible, in this first phase, to reconstruct the current composition of the teaching staff in terms of the qualification and adequacy of the degrees held. The distribution of newly hired teachers has been analyzed in required, sufficient, shortage and unlisted titles, with a focus on variations by subject and education level between 2020 and 2023 (Fédération Wallonie-Bruxelles, 2023).

Data offer relevant insights into how the share of required titles has evolved over time. In particular, two indicators have been computed:

- Δ **Required (%)**: the variation in the number of teachers (hired since 2015) holding a required formal title aligned with their teaching position;

[2]The Job Vacancy Rate (JVR) is calculated as:

$$\text{JVR} = \frac{\text{Number of job vacancies}}{\text{Number of occupied posts} + \text{Number of job vacancies}} \times 100$$

- Δ **Unlisted (%)**: the variation in the number of unlisted titles, i.e., degrees that are not part of the official lists under current decrees, used to hire teachers.

With respect to unlisted titles (**Figure 1**), a significant increase is observed between 2020 and 2023 in specific disciplines such as practical subjects, philosophy, citizenship and language immersion. This trend suggests a clear case of *de facto* degree resetting, where schools increasingly rely on alternative or non-standard qualifications to fill vacancies. In contrast, a modest decrease in unlisted titles is observed in subjects such as mathematics and religion, particularly at the upper secondary level. This pattern may reflect a preference for formally aligned degrees in technical subjects at higher education levels, likely in an effort to maintain high academic standards.

Turning to the required titles (**Figure 2**), the evolution appears to be consistent with the previous observations. There is a slight increase in required titles for mathematics and religion and a decrease in philosophy and immersion teaching.

In conclusion, between 2020 and 2023, there has been a clear rise in the use of non-official degrees (unlisted titles) probably to address teacher shortages, particularly in primary and lower secondary education. At the same time, in certain key topics, mainly technical or foundational at the upper secondary level, there appears to be a strengthening of formal qualification requirements, possibly to preserve instructional quality.

This preliminary analysis is fully consistent with the key findings reported by 7sur7.be which underscores that 25% of teachers in Belgium don't hold any specific competence for the role they are covering (7sur7.be, 2025). In particular, the 2016 decree (*décret Titres et Fonctions*) introduced the rule by which a specific position is given primarily to a teacher who fully matches the subject and, if none is available, it is given to a less qualified teacher. Only 53% of new teachers have the required qualification, a percentage that has constantly decreased from 71% in 2016. The number of unlisted titles has exploded in the last decade, rising from 10% to 25% in 2024.

These findings represent a promising starting point for the further analysis that will be presented later in this dissertation; they offer a meaningful reason to delve into the phenomenon and seek to understand the forces at play. Importantly, the data used in this first step are specific to the Wallonie-Bruxelles region; however, it is reasonable to consider them as representative of Belgium as a whole.[3]. The subsequent analysis will rely on a complete dataset including information from all provinces.

3.2 Health Sector

In recent years, Belgium has been facing a structural and persistent shortage of personnel in the health sector, with a particularly high impact on the nursing profession. Even though in 2021 the number of nurses was higher than the EU average (around 11.1 per 1,000 inhabitants compared to 8.5), the Belgian healthcare system was still reporting a shortfall of about 20,000 workers, underlining how the overall supply remains insufficient to meet actual healthcare needs (OECD/European Observatory on

[3]The Fédération Wallonie-Bruxelles applies the same "required/unlisted title" definitions set out in the nationwide *décret Titres et Fonctions*, and national monitoring by Statbel and the Flemish Ministry of Education shows comparable trends in teacher shortages and qualification mixes across all three Communities. Because the FWB accounts for roughly 40 % of Belgium's teaching workforce, its patterns provide a statistically robust proxy for the country as a whole.

Health Systems and Policies, 2023). In 2022, more than 80% of hospitals temporarily closed some bed positions due to this lack of human resources (Zorgneticuro, 2022).

This problem is also highlighted by a study from the Itinera Institute, conducted by Johan Albrecht, which shows that the increasing demand for healthcare services will put growing pressure on the system, with the need for more than 124,000 additional health workers by 2040, not only medical and paramedical hospital staff, but also personnel for elderly care and home nursing (The Brussels Times, 2024).

The tension is also confirmed on the side of working conditions. The 2025 global survey by UNI Global Union, conducted between 6 January and 3 February on 11,233 healthcare workers across 63 countries (including Belgium), shows that nearly 70% of respondents report often working understaffed and more than one third say they are always in shortage (UNI Global Union, 2025). The majority (66.8%) work in public or private hospitals, while the rest are employed in elderly care facilities (11.4%) or mental healthcare (6.2%).

The framework emerging from the data at hand is characterized by strong and constant pressure on recruitment and retention, similar to what is observed in the education context: the demand for personnel is increasing more rapidly than the supply and employers may be forced to look for alternative recruitment channels.
In this context, it is therefore legitimate to conduct further research on formal thresholds, degrees, professional qualifications and specializations, and to understand whether these are already involved in the phenomenon of degree resetting. It will also be interesting to understand if this type of adjustment is temporary and cyclical, or rather structural and lasting.

4 Part 1: Educational sector

4.1 Research Design and Data Strategy

The following analysis is divided into two distinct phases, each based on different sources and methodological approaches. In the first part, a more macroscopic perspective is adopted: using aggregated school-level data from PISA questionnaires, it is examined whether there is a systematic relationship between the increase in teacher shortages and a progressive decline in the qualifications of newly hired teaching staff, measured in terms of pedagogical certification and educational qualifications (OECD, 2025). It is important to emphasize that these shortages are not solely due to recruitment difficulties: retention problems, particularly high dropout rates among teachers[4] (a workforce that is around 80% female), fuel the shortfall and may themselves encourage schools to relax formal qualification standards in order to fill vacancies (STATBEL, 2025).

In the second part, the focus shifts to a more micro level: thanks to a detailed administrative dataset from the Fédération Wallonie-Bruxelles, which provides disaggregated information by year, subject taught and level of academic qualification, it is possible to estimate, using an ordinal regression model, not only whether there is a relationship between shortages and a decline in the qualifications required, but also how strong this relationship is on average and whether there are systematic differences between different school subjects.

4.2 Step 1: Macro-Level Evidence on Teacher Quality from PISA Data

The first part of the analysis explores how teacher shortage has influenced the profile of the teaching staff in Belgian schools over time, using school-level data from the PISA (Programme for International Student Assessment) questionnaire (OECD, 2025).

At this stage, the central objective is to understand whether increases in teacher shortage are associated with changes in two key indicators of staff quality: the share of certified teachers (PROPCERT) and the share of highly qualified teachers (PROPQUAL), defined as those holding at least an ISCED 5A degree, which corresponds to a tertiary-level academic program oriented toward theoretical knowledge and high-skill professions.

4.2.1 Dataset Description

The PISA program, conducted every three years by the OECD, is an international survey created to evaluate students' competencies in three specific subjects: reading, mathematics and science. It is implemented in all 38 OECD countries as well as in several partner economies such as Saudi Arabia, India, Indonesia, Vietnam, Thailand and Morocco.
In addition to the cognitive tests, PISA gathers extensive information about school context and characteristics through questionnaires completed by students, parents, teachers and school principals.

This analysis is based specifically on the *School Questionnaire*, administered to principals, which provides key insights into resources, school climate, managerial practices and human resources. Since the 2015 cycle, the entire data collection process has been conducted digitally, using devices provided

[4] low retention levels

by national education authorities. This guarantees a high level of standardization and data security (OECD, 2022).
The PISA school questionnaire includes information on both structural and organizational aspects of each school, such as:

- School size
- School type (public or private)
- Educational programs and tracks
- Material and digital infrastructure
- Teaching and non-teaching staff shortages
- Teacher quality and certification
- School climate and discipline
- School autonomy
- Family involvement
- Socioeconomic background of students

While the questionnaire is standardized at the international level, it can include country-specific questions selected by national authorities (OECD, 2025)

Before starting the time-series and the econometrics analysis, it is useful to provide an overview of the educational landscape examined through the PISA data. To this end, a few descriptive statistics are presented for the year 2022, the most recent wave available.
In 2022, the number of schools participating in the survey in Belgium was 285. Since 2003, this number has remained relatively stable, generally fluctuating between 275 and 290 schools.
Table 1 shows the distribution by type of school: 17.9% of schools are government-run private schools, 15.4% are public schools, while only a small proportion (3.9%) are independent private schools. However, it is important to take into consideration that for 62.8% of the observations, information on the type of school is missing.
Table 2, dedicated to geographical location, shows that almost half of the schools (47.4%) are located in medium-sized to large cities (15,000–100,000 inhabitants), followed by those in small urban centers (3,000–15,000 inhabitants, 23.9%). Schools located in large metropolitan areas (over 1 million inhabitants) or in villages make up only a small part of the sample.
Table 3 summarizes the distribution of schools by region. 39.6% of schools are located in Flanders, while the remaining 60.4% are located in the "Wallonia and Brussels Region" aggregate.

The distribution of school size, measured by the number of enrolled students, is shown in **Figure 3**. In both areas, most schools have between 400 and 1,200 students, but in the Wallonia and Brussels region there is a slightly higher presence of schools with over 1,500 students, while in Flanders the density drops more rapidly after 1,000 students.
Figure 4 shows the distribution of the student/teacher ratio by region. The densities suggest a visible difference between the two areas: schools in Wallonia and the Brussels Region tend to have a higher ratio, peaking at around 9–10, while in Flanders the distribution is shifted towards lower values, indicating a higher average number of teachers per student. This may be an early sign of differences in the availability of human resources between regions.
Finally, the **map (Figure 5**) shows the distribution of schools across Belgium in 2022, broken down by NUTS1 regions [5]. There is a high concentration of schools in Wallonia, followed by Flanders and finally Brussels, consistent with the proportional breakdown in the previous phase (OECD, 2022).

[5]The Nomenclature of Territorial Units for Statistics (NUTS) is a hierarchical classification developed by Eurostat for dividing up the economic territory of the EU. NUTS1 corresponds to the major socio-economic regions within a country. In Belgium, these are: Flanders, Wallonia and the Brussels-Capital Region.

4.2.2 Time Series Analysis

The main indicators taken into consideration to carry out the analysis are the following three:

- **Proportion of certified teachers (`PROPCERT`)**: share of school teachers with a formal pedagogical certification issued by a competent authority (i.e., Ministry of Education). It is calculated as the ratio between the number of fully certified teachers and the total number of teachers in the school (National Center for Education Statistics (NCES), 2011).
- **Proportion of qualified teachers (`PROPQUAL`)**: percentage of teachers with an ISCED 5A academic qualification (National Center for Education Statistics (NCES), 2011) [6]. To be precise, the fundamental difference between `PROPCERT` and `PROPQUAL` is that `PROPCERT` measures the possession of a teaching qualification, while `PROPQUAL` refers to the level of academic education achieved. A teacher can therefore be qualified (`PROPQUAL`) even if they are not yet certified (`PROPCERT`), for example if they were hired before completing their pedagogical training.
- **Index of perceived shortage (`index_shortage`)**: composite indicator based on school principals' responses regarding the severity of teacher shortages in various subjects (science, mathematics, language of instruction, etc.). It is constructed on a standardized scale to enable international comparisons (National Center for Education Statistics (NCES), 2011) [7].

Figure 6 shows the evolution from 2003 to 2022 of these three key indicators, all standardized as Z-scores to allow comparison on a common scale. The shortage indicator displays a clear upward trend over time. After remaining relatively stable and low between 2003 and 2012, the shortage has constantly increased since 2015, peaking in 2022.

The percentage of certified teachers has been declining, particularly between 2012 and 2018, with a modest recovery in 2022. The observed drop may be a signal of the system's progressive loss of capacity to attract and maintain a high proportion of formally certified teachers, a phenomenon that could, to some extent, be the result of the increasing shortage of personnel.

In contrast, the percentage of qualified teachers increases significantly after 2015. This may suggest that, faced with growing staff shortages, schools are increasingly relying on academically qualified individuals who do not necessarily have formal teaching certification.

These tendencies highlight a clear trade-off: as the labor shortage increases, the percentage of highly academically qualified teachers rises, while the share of teachers with pedagogical certification declines. This pattern is consistent with an adjustment mechanism on the part of schools, whereby hiring

[6] This level consists of tertiary programs having an educational content more advanced than those offered at levels 3 and 4. Entry to these programs usually requires the successful completion of ISCED level 3A or 3B or a similar qualification at ISCED level 4A. They do not lead to the award of an advanced research qualification (ISCED 6). These programs must have a cumulative duration of at least two years. These programs are largely theoretically based and are intended to provide sufficient qualifications to enter advanced research programs and professions with high skills requirements.

[7] It should be underlined that both *PROPCERT* and *PROPQUAL* are stock variables, as they capture the overall composition of the teaching staff at a given point in time. By contrast, the *index of perceived shortage* reflects current labour market tensions as reported by school principals, and is thus more responsive to short-term staffing difficulties. This conceptual difference implies that any adjustment mechanism, such as increased hiring of uncertified but academically qualified teachers, may take time to materialize in stock measures.

criteria shift to prioritize academic qualifications over formal credentials in response to recruitment difficulties.

4.2.3 Regression analysis: empirical strategy and specifications implemented

In order to rigorously estimate the relationship between the perceived shortage of teachers and the composition of the teaching staff in Belgian schools, a series of **linear regression models** with fixed year effects were implemented.

The objective is to assess whether and to what extent an increase in perceived shortage affects the probability that schools employ formally certified teaching staff (`PROPCERT`) or staff who hold an ISCED 5A degree, reflecting a higher level of formal education typically required for teaching professions (`PROPQUAL`).

However, a fundamental limitation of the analysis should be pointed out. An ideal analysis would require estimating the impact of the perceived shortage of teachers not only on the average composition of the teaching staff (a stock measure), but also on annual changes in new entrants (a flow measure). Unfortunately, this was not possible in this study. Although PISA microdata provide repeated information over time on Belgian schools, it is not possible to reliably track the same institutions over the years due to a discontinuity in school identifiers: starting in 2012 and, in particular, after the digitization of the questionnaire in 2015, school identification codes were restructured. This prevents the consistent calculation of year-on-year changes (delta) in staff composition per school, making it impossible to distinguish between flow effects and stock effects. For the same reason, it is not possible to implement a reliable lagged specification in which the shortage perceived in one year is matched to the observed staff composition in the same school in a subsequent year. If a stable longitudinal identifier is not available, the use of lagged variables does not guarantee that the data refer to the same observation unit in different periods, with the risk of comparing different subjects or entities over time.

4.2.4 Baseline specification

For both outcome variables the following linear model is estimated:

$$Y_{it} = \beta_0 + \beta_1 \cdot \texttt{index\_shortage}_{it} + \beta_2 \cdot log(\texttt{SCHSIZE}_{it}) + \delta_t + \varepsilon_{it}, \tag{1}$$

where:

- Y_{it} denotes, alternatively, the share of certified or qualified teachers in school i at year t;
- $\texttt{index\_shortage}_{it}$ is the standardized index of perceived shortage, based on school principals' responses;
- $\texttt{SCHSIZE}_{it}$ indicates the total number of students in the school. The logarithm of `SCHSIZE` is used to reduce the asymmetry of the variable, preventing a few very large schools from disproportionately influencing the estimate and to make the coefficient interpretable as elasticity, i.e., the percentage change in outcome relative to a percentage change in the number of students.
- δ_t represents year fixed effects, absorbing systemic shocks or reforms common to all schools;

- ε_{it} is the idiosyncratic error term.

4.2.5 Model extensions

Three extensions of the baseline specification are carried out in order to test the robustness of the results and the possible presence of heterogeneity.

(a) Interaction between deficiency and size of the institution. To verify whether the effect of deficiency varies according to the scale of the school organization, the following interaction model is estimated:

$$\begin{aligned} \texttt{Y}_{it} = \beta_0 + \beta_1 \cdot \texttt{index\_shortage}_{it} + \beta_2 \cdot \log(\texttt{SCHSIZE}_{it}) \\ + \beta_3 \cdot (\texttt{index\_shortage}_{it} \times \log(\texttt{SCHSIZE}_{it})) + \delta_t + \varepsilon_{it}. \end{aligned} \tag{2}$$

The marginal effect of the shortage on certification and qualification may therefore vary with the size of the school, capturing any differences in institutional responsiveness.

(b) Exclusion of the year 2022. To test the sensitivity of the estimates to exogenous shocks related to the pandemic period, the baseline specification is replicated omitting the year 2022.[8] This verifies whether the estimated relationship is driven by transitory phenomena or it could be considered as a systemic and persistent change.

(c) Weighted model. Finally, a model with weights proportional to school size is estimated:

$$\texttt{weights} = \texttt{SCHSIZE}_{it}, \tag{3}$$

where is given more importance to schools with a larger number of students, reflecting their broader impact on the education system as a whole. The variable $\log(\texttt{SCHSIZE})$ is maintained as a regressor, as no evidence of multicollinearity has been found
Importantly, for all regressions, standard errors are clustered at the year level[9], to allow for autocorrelation and heterogeneity within survey years (Colin Cameron and Miller, 2015).

4.2.6 Elasticity estimation

Finally, in order to facilitate economic interpretation of the estimated coefficients on the index shortage, a back-of-the-envelope elasticity indicator is computed as follows:

$$\text{Elasticity} = \frac{\hat{\beta}_1}{\overline{Y}}, \tag{4}$$

[8] While the ideal exclusion year would have been either 2020 or 2021, when the effects of the COVID-19 pandemic were most pronounced, such an option is not available in our dataset. The PISA 2021 wave, originally scheduled for that year, was postponed to 2022 precisely due to disruptions caused by the pandemic. As a result, 2022 is the only post-pandemic observation available and its exclusion is used as a robustness check to assess the sensitivity of the results to possible pandemic-related distortions.

[9] Clustering at the year level accounts for possible intra-year correlation or heteroskedasticity, ensuring valid inference even in the presence of unobserved year-specific shocks.

where:

- $\hat{\beta}_1$ is the estimated coefficient associated with the shortage index;
- $\overline{Y}$ is the sample mean of the dependent variable.

This elasticity provides an approximate measure of the percentage change in PROPCERT or PROPQUAL associated with a one-unit increase in the shortage index. Even if simplified, this indicator enables an immediate comparison between the dimensions of the effects across different model specifications (Angrist and Pischke, 2009).

4.2.7 Results

(a) Basic regression on PROPCERT. The OLS model with fixed year effects shows that, for schools of the same size, a unit increase in index_shortage (i.e., a worsening of one standard deviation in perceived shortage) is associated with a decrease of approximately 2.5 percentage points in the proportion of certified teachers ($\beta = -0.025$, $t \approx -3.44$). The significance remains high even after including the cluster correction by year ($t \approx -5.29$), indicating that the relationship is not an artifact of heterogeneous variance between PISA surveys[10]. The coefficient on log(SCHSIZE) is positive but not significant, suggesting that, larger schools do not have a structurally higher presence of certified teachers. The Adjusted R^2 remains modest (≈ 0.028), consistent with the idea that a substantial part of the heterogeneity in certification is explained by unobserved variables (e.g., regional incentives, local reputation), **(Table 4)**.

(b) Basic regression on PROPQUAL. When examining the share of teachers with ISCED 5A qualifications, the coefficient on index_shortage remains negative ($\beta = -0.014$) and statistically significant even after accounting for year-clustered standard errors. However, it is less significant than the effect found for certified teachers, which is robust at the 1% level.
Conversely, school size explains a relevant portion of the variation: SCHSIZE is positive and highly significant ($\beta \approx 0.079$, $t \approx 10.88$), indicating that larger institutions have easier access to teachers with specific disciplinary training, perhaps due to economies of scale or a larger recruitment pool, **(Table 5)**.

(c) Back-of-the-envelope elasticity. Dividing the coefficients by the mean values of the dependent variables yields elasticities of -0.029 for PROPCERT and -0.032 for PROPQUAL.. In practical terms, a 10% increase in the deficiency index reduces the two quotas by 0.29% and 0.32% respectively. Although the elasticities are similar in magnitude, it is fundamental to remember that the impact of the independent variable, namely index_shortage, is higher for the proportion of certified teachers.

[10] In this context, "not an artifact of heterogeneous variance" means that the observed negative relationship is not simply due to differences in the variability (heteroskedasticity) of the outcome across PISA years. Clustering by year adjusts standard errors to account for such within-group correlation and potential heterogeneity in residual variance, making the inference more robust. The persistence of statistical significance after clustering suggests the estimated effect reflects a genuine pattern rather than noise driven by survey design or sample composition.

(d) Interaction model: `index_shortage` × `log(SCHSIZE)`. The introduction of interaction term serves to verify whether the effect of shortage varies according to the organizational scale of the institution. In the case of PROPCERT, the interaction term is positive but not significant ($\beta \approx 0.0063$; $p \approx 0.49$). The main coefficient on index_shortage also decreases in absolute value ($\beta \approx -0.066$) and loses significance, indicating that the variable fragments when broken down into average and differential effects by school size. In summary, the evidence does not support the hypothesis that larger schools are more resilient in maintaining formal standards: the effect of shortage on certification appears to be homogeneous across institutions of different sizes.

In the corresponding model on PROPQUAL, neither the main coefficient of index_shortage ($\beta \approx 0.0026$; $p \approx 0.96$), nor the interaction term ($\beta \approx -0.0026$; $p \approx 0.77$) are significant. This further suggests that the impact of shortages on the academic qualification profile of staff does not systematically differ depending on the size of the school.

(e) Model without the year 2022. The exclusion of the year 2022 serves as a robustness check to assess whether the negative relationship between perceived staff shortage and teacher certification/qualification reflects a structural trend or is instead driven by a temporary shock, as the COVID-19 pandemic. It's important to take in mind that without 2022, the data sample drops from seven to six PISA surveys, reducing the clusters on which the robust standard errors are based. In this configuration, the index_shortage coefficient remains virtually unchanged ($\beta \approx -0.025$), but the standard error increases and, with only six clusters, the parameter loses significance ($p \approx 0.65$). The decline does not reflect a weakening of the effect but rather a problem of statistical power due to the reduced number of groups: the clustering procedure "inflates" the variances when there are few clusters.

To verify this, the same regression is estimated without cluster correction: the coefficient remains negative and returns to significance at 1% ($\beta \approx -0.026$; $p < 0.01$). This indicates that the negative relationship between perceived shortage and the proportion of certified teachers persists even without the 2022 observation. In conclusion, the relationship observed between the number of certified teachers and the shortage index does not appear to be the result of exceptional or transitory dynamics, such as those linked to the COVID-19 pandemic, but rather represents a structural tendency that has persisted over time. However, the statistical evidence supporting this relationship becomes more fragile when the "between-years" variation is limited and the number of clusters is too small to allow robust inference.

In the case of PROPQUAL, the effect of index_shortage remains negative ($\beta \approx -0.011$), but with no significance. This result is consistent with what has been found for the case of PROPCERT. By reducing the number of survey waves considered (excluding 2022), the inference based on year-clustered standard errors loses statistical power: with only six clusters, the estimated variances inflate, the t-statistic falls and the effect can no longer be distinguished from noise. Hence, although the coefficient's sign and magnitude remain stable, the evidence becomes fragile when between-year variation is further curtailed.

(f) Regression weighted by institution size. Finally, by assigning a proportional weight to SCHSIZE, the statistical influence of larger schools, which employ a greater number of teachers, is amplified.

In the weighted model, the index_shortage coefficient on PROPCERT remains robustly negative ($\beta \approx -0.024$; $p < 0.001$), confirming the strength of the association even at the aggregate level. In other words, the estimated effect is not driven by small schools but reflects a systemic dynamic in the education sector. In the PROPQUAL weighted model, the coefficient on index_shortage remains negative but slightly significant ($\beta \approx -0.0112$; $p \approx 0.094$). Again, the effect of shortage on qualification is lighter than on certification, reinforcing the idea that adjustments made by schools in response to increasing staff shortages are more likely to focus on reducing formal certification requirements rather than on teacher qualifications.

4.2.8 Conclusions

The analysis conducted on PISA data at the school level provides initial, robust empirical evidence of the phenomenon of "degree resetting" in the Belgian education system, revealing how the shortage of teaching staff translates into a strategic trade-off in hiring practices.

The central and most robust result, confirmed by multiple model specifications, is the negative and statistically significant relationship between perceived teacher shortages and the proportion of formally certified staff (PROPCERT). In particular, regression models indicate that an increase of one standard deviation in the shortage index is associated with a decrease of approximately 2.5 percentage points in the share of certified teachers. The robustness of this result, which persists even when excluding the post-pandemic year 2022 and weighting for school size, suggests that the tendency to forego pedagogical certification is not a cyclical or transitory phenomenon, but reflects a structural and systemic adjustment mechanism.

The dynamics related to academic qualifications (PROPQUAL) appear to be more nuanced. While the descriptive analysis of the time series shows a progressive increase in the proportion of teachers with higher education qualifications (ISCED 5A), suggesting a possible substitution effect, the regression models, which control for other factors such as school size, reveal a weaker and sometimes negative direct impact of the shortage. This apparent discrepancy reinforces the main conclusion: the priority adjustment margin for schools is to forego pedagogical certification in an attempt to maintain high academic standards. The fact that this effect is homogeneous with respect to the size of the institution further confirms its systemic nature.

Nonetheless, this strategic choice is not without risks. Indeed, as reported in several important studies on the Belgian labor market (Delvaux et al., 2013), there is a strong correlation between the lack of pedagogical certification and retention in the teaching profession. The departure rate for new teachers without pedagogical certification is as high as 61% within the first five years, three times higher than that of certified professionals (Witte and Hindriks, 2018). This suggests that the short-term solution of "degree resetting," consisting in reducing certification requirements to alleviate labor market pressure, may inadvertently fuel a vicious cycle of instability and higher turnover among newly hired staff, thereby worsening the very problem it aims to solve.

However, the aggregated nature of the PISA data also constitutes a limitation. Although the analysis clearly identifies the type of qualification that is sacrificed (professional certification rather than academic qualifications), it does not allow us to understand in which disciplines or areas of teaching

this occurs most frequently. This limitation is the main motivation for the next phase of disaggregated analysis, which will explore "degree resetting" in greater detail, distinguishing between qualifications and subjects.

4.3 Step 2: Fine-Grained Analysis of Degree Resetting in Wallonia-Brussels Data

The preliminary analysis based on PISA data has revealed a system-wide dynamic: the higher the perceived shortage, the lower the share of certified and highly qualified (or well-matched) teachers and professors. Although this result is fundamental for the general understanding of the degree resetting phenomenon, it does not address several other important questions: which subjects are most affected by this phenomenon? And what mechanisms underlie the correlation between shortages and the reduction in employment standards?

To better analyze these fine-grained dynamics, the second part of the analysis adopts a more **microlevel approach**. Using the disaggregated data from the *Fédération Wallonie-Bruxelles*[11], this section examines the composition of the teaching staff, focusing on the specific subject taught and the academic degree held (Fédération Wallonie-Bruxelles, 2025).

The higher level of data granularity entails a shorter time horizon, with the available data covering the years from 2018 to 2024. Nonetheless, this restricted focus enables a more direct and accurate testing of hypotheses linking the degree resetting phenomenon to labor market pressures. Importantly, this temporal window includes the 2020 pandemic year, which is highly relevant for confirming, once again, that the modification in hiring practices is not cyclical (driven by the exogenous shock of COVID-19) but rather structural and persistent.

Note on the structure of the dataset. The administrative file is organised **by academic year**, **by school level** (primary, lower secondary and upper secondary) **and by subject taught**. For each combination of these dimensions, the dataset reports:

- the total number of teachers employed;
- the distribution of teachers by academic qualification, from the highest (*Master*) to the least specific (*Secondaire supérieur, autres*);
- the breakdown, within each qualification level, between teachers holding the *titre pédagogique*, (certified teachers)[12] and those without it.

No information is available at the level of individual schools; the unit of observation is therefore the cell defined by *year* × *school level* × *subject* × *sector*.

[11] In this case, once again, such disaggregated data are only available for the Wallonia and Brussels regions. However, as previously documented, these account for more than 50% of all Belgian schools.

[12] In the education system of the French-speaking Community of Belgium, the *titre pédagogique* is the professional certification legally required for teaching and is distinct from the academic degree attesting subject knowledge. The certification can be obtained through programmes such as the *Agrégation de l'Enseignement Secondaire Supérieur* (AESS) or the *Certificat d'Aptitudes Pédagogiques* (CAP) and confers the status of *Titre Requis*. Possession of the academic degree alone, without the pedagogical certification, confers a *Titre Suffisant*. This distinction closely mirrors the classification used in the PISA dataset between *PROPQUAL* (academic degree) and *PROPCERT* (teaching certificate), both of which are stock variables. According to some interpretations, the certification path primarily involves administrative formalities, with limited impact on actual teaching quality. As such, temporarily waiving this requirement during periods of acute teacher shortages may represent a relatively low-cost adjustment strategy.

4.4 Conceptual Framework: Search and Matching Theory

The literature review identified Diamond, Mortensen and Pissarides' Search and Matching model as the most suitable theoretical framework for explaining the existence of frictions and imbalances in the labour market (Pissarides, 2000)[13]. Building on this foundation, this section aims to operationalise this framework. A specific conceptual model will be developed here that interprets "degree resetting" **not as a random phenomenon, but as the result of a discrete and rational choice by institutions** (school in this section) in the face of increasing market pressure. However, it is important to recognize that the education sector operates as a quasi-market: schools cannot freely adjust salaries and unemployment is virtually non-existent for qualified teachers in the public system. As a result, "market pressure" in this context does not refer to classic labor market clearing mechanisms, but rather to the persistence of vacancies and chronic recruitment difficulties, which may gradually push institutions to relax formal hiring criteria.

4.4.1 Baseline matching model

Time is discrete, $t = 0, 1, \ldots$. Let U_t be unemployment, V_t posted vacancies (one period in duration) and $M_t = \mathcal{M}(U_t, V_t)$ the new matches generated by a constant–returns–to–scale matching function $\mathcal{M}$. Employment evolves according to

$$E_{t+1} = (1 - \lambda)E_t + M_t, \qquad E_t := N - U_t.$$

Job–finding and vacancy–filling probabilities are defined as

$$f_t = \frac{M_t}{U_t}, \qquad q_t = \frac{M_t}{V_t}, \qquad \theta_t = \frac{V_t}{U_t}.$$

Workers. The expected present value of employment and unemployment satisfy the standard Bellman relations

$$\mathcal{V}_E = w + \frac{1}{1+r}\Big[(1-\lambda)\,\mathcal{V}_E + \lambda\,\mathcal{V}_U\Big], \tag{5}$$

$$\mathcal{V}_U = z + \frac{1}{1+r}\Big[f\,\mathcal{V}_E + (1-f)\,\mathcal{V}_U\Big], \tag{6}$$

where $\frac{1}{1+r}$ is the one–period discount factor. The first equation states that an employed worker receives the wage w today and, tomorrow, either remains employed (probability $1-\lambda$) or becomes unemployed (probability λ[14]); mutatis mutandis for the second equation.

Firms. Upon filling a vacancy a firm produces output y each period and pays w to the worker. The match dissolves with the same probability λ. The present value of a filled position is therefore

$$J = y - w + \frac{1}{1+r}\Big[(1-\lambda)J + \lambda \cdot 0\Big] = \frac{1+r}{r+\lambda}\,(y-w), \tag{7}$$

[13] the model, also called DMP, has been jointly developed by Peter Diamond, Dale Mortensen and Chris Pissarides (Nobel prize 2010)

[14] For the educational sector the λ should be set equal to 0, since the probability for a teacher of being fired is very low

where the term $\lambda \cdot 0$ reflects the fact that once the match ends the asset (the filled job) has zero continuation value for the firm.

Wage determination. Wages are set through Nash bargaining over the surplus of the match. Let $\beta \in (0, 1)$ be the bargaining weight of the worker. With V vacancies and U unemployed workers, define $\theta \equiv V/U$—labour–market *tightness*. If c is the per–period flow cost of keeping a vacancy open, the equilibrium wage is

$$w = \beta\, y + (1 - \beta)\, z + \beta\, c\, \theta, \tag{8}$$

the standard result that splits the total surplus according to the bargaining weights and compensates the worker for the expected cost of creating the job.

Equations (5)–(8) fully characterise the *baseline* model and will serve as building blocks for the degree–resetting extension described below.

4.4.2 Extension: two hiring standards and vacancy costs

Building on the baseline matching model outlined above, consider now how a school modifies its recruitment strategy when qualified teachers are scarce. Instead of posting a vacancy with a single, fixed requirement, the school can choose between two mutually exclusive *qualification standards*:

	High standard S_H	Low standard S_L
Required qualification	Matched Degree	Alternative / lower degree
Matching rate	q_H	$q_L > q_H$
Output per match	y_H	$y_L < y_H$

Relative to the baseline model, three additional ingredients are introduced. First, the school now faces a *discrete search-technology choice*: it can keep the vacancy under the high standard S_H or downgrade to the low standard S_L, trading higher productivity ($y_H > y_L$) for a higher contact probability ($q_H < q_L$). Second, the vacancy itself becomes an *enduring asset*: it can remain open over many periods instead of expiring after one, so the elapsed duration d becomes a state variable that affects future pay-offs. Third, both a one-off opening cost c_0 and a flow opportunity cost c_v are carried explicitly into the objective, making the timing of the switch decision economically meaningful and giving rise to two distinct vacancy values, V_H and V_L, which enter the Bellman system. Specifically, it's assumed that at the end of each period the principal sets the binary control $\mu \in \{0, 1\}$: $\mu = 0$ maintains the high standard, $\mu = 1$ permanently lowers it. The decision is based on a comparison of the present values V_H and V_L of holding an unfilled vacancy under the two standards; switching occurs when $V_H < V_L$. The formal Bellman equations reflecting these modifications are given in the next following equations.

4.4.3 Two modelling strategies

Model A: Static Formulation

In the static formulation, all relevant parameters, matching rates (q_H, q_L), the separation rate λ, and the vacancy cost c_v, are assumed to be constant over time. The vacancy does not keep track of its

own duration: it is simply re-posted in the following period if it remains unfilled and the school has not yet decide to close it. Consequently, the value functions V_H and V_L do not depend on time or duration.

The Bellman system is defined as:

$$V_H = \max_{\mu \in \{0,1\}} \left\{ -c_0 - c_v + \beta(1-\mu)\left[(1-q_H)V_H + q_H J_H\right] + \beta\mu V_L \right\}, \tag{9}$$

$$V_L = -c_v + \beta(1-q_L)V_L + \beta q_L J_L, \tag{10}$$

where the match surplus is given by

$$J_s = \frac{1+r}{r+\lambda}(y_s - w_s), \qquad s \in \{H, L\}. \tag{11}$$

The maximisation operator in (9) selects the *degree–resetting* rule

$$\mu^\star = \begin{cases} 0 & \text{if } V_H \geq V_L \quad \text{(keep the high standard)}, \\ 1 & \text{if } V_H < V_L \quad \text{(switch to the low standard)}. \end{cases}$$

This system admits a closed-form solution for both V_H and V_L under the assumption that the school delays switching ($\mu = 0$) until $V_L = V_H$. Solving (9) and (10) under this condition yields:

$$\begin{aligned} V_H &= \frac{-c_v + q_H J_H}{r + q_H}, \\ V_L &= \frac{-c_v + q_L J_L}{r + q_L}. \end{aligned} \tag{12}$$

By imposing the indifference condition $V_H = V_L$, we derive the critical **cost threshold** that determines when the school should optimally downgrade its qualification standard[15] :

$$\boxed{c_v \; > \; \frac{q_L J_L (r + q_H) \; - \; q_H J_H (r + q_L)}{q_H - q_L}} \tag{13}$$

Interpretation. This inequality shows that the school switches to the low standard whenever the flow cost of keeping the vacancy unfilled (c_v) exceeds the discounted benefit of waiting to match with a higher-quality teacher. The denominator reflects the rate at which the opportunity to match or separate changes over time, while the numerator captures the expected gain in match productivity from sticking with the high standard.

Model A is well suited for analytical derivations and comparative statics. However, it abstracts from duration effects, which may be important in practice.

[15]The separation rate λ is included in the denominator to ensure numerical stability and a strictly positive scaling factor. Without λ, the term $r + q_H - q_L$ could approach zero (or even become negative if q_L becomes sufficiently large relative to q_H), making the threshold ill-defined or highly sensitive to small estimation errors in the matching probabilities. Adding λ preserves the economic interpretation, discounting plus effective exit from the vacancy, and guarantees a well-behaved denominator in empirical calibration.

Model B: dynamic environment with duration state

In this dynamic formulation, the value of a vacancy depends not only on the qualification standard but also on its duration and the state of the labour market. The key idea is that the longer a vacancy remains unfilled, the more costly it becomes to maintain, either due to increasing administrative burdens, the need for temporary coverage or growing reputational and performance costs.

State variables. Two state variables govern the evolution of the value functions:

- d_t: the elapsed duration since the vacancy was posted;
- θ_t: the tightness of the labour market, affecting matching probabilities.

Cost and matching structure. The per-period opportunity cost is duration-dependent:

$$c_v(d) \quad \text{with} \quad c_v'(\cdot) \geq 0,$$

and the matching probabilities depend on market tightness:

$$q_s = q_s(\theta), \quad \text{for } s \in \{H, L\}.$$

Tightness evolves according to a known Markov or deterministic transition law:

$$\theta_{t+1} \sim G(\cdot \mid \theta_t).$$

Bellman system. The school solves a dynamic programming problem in which the value of a vacancy at duration d and tightness θ is given by:

$$V_H(d,\theta) = \max_{\mu \in \{0,1\}} \Bigg\{ -\mathbf{1}_{\{d=0\}}\, c_0 - c_v(d) + \beta(1-\mu)\Big[(1-q_H(\theta))\,\mathbb{E}_{\theta'} V_H(d+1,\theta') + q_H(\theta) J_H\Big] + \beta\,\mu\,\mathbb{E}_{\theta'} V_L(d+1,\theta') \Bigg\}, \tag{14}$$

$$V_L(d,\theta) = -c_v(d) + \beta(1-q_L(\theta))\,\mathbb{E}_{\theta'} V_L(d+1,\theta') + \beta\, q_L(\theta) J_L.$$

The term $\mathbf{1}_{\{d=0\}} c_0$ ensures that the opening cost c_0 is only incurred at the start ($d = 0$), not upon transition to the low standard. The expectation $\mathbb{E}_{\theta'}[\cdot]$ reflects the stochastic evolution of tightness from θ to θ' (Adda and Cooper, 2002).

Interpretation and optimal policy. Because duration increases deterministically over time and costs escalate with duration, the model exhibits natural non-stationarity. This justifies including d as a state variable, even under an infinite horizon.

The optimal policy is characterised by a **duration threshold** function $d^\star(\theta)$, specifying when the

school switches to the low standard:

$$\mu^* = \begin{cases} 0 & \text{if } d < d^\star(\theta) \quad \text{(keep } S_H\text{)}, \\ 1 & \text{if } d \geq d^\star(\theta) \quad \text{(switch to } S_L\text{)}. \end{cases} \tag{15}$$

Unlike in Model A, no closed-form cost threshold exists. The threshold function $d^\star(\theta)$ must be computed numerically using value-function iteration or policy search techniques over the (d, θ) state space.

Continuous–time analogue and waiting–time rule. In continuous time, with discount rate r and Poisson arrival of matches, the Bellman equations become Hamilton–Jacobi–Bellman equations defined over a continuous state space. The corresponding optimal policy satisfies a *waiting-time threshold rule*, under the simplifying assumption of constant match probabilities and opportunity cost:

$$T^\star = \frac{J_H - J_L}{c_v}. \tag{16}$$

This expression indicates that a school operating under a high hiring standard will optimally downgrade to the lower standard after $T^\star$ periods of unsuccessful search. Intuitively, this threshold equates the cumulative loss from keeping the vacancy unfilled with the surplus gain of continuing to search for a better-qualified match. Although the derivation assumes stationarity in q_H, q_L, and c_v, the result provides a useful benchmark for interpreting behaviour in the dynamic model

Empirical interpretation. Although the theoretical framework is articulated in terms of vacancy-level behaviour and optimal switching between qualification standards, the administrative data do not report posted vacancies or search spells. Instead, they record the *stock* of employed teachers and their observed qualifications at yearly frequency. A decline in the qualification profile of new hires can therefore be interpreted as the *revealed outcome* of schools that have lowered their hiring standard in response to labour-market tightness. However, this adjustment is likely to be a gradual process that unfolds over time, depending on the turnover rate (i.e., the ratio of new hires to total employment) which in the education sector is typically low [16]. This interpretation is consistent with Marinescu and Wolthoff (2020), who highlight the role of mismatch as a revealed friction in the matching process and a valid empirical proxy for market tightness.

The key driver of this adjustment is the *mismatch index*

$$\text{mismatch} = \frac{\text{total positions} - \text{certified hires}}{\text{certified hires}}. \tag{17}$$

which serves as an observable proxy for market tightness.[17] This interpretation is consistent with Marinescu and Wolthoff (2020), who highlight the role of mismatch as a revealed friction in the matching process and a valid empirical proxy for market tightness. Within the model, a larger

[16] Supporting evidence suggests that in Belgium, teacher retention is exceptionally high, with about 86% of new teachers remaining after one year and nearly 70% still employed after ten years (Belga News Agency, 2024)

[17] When certified hires are scarce relative to advertised posts, the index rises, indicating a tighter market and a lower matching probability $q_H(\theta)$ under the high standard. This mirrors the theoretical mechanism that pushes schools toward degree resetting.

mismatch lowers q_H, tightening the trigger inequality in Model A and shortening the waiting-time threshold $T^\star$ in Model B. Empirically, this manifests as a higher share of hires with non-matching or lower degrees in subjects and locations that exhibit greater mismatch pressure.

Empirical hypothesis (H_1). *Both the probability and the speed of hiring less-qualified teachers increase with the teacher–labour mismatch index.*

Choice of structural benchmark. Because the data exhibit year-to-year shifts in the qualification composition of new hires, the econometric specification is most appropriately grounded in the **dynamic framework (B)**. Model B accommodates duration-dependent behaviour and delivers an interpretable waiting-time rule that links mismatch to the speed of standard downgrading, while Model A is purely static and cannot generate temporal patterns. In estimation, vacancy duration is latent but its effect is captured by observing how quickly schools transition from certified to non-certified hires as mismatch varies.

4.4.4 Transition from Theoretical Framework to Empirical Model

The empirical verification of hypothesis H_1 requires the specification of an econometric model capable of quantifying the relationship between market pressure and hiring standards. Since the data from the Wallonia-Brussels Federation covers both primary and secondary education, the empirical analysis extends to both segments of the education system. However, the profound structural, regulatory and operational differences in the labour market that characterize these two levels make an aggregate analysis inappropriate. Educational pathways, teaching requirements and the availability of candidates vary between primary and secondary education. For this reason, the analytical strategy adopted involves estimating **two distinct and specific econometric models**, one for each school level.

Definition of Model Variables. The econometric model is constructed from a set of variables designed to measure degree resetting, market pressure and other relevant control factors.

Dependent Variable.

- `Qualification Reset Index`: the dependent variable of the model is an **ordinal** measure of degree resetting. While the ideal candidate profile combines a high-level academic degree with the "Titre pédagogique," the variable `reset_ord` is specifically constructed to capture the hierarchy of academic qualifications only. A higher-level diploma, such as a *Master*, is assigned the lowest ordinal value (0), whereas progressively less specific or lower-level qualifications (e.g., *Bachelier non pédagogique*, *Secondaire supérieur*) are assigned increasing integer values. This coding reflects the hierarchical nature of academic credential devaluation, where a higher value of the variable indicates a more substantial "downward reset."

Independent Variables (Regressors).

- `Mismatch index`: this is the key explanatory variable, designed to measure the **specific labour market pressure** for certified profiles. As defined in the theoretical framework, it is calculated as the ratio between the deficit of certified hires and the number of certified hires.

This indicator is a relative measure, normalizing shortage by the size of the qualified teacher market segment, and thus allowing comparability across subjects and years. The hypothesis is that its coefficient should be **positive**.

- log(`Total teaching positions`): the natural logarithm of the total number of positions for a given function acts as a control for the **scale of demand**. This variable is essential to isolate the effect of `mismatch` from potential scale effects. It is plausible that highly demanded positions follow different recruitment dynamics (e.g., greater attractiveness, more standardized procedures), regardless of the specific shortage.
- `Educational Track` and `School Cycle`: categorical variables controlling for structural heterogeneity. The former distinguishes between "Ordinaire" and "Spécialisé" teaching[18]. The latter, (included only in the secondary model) distinguishes between lower and upper cycles.
- `Subject Area`: a categorical variable identifying the subject taught. Its inclusion controls for the intrinsic heterogeneity of disciplines, in terms of both candidate supply and rigidity of curricular requirements.
- `Year`: year fixed effects are included to absorb the impact of time-varying shocks common to all observations (e.g., national reforms, economic crises) that could otherwise bias the estimation of the effects of interest.

Baseline Model Specification. The relationship between the variables is formally tested using an *ordered logit model*, estimated separately for primary and secondary education (McCullagh, 1980). This methodological choice is motivated by the nature of the dependent variable, which is *ordinal*: it reflects a hierarchy among academic qualifications, ordered from the highest to the least specific, and aims to capture the intensity of the "down-grading" in formal requirements.

Technically, the model posits a continuous latent variable y_j^*, representing the unobserved propensity, within each **subject–year–cycle–sector cell**, to employ teachers with lower academic qualifications.[19] The model is specified as follows:

$$y_j^* = \beta_1 \,\text{mismatch}_j + \beta_2 \,\log(\text{total\_positions}_j) + \boldsymbol{\gamma}'\mathbf{X}_j + \epsilon_j, \tag{18}$$

where

- $\mathbf{X}_j$ is a vector of categorical control variables, including *Subject Area* (`fonction`), *Sector* (ordinary vs. specialised), *School Cycle* (primary, lower-secondary, upper-secondary) and *Year* (fixed temporal effects);
- ϵ_j is the error term, assumed to follow a logistic distribution.

[18] In the educational system of the French-speaking Community of Belgium, schooling is divided into two main pathways: *enseignement ordinaire*, which represents the traditional and mainstream system attended by the majority of students; and *enseignement spécialisé*, a specialized track designed for pupils with specific educational needs (e.g., physical or sensory disabilities, learning or behavioral disorders). This latter type of education provides tailored pedagogical, paramedical and psychological support, with the aim of fostering students' personal development and social and professional integration.

[19] Each cell combines one subject area, one academic year, one school cycle (primary, lower-secondary, or upper-secondary) and one track (ordinary or specialised).

The observed dependent variable, $\texttt{Reset Index}_j$, results from partitioning the range of the latent variable y_j^* into $K+1$ ordered categories, defined by thresholds $(\tau_1, \tau_2, \ldots, \tau_K)$:

$$\texttt{reset\_index}_j = \begin{cases} 0 & \text{if } y_j^* \leq \tau_1, \\ 1 & \text{if } \tau_1 < y_j^* \leq \tau_2, \\ \vdots & \\ K & \text{if } y_j^* > \tau_K. \end{cases} \tag{19}$$

This structure allows for a probabilistic interpretation of the likelihood that a given subject–year cell shifts toward lower qualification standards, conditional on labour-market pressure and institutional characteristics (McCullagh, 1980).

Subject-Level Heterogeneity in Degree Resetting. In addition, to understand which subjects are most affected by the degree-resetting phenomenon, an alternative model is estimated that includes an interaction term between the degree of mismatch and the subject taught. The *Subject Area* variable is treated as categorical and represents the discipline taught (e.g., general courses, technical subjects, religion, etc.).

The *Mismatch Index* × *Subject Area* interaction makes it possible to estimate the differential impact of shortage for each subject relative to a reference category (in this case, *general subject teachers*). In other words, this is equivalent to introducing a group of additional coefficients that measure how the effect of mismatch changes across different disciplines.

Formally, the latent model is expressed as

$$y_j^* = \beta_1 \,\text{Mismatch}_j + \beta_2 \,\text{Subject}_j + \beta_3 \,(\text{Mismatch}_j \times \text{Subject}_j) + \beta_4 \,\log(\text{total\_positions}_j) + \boldsymbol{\gamma}' \mathbf{X}_j + \epsilon_j. \tag{20}$$

where:

- β_2 represents the coefficients associated with the different subjects, relative to the reference discipline[20];
- β_3 captures how the effect of mismatch changes according to the subject taught;
- $\mathbf{X}_j$ contains the remaining control variables (educational track, year, school cycle);
- ϵ_j is the error term, assumed to follow a logistic distribution.

This extended formulation enables a more detailed and disaggregated estimation of the impact of certified-teacher shortages, potentially revealing systematic differences across subjects in the propensity for degree resetting.

[20]Each cell combines one subject area, one academic year, one school cycle (primary, lower secondary, or upper secondary) and one track (ordinary or specialised).

4.4.5 Empirical Findings: baseline model

The analysis of the two models, one for secondary school and one for primary school, confirms the existence of a degree resetting mechanism driven by the qualified teacher shortage. However, the intensity of the effect, the significance of the covariates and the institutional implications differ strongly between the two educational levels. In the following paragraphs, a detailed analysis of each model is outlined, followed by a transversal comparison.

Secondary Schools

In the context of secondary schools, the model shows dynamics that are extremely sensitive to the shortage of certified profiles, with coefficients of great amplitude and high statistical significance.

Mismatch index. The mismatch coefficient (4.0676) is positive and highly significant. Looking at the odds ratio, each unit increase in the qualified teacher shortage multiplies the reset probability by a factor of about 58 ($e^{4.0676} \approx 58.4$). This result is even more striking if one considers that the mismatch index is a relative measure[21] that varies on a continuous scale. This implies that even small and minimal variations in the shortage level are translated into an exponential increase in the probability that formal qualification requirements are reduced.

This suggests a segmented labour market[22], where the scarcity of certified teachers produces a systemic and rapid institutional reaction: the reduction of academic requirements becomes a quasi-automatic adjustment mechanism.

Scale and Institutional Effects (Controls variables). The total teacher coefficient, `Total teaching positions`, is negative and significant as well (-0.2456), in line with the common idea that more requested positions benefit from higher visibility, attract a larger pool of candidates and undergo more formal and structured selection procedures. The higher the demand for a position, the lower the probability of a reset in academic qualifications.

Additionally, the coefficient for the specialized teaching sector is significant and negative (-0.6623): the specialized sector exhibits a reset probability that is roughly halved with respect to the ordinary sector. This could reflect either greater regulatory rigidity or prioritization in staffing allocations[23].

Similarly, the "Degré supérieur"[24] shows a negative and significant coefficient (-0.4696), suggesting that upper secondary schools (second cycle) are less prone to reset than those in the first cycle. In other words, more advanced schools tend to protect the quality of their teaching staff more.

Finally, the time variable, `Year`, treated as continuous, reveals a positive effect (+0.0117), small in magnitude but highly significant from a statistical point of view. This underscores the presence of a slow but continuous increase in the degree resetting phenomenon over time, even when controlling for mismatch levels.

[21] Defined as the ratio between unfilled positions and positions requiring certified candidates.

[22] The term "segmented" refers here to the existence of heterogeneous institutional responses depending on school type and shortage intensity, where some segments react more rapidly by relaxing requirements.

[23] In some systems, specialized education may follow different recruitment norms or benefit from dedicated pipelines.

[24] Literally "upper degree"; refers to the upper cycle of secondary education (e.g., ages 16–18).

Primary Schools

The model confirms the presence of the resetting mechanism, albeit with a lower intensity than in secondary school.

Mismatch Index. The mismatch coefficient is positive and significant (0.9153), with an odds ratio of about 2.5. This means that each unit increase in mismatch raises the probability of resetting by 150%. It remains an important impact, though less intense than what is observed at the secondary level.
In primary schools, shortage remains a key factor, but schools appear to be less elastic, probably because the requested profiles are more generalist[25] or because personnel management is more centralized[26].

Scale and Institutional Effects (Controls variables). The `Total teaching positions` coefficient is again negative and significant (-0.1928), confirming the general rule of greater "protection" for high-demand roles.

The specialized sector is not statistically different from the ordinary sector: in primary school, institutional differences between the two sectors seem to be less relevant for the reset.

The time dummies included in the model (*year 2018–2024*) are statistically insignificant, indicating that once controlled for other covariates, there is no clear upward or downward temporal trend in the degree resetting phenomenon in primary schools. Unlike the secondary model, where the year variable showed a small but highly significant positive trend, primary education appears to have experienced more temporal stability in qualification adjustment practices.

4.4.6 Cross-Sector Comparison: Secondary vs. Primary Education

Aspect	Secondary	Primary
Mismatch Intensity	Very high (OR $\approx$ 58)	High but more moderate (OR $\approx$ 2.5)
Volume Effect	Significant and negative	Significant and negative
Sector Difference	Significant (specialized less affected)	Not significant
School Cycle Effect	Upper level less affected by reset	Not applicable
Time Trend	Present and increasing	Not significant

4.4.7 Empirical Findings: Analysis of Heterogeneity by Subject

Secondary Schools

The inclusion of the interaction term between `mismatch` and `subject area` in the model for secondary schools allows for an analysis of the heterogeneity of the mismatch effect as a function of the discipline taught. This approach permits to move beyond the estimation of an average effect and

[25] Primary education teachers are often trained as generalists, covering multiple subjects, which may reduce the impact of precise certification shortages.

[26] In many systems, primary education staffing is managed more uniformly by public authorities, reducing school-level discretion.

obtain a disaggregated measure of the sensitivity of the degree resetting process with respect to the shortage of certified profiles in each subject area.

The main coefficient of `mismatch` (equal to 3.228) represents the reference effect for the category of "general subject teachers" and is already highly significant (odds ratio ≈ 25). However, the interaction terms indicate that this effect is significantly amplified in certain subject areas:

- **Technical and artistic subjects**: the interaction term is both positive and significant (3.126), suggesting a total effect of 6.354. This indicates that the likelihood of lowering formal requirements in response to teacher shortages is very high in these subjects.
- **Professional practice**: The coefficient of the interaction term is 2.075, which, when added to the main effect, yields a total value of 5.303 (odds ratio ≈ 200).
- **Religion and ethics**: The interaction coefficient is 0.521, also statistically significant, resulting in a total effect of 3.749 (odds ratio ≈ 42.5).

In summary, the model indicates that while degree resetting is a widespread phenomenon in secondary education, its intensity is considerably greater in technical, practical and professional subjects. These disciplines appear to be structurally more vulnerable, where the institutional response to a lack of certified candidates is more frequently reflected in a systematic relaxation of formal hiring criteria.

Primary Schools

For primary education, the model incorporating the interaction between `mismatch` and `subject area` also provides a nuanced picture of the variation in responsiveness to staff shortages across different subjects. The main coefficient of `mismatch` is equal to 0.483 (odds ratio ≈ 1.62), indicating a positive and significant effect for the reference group (generalist primary teachers), although its magnitude is notably lower than in secondary schools.

Nevertheless, the interaction terms highlight considerable variation by subject:

- **Physical education**: This subject presents the highest interaction coefficient (3.095), pointing to a pronounced sensitivity to the shortage of certified personnel.
- **Philosophy and citizenship, religion/morality, psychomotor skills and second language teaching**: All of these disciplines exhibit positive and statistically significant interaction coefficients (respectively 1.126, 1.320, 0.805 and 1.051), suggesting a higher propensity for degree resetting relative to the reference category.

Consistency with Descriptive Analysis. The econometric findings are fully consistent with the descriptive evidence presented in Figures 1 and 2. In particular:

- Figures 1 and 2 illustrate a substantial increase in "unlisted qualifications"[27] for certain subjects in primary education, notably for *Vocational/Practical* disciplines and *Philosophy and Citizenship*.

[27] That is, qualifications not officially recognised as appropriate for the subject taught.

- The regression results confirm that these subjects exhibit a significantly stronger response to the mismatch index, indicating that schools tend to recruit non-certified teachers more frequently in these areas.

Hence, the model suggests that the increase in degree resetting is not a random phenomenon, but the consequence of a systematic and statistically robust relationship between teacher shortages and the relaxation of formal recruitment requirements.

In conclusion, the analysis confirms that the empirical patterns observed in the descriptive data reflect underlying mechanisms that are both theoretically sound and statistically identifiable. The degree resetting process is not uniform across subjects but rather responds heterogeneously to labour market pressures, indicating a structural segmentation of recruitment practices in the education sector.

4.4.8 Conclusions

The econometric analysis conducted in this previous section on disaggregated data from the Wallonia-Brussels Federation provides robust empirical evidence of the phenomenon of "degree resetting" in the education sector, confirming the central hypothesis derived from the theoretical framework: the lowering of academic qualification standards is a direct and statistically significant response to the pressure generated by the shortage of teachers. However, the results highlight strong structural differences both between levels of education and between different disciplines.

A comparison between primary and secondary school models reveals two distinct adjustment regimes. In the secondary sector, the response to shortages is exceptionally intense, suggesting an almost automatic mechanism of downgrading requirements in the face of recruitment difficulties. This greater vulnerability is consistent with external analyses of the Belgian labour market, which for years have highlighted how the shortage of teachers is particularly critical in secondary education, often concentrated in specific scientific and linguistic disciplines (Desagher, 2012). In addition, a higher dropout rate in this sector and a more marked decrease in the number of graduates in Master's programs for teaching purposes further accentuate the pressure (des Associations de Parents de l'Enseignement Catholique , UFAPEC).

On the contrary, in the primary sector, the reaction to the shortage, although significant, is much more limited. The hypothesis that this lower elasticity is linked to an intrinsically more flexible labour market is based on the very nature of the professional profile required. Primary school teachers are trained as "generalists" and multi-skilled professionals, whose expertise lies in the integrated management of the entire basic curriculum. Furthermore, structural incentives further limit the scope for academic advancement in this segment: the vast majority of primary school teachers are hired on Bareme 301 contracts, linked to short-term diplomas. Master's degrees, associated with Bareme 501, are rare in primary schools and are neither required nor financially rewarded (CSC Bruxelles, 2024). This implies that the adjustment observed in qualification levels may be mechanically limited and that any measured 'resetting of qualifications' may reflect a distorted variation due to this structural constraint. This lower level of disciplinary specialization, also enshrined in the Initial Training Reform, creates a more homogeneous pool of candidates and can make the system less vulnerable to shortages of hyper-specific profiles.

Finally, the analysis of heterogeneity by subject made it possible to accurately map the areas of greatest criticality. In secondary school, degree resetting is mostly concentrated in technical, practical and professional subjects, while in primary school, subjects such as physical education, philosophy and religion show the greatest sensitivity to market pressure. This not only confirms the trends observed in the descriptive analysis but also links them to a statistically identifiable causal mechanism.

In conclusion, the analysis conducted did not merely validate the existence of "degree resetting," but sought to quantify its intensity, revealing its determining factors and ultimately painting a picture of an education system that adapts to labour market frictions in heterogeneous and structurally segmented ways.

5 Part 2: Health Sector: Nurses

5.1 Research Design and Data Strategy

Building on the framework developed for the education sector, the second part of the analysis focuses on the healthcare sector, with the aim of identifying empirical evidence of the degree resetting phenomenon. However, the scarcity of individual microdata makes this context more challenging. The analysis is therefore structured on two main levels: national and regional, with an additional section dedicated to labor migration. The focus is placed specifically on the nursing profession, both due to data availability and because this category is structurally more exposed to variation in qualification requirements compared to physicians, whose training pathways are more rigid and standardized. Moreover, nursing shortages are more visible and topical than doctor shortages, making any adjustments particularly policy-relevant. For instance, the specialist health journal Le Spécialiste described the situation as "une bombe à retardement pour le système de santé" ("a time bomb for the healthcare system"), citing burnout rates of 46% and revealing that "43% of nurses considered leaving their hospital positions and 27% contemplated leaving the profession entirely" (Spécialiste, 2024). In a related policy briefing, the Institut pour l'égalité entre femmes et hommes referred to the current challenges as a "pénurie des infirmier·es et crise du 'prendre soin'," emphasizing the compounded crises of recruitment, training and retention, largely driven by deteriorating working conditions and structural gender inequalities (Institut pour l'égalité entre les femmes et les hommes, 2023).

At the national level, the evolution of the qualification mix among registered nurses is analyzed in relation to the vacancy rate in the 'Human Health' sector. The latter, estimated by Eurostat, is the only external indicator of shortage available (Eurostat, 2024). This block aims to provide an initial macro-level indication of how vacancy dynamics may influence the distribution of required educational qualifications.

At the regional level (Flanders, Brussels-Capital, Wallonia), the challenge of granular data is addressed by constructing an internal proxy for shortage: the ratio between the number of practitioners (as measured by the Labor Force Survey - Statbel (2024)) and registered nurses (as measured by the SPF Santé publique (2024)). This shortage proxy is included in a regression on the share of registered nurses at each qualification level. The aim is to estimate whether the variation in this proxy pushes organizations to "lower the bar" for the required qualification, i.e., to reduce the share of High qualifications in favor of Medium or Low.
At this level, for the sake of completeness and to expand the analysis, a battery of robustness checks is adopted, including Placebo Test, Chow Test and exclusion of COVID - 19 years.

Finally, to capture possible adjustments through the inflow of foreign personnel, a difference-in-differences analysis (and related triple difference) is set up on the OECD Health Workforce Migration 2007–2022 dataset (OECD, 2024a). The treatment in this case consists of the 2016 reform, implemented starting from the 2016/2017 academic year, which extended the duration of the nurse's degree program from three to four years. This change led to a sharp reduction in the number of graduates in 2019, creating a temporary but significant shock in the supply of healthcare personnel (Government of Belgium, 2016). The key coefficient of this analysis measures the post-reform change in the inflow

[27] This reform affects only the Communauté française (French-speaking Community), but has had a significant impact

of non-EU-trained nurses to Belgium compared to a control group consisting of France, Germany and the Netherlands. This extension aims to verify whether the bachelor's degree reform stimulated the inflow of non-EU nurses as an additional channel of adjustment to the shortage. These combined approaches address the challenges associated with data scarcity in the healthcare sector, offering a more comprehensive view of degree-resetting dynamics and workforce adjustments in response to shortages.

5.2 National-level data

The national analysis is based on two main sources: the Labour Force Survey (LFS), used to estimate the composition of the active nursing workforce (practitioners), and the Job Vacancy Rate provided by Eurostat, used as an indicator of labor shortages in the healthcare sector.

The LFS is an harmonized European sample survey conducted quarterly by Statbel in Belgium, to assess the employment situation of the resident population aged 15 and over. For this analysis, only professionals active in the healthcare sector as nurses or in related roles were selected, identified through the corresponding ISCO-08 codes[28]:

- **2221** (Nursing professionals): specialized nurses or managers (high level);
- **3221** (Nursing associate professionals): general or practical nurses (medium level);
- **5321** (Personal care workers): nursing assistants or social and health care workers (low level).

This three-level classification allows the distribution of the nursing workforce to be reconstructed based on the educational qualification associated with the position held. The data, collected with a response rate of over 75%, are aggregated on an annual basis, applying the official sample weights provided by Statbel (Statbel, 2024).

To measure labor shortages, we use the Job Vacancy Rate published by Eurostat in the `jvs_q_nace2` series:

$$\text{Job Vacancy Rate} = \frac{\text{Vacancies}}{\text{Vacancies} + \text{Filled positions}} \times 100. \tag{21}$$

The indicator refers to the **NACE Rev. 2 Q – Human health** sector, including all company size classes. The data are available on a quarterly basis, in non-seasonally adjusted form and only at the national level. For the purposes of the current analysis, an annual average of the vacancy rate is computed.

To complete the outline of the dataset, a descriptive analysis was conducted on the *Job Vacancy Rate*, tracking its trend from 2013 to 2024. As shown in **Figure 8**, the indicator remains virtually stable until 2015 (around 1,5%), gradually increases to exceed 2% in 2019, records a temporary retracement

on the total number of graduates nationwide, as shown in Figure 7.

[28] ISCO-08 (International Standard Classification of Occupations, 2008 revision) is the international system developed by the International Labour Organization (ILO) for classifying and aggregating jobs and occupations based on the tasks and duties performed. It is widely used for international comparisons of labour market data

in 2020, likely linked to the most acute phase of the COVID-19 pandemic[29] and finally makes a decisive leap in the two-year period 2022-2023, stabilizing above 3%.

To verify whether 2020 had a significant impact and whether the subsequent trend represents a structural discontinuity, an OLS model with a break in 2020 was estimated[30] (Stock and Watson, 2020). The results, as shown in **Table 6**, confirm the graphical evidence:

- the pre-2020 trend is positive and statistically significant ($p < 0{,}01$);
- the interaction between the trend and the post-2020 dummy[31] is also positive and highly significant (increase in slope of ≈ 0.26 p.p./quarter; $p < 0{,}001$), signaling a marked acceleration in the growth of job vacancies after the pandemic;
- the immediate jump in level linked to 2020 is negative, but is more than offset by the new steeper slope, generating the surge observed in the following two years.

Overall, the analysis suggests that the pandemic shock triggered a permanent change in the healthcare sector's ability to fill open positions, corroborating the hypothesis of increasing pressure on the demand for nursing labor [32].

5.2.1 Methodology and results

To assess the impact of the labor shortage on the composition of nursing qualifications, a simple lag model was estimated, linking the vacancy rate recorded in the healthcare sector in the previous year with the proportion of nurses belonging to each qualification level (high, medium, low) in the current year. The model is formulated as follows:

$$\text{QualificationShare}_t = \beta_0 + \beta_1 \, \text{JobVacancyRate}_{t-1} + \varepsilon_t . \tag{22}$$

where the explanatory variable $\text{JobVacancyRate}_{t-1}$ is the annual average of the Job Vacancy Rate in the *Human Health* sector published by Eurostat and the dependent variable is alternatively the share of nurses with high qualifications (share_high_t), average (share_medium_t), or low (share_low_t) observed in year t.

The use of a one-year lagged value serves to mitigate simultaneity issues and reflects a plausible economic assumption: the increase in demand for nurses, measured by a higher vacancy rate, does

[29] The job-vacancy rate fell in 2020 chiefly because firms withdrew or froze job postings during lockdowns and heightened uncertainty, causing the numerator of the indicator, the number of vacancies, to contract sharply.

[30] OLS with term break refers to a linear regression with constant coefficients up to a predetermined instant t_0 (here, the first quarter of 2020) and authorized to change both level and slope from t_0 onwards. Operationally, the following are introduced: (i) a *dummy* D_t that is equal to 1 for $t \geq t_0$ (level jump) and 0 otherwise; (ii) an interaction term $D_t \cdot t$ (slope variation). In this way, the model jointly estimates the pre-break trend, the immediate shift at t_0, and any acceleration or deceleration of the post-break trend.

[31] The post-2020 dummy is 1 from the first quarter of 2020 and 0 before that; isolates any level jump associated with the pandemic shock. The interaction with the time index allows us to verify whether, in addition to the jump in level, the slope of the trend has also changed after 2020.

[32] This interpretation is supported also by a Chow test (Stock and Watson, 2020) for structural break in 2020, which strongly rejects the null hypothesis of parameter stability (F = 22.93, $p < 0.001$), confirming a statistically significant discontinuity in the time series.

not translate into instantaneous adjustments in the composition of the workforce, but manifests itself with a certain delay through hiring decisions or internal staff retraining.

The model is estimated using Ordinary Least Squares (OLS), treating Belgium as a single observational unit observed over time. Standard errors are corrected using the Newey–West scheme to account for potential serial autocorrelation and heteroscedasticity, ensuring more reliable statistical inference in the presence of time-dependent errors (Stock and Watson, 2020).

In terms of robustness, it should be taken into consideration that the main results remain stable even when using the non-lagged vacancy rate. The use of the time lag, therefore, does not change the substance of the estimates but strengthens the causal interpretation.

Results. The coefficients (**Table 7**) show that a one percentage point increase in the Job Vacancy Rate in year $t-1$ is associated, in year t:

- with an increase of approximately 0.05 percentage points in the share of nurses with medium qualifications (share_medium$_t$);
- a decrease of approximately 0.04 percentage points in the share of nurses with high qualifications (share_high$_t$);
- a slight but significant reduction of approximately 0.01 percentage points in the share of low-qualified profiles (share_low$_t$).

All coefficients are statistically significant at conventional levels. Overall, the increase in staff shortages shifts the qualification distribution toward intermediate profiles, at the expense of highly specialized staff and, to a lesser extent, low-qualified profiles. This suggests that healthcare facilities, when faced with persistent vacancies, tend to lower formal hiring requirements, favoring mid-level candidates in order to meet workforce needs more efficiently.

5.3 Regional-Level Data

In addition to the analysis conducted at the national level, an in-depth examination of the dynamics of the nursing labor market was carried out at the regional level in order to capture the specific characteristics of the Belgian context. To this end, two complementary data sources were employed: on the one hand, the *Labour Force Survey* (Statbel, 2024), which is representative of active workers; on the other hand, the *Cadastre Santé* (SPF Santé publique, 2024)[33], which collects all individuals formally registered as healthcare professionals, regardless of their actual employment status.

For the component concerning active professionals, LFS microdata for the period 2013–2024 were used, selecting only individuals who reported employment in nursing or personal care services. In line with the national-level analysis, three professional groups were considered, identified according to the ISCO classification:

[33]The statistics published by the *cadastre* of the SPF Santé publique are based on data concerning professionals legally domiciled in Belgium, regardless of their employment status. The database includes doctors, nurses, dentists and other healthcare professionals who are registered and licensed to practice, according to the Eurostat definition of *licensed to practice*. The data are validated through cross-checks with the National Register and include information on age, gender and legal residence.

- **Professional nurses (ISCO 2221)** — classified as *high* level;
- **Associate nurses (ISCO 3221)** — associated with *medium* level;
- **Social and healthcare workers and personal care assistants (ISCO 5321)** — mapped to the *low* level.

Based on these categories, the number of active professionals at each qualification level was calculated for each year and for each region (Flanders, Wallonia, Brussels and Belgium as a whole). These estimates represent the effectively employed nursing workforce.

For formally registered professionals, no distinction was made by qualification level: all individuals registered under the three ISCO categories used for practitioners (2221, 3221, 5321) were selected, resulting in an aggregate count of total registrants by region and year.

The sole purpose of using the *Cadestre Santé* data was to compute a synthetic indicator, at the regional level, of labor force pressure, defined as the *shortage ratio*:

$$\text{shortage ratio}_{rt} = \frac{\text{registered}_{rt} - \text{practitioner}_{rt}}{\text{practitioner}_{rt}} \tag{23}$$

where r indicates the region and t the year. A higher value implies a greater shortage of profiles actually practicing the profession.

The Eurostat-provided vacancy rate was not employed, as it is only available at the national level and is therefore unsuitable for capturing regional heterogeneity. By contrast, the approach adopted here enables estimation of workforce pressure on the nursing sector at a disaggregated territorial level.

In conclusion, the final dataset, structured as a regional panel, includes the following variables for each year and region:

- the estimated share of practicing staff at each qualification level (*low*, *medium* and *high*);
- the *shortage ratio*, constructed as described above.

5.3.1 Descriptive Analysis and Data Visualization

Before proceeding with the estimation of econometric models, this section provides a descriptive and visual analysis of the main variables and their trends over time. The aim is to provide an intuitive overview of the context and relationships that will be formally tested. The analysis focuses exclusively on the regions of Flanders and Wallonia, as a preliminary analysis of the Labor Force Survey (LFS) revealed a significant lack of data for the Brussels-Capital region, which would have compromised its statistical reliability [34].

The external validity of the calculated nursing staff shortage indicator is tested by comparing it with the official Job Vacancy Rate indicator for the healthcare sector published by Eurostat, which was

[34] Although the Brussels-Capital Region is institutionally significant, it hosts a considerably smaller number of general hospitals compared to Flanders and Wallonia, which together account for more than 80% of all hospital networks in Belgium. Therefore, its exclusion due to data quality concerns does not undermine the overall validity of the analysis for the Belgian hospital system ((Federal Public Service (FPS) Health, Food Chain Safety and Environment, 2023)).

also used in the previous section. **Figure 9** shows both indicators: the black line shows the indicator calculated for Belgium, while the green dotted line shows the Eurostat indicator [35]. Although the two series are measured on different scales, there is a remarkable similarity in the underlying trend, especially in the growth trend since 2018. This consistency validates the calculated indicator as a reliable measure of labor market tension, reinforcing its use as an explanatory variable in subsequent models.

Once the validity of the measure has been established, **Figure 10** illustrates its evolution at the regional level, comparing Flanders, Wallonia and the national average. A general upward trend can be observed for all series, although distinct regional dynamics emerge, such as the greater volatility recorded in Wallonia compared to the more gradual increase in Flanders.

Finally, **Figure 11** provides a visual representation of the central research hypothesis, directly linking the trend in staff shortages with the composition of qualifications. This graph is not only a description of the data, but also a powerful initial visual test of the deskilling theory. The separate analysis for the two regions, Flanders and Wallonia, is particularly illuminating, as it reveals a surprisingly similar strategic response despite very different shortage trends.

5.3.2 Analysis of Dynamics in Flanders

In the upper panel of **Figure 11**, which refers to Flanders, the shortage trend (black dashed line) displays a steady and gradual increase throughout most of the observed period. This progressive rise in pressure appears to be accompanied by a systematic adjustment in the composition of the nursing workforce. In particular, the share of highly qualified personnel (blue line) follows a clearly decreasing trajectory beginning in 2016. Simultaneously, the share of medium-qualified staff (orange line) rises, suggesting a reallocation mechanism primarily occurring between these two groups, resembling a "communicating vessels" dynamic. In contrast, the share of low-qualified workers (red line) remains remarkably stable over time, indicating that the adaptive response does not involve a general lowering of qualification thresholds, but rather a targeted substitution between higher qualification tiers.

5.3.3 Analysis of Dynamics in Wallonia

The lower panel, which presents the trend in Wallonia, highlights a different dynamic. Here, the shortage indicator exhibits considerable volatility rather than a steady upward path, reaching a peak around 2020 before declining in subsequent years. Workforce composition appears to respond rapidly to these fluctuations. The share of highly qualified personnel drops as the shortage intensifies and begins to recover as the pressure subsides, displaying a strong inverse association. The share of low-qualified workers again shows limited variation, reinforcing the interpretation that substitution occurs predominantly among the higher skill categories. The share of medium-qualified personnel follows a U-shaped pattern, declining during the peak of the shortage and recovering thereafter, suggesting that during periods of acute stress, staffing challenges extend across all non-basic qualification levels.

Taken together, these descriptive patterns reveal a consistent association: rising shortage levels tend

[35] It should be noted that the indicator calculated at national level was developed specifically to enable direct comparison with the official Eurostat data. The main methodological contribution and focus of the subsequent analysis lies in the indicators broken down at regional level (Flanders and Wallonia), the trends of which are shown in **Figure 10**.

to coincide with a decline in the share of highly qualified personnel, partially offset by an increase in medium-qualified staff. This recurring configuration across two distinct regional contexts strengthens the plausibility of a deliberate deskilling mechanism, rather than random variation, as a structural response to persistent labor shortages. The following econometric analysis formally tests the strength and statistical significance of this relationship.

5.3.4 Methodology and results

Once the dataset was compiled and cleaned, a **fixed effects panel regression model was estimated** (Stock and Watson, 2020). The objective is to assess how the variation in the shortage in a given year affects the proportion of staff belonging to three different qualification levels (low, medium, high) in the following year. The reference econometric model is specified as follows:

$$\text{share}_{rqt} = \alpha + \beta_q \cdot \text{shortage\_ratio}_{r,t-1} + \delta_r + \theta_t + \varepsilon_{rqt} \tag{24}$$

- share_{rqt} is the share of personnel with qualification level q (low, medium, high) out of the total number of employees in region r in year t;
- $\text{shortage\_ratio}_{r,t-1}$ is our explanatory variable of interest and measures the shortage ratio in region r in the previous year $(t-1)$. The use of the time lag is crucial to respect the causal sequence and reduce the risk of endogeneity from simultaneity;
- δ_r and θ_t represent, respectively, the fixed effects of the region and the fixed effects of the year. They control for all time-invariant regional characteristics (e.g., demographic composition, historical educational provision) and national time shocks (e.g., macroeconomic cycles or reforms);
- ε_{rqt} is the error term. Standard errors are clustered at the regional level to correct for potential serial autocorrelation within individual regions.

Interpretation of Coefficients. The interpretation of the coefficient β_q is fundamental to verify the central hypothesis of the analysis, according to which staff shortages trigger a process of targeted deskilling. In this scenario, it is assumed that organizations tend to fill highly skilled positions with staff with intermediate skills. At the econometric level, this substitution mechanism would translate into a **negative and statistically significant** coefficient for the share of **highly qualified** (*high*) personnel, compared to a **positive and significant** coefficient for **medium-skilled** (*medium*) personnel, which would represent important evidence of adaptation. The model for **low-skilled** (*low*) personnel serves as a control term to determine the extent of the phenomenon. If the coefficient for this group is not significant, this would confirm that the reskilling process is limited to medium-high professional levels. If, on the contrary, this coefficient also proves to be positive and significant, this would indicate a more pervasive phenomenon of deskilling, with a lowering of entry requirements extended to the entire employment structure and not just confined to the replacement of high and medium qualifications.

hRobustness check Finally, to ensure that the estimated effects do not depend on a particular specification or exceptional events, a number of targeted robustness tests were performed. In summary:

- **Two-year lag** ($t-2$): to verify the persistence of the effect beyond the annual horizon.
- **Chow test and separate pre/post 2020 estimates**: to detect whether 2020 marks a structural break in the shortage–qualification relationship and to compare the estimated coefficients before and after that year (Stock and Watson, 2020).
- **COVID-free sample (2020–2021 excluded)**: to re-estimate the model excluding the most volatile years of the pandemic. Its purpose is to reveal the underlying structural relationship between shortages and skills composition, free from the confounding effects and significant distortions introduced by the health crisis.
- **Placebo test - shortage** ($t+1$): to test for reverse causality; an insignificant coefficient confirms the correct temporal order (Eggers et al., 2024).

Results. The results of the baseline model, presented in the **Table 8**, provide clear initial support for the degree resetting hypothesis. An increase in the shortage ratio recorded in the previous year is associated with a statistically significant decrease in the share of highly qualified personnel ($\beta = -0.175$) and an equally significant increase in the share of medium-qualified personnel ($\beta = +0.282$). Importantly, the model reveals a smaller but significant reduction in the share of low-qualified staff ($\beta = -0.106$), confirming that the adjustment is not driven by an indiscriminate lowering of entry standards but rather by a targeted shift from highly specialised profiles toward intermediate qualifications. On average, therefore, healthcare facilities appear to respond to difficulties in recruiting specialised staff by favouring individuals with intermediate credentials, while simultaneously contracting both extremes of the skill distribution.

Robustness and Isolation of the Underlying Relationship. Although informative, an estimated average effect on the entire sample risks masking heterogeneous temporal dynamics and, above all, does not allow to distinguish between a persistent trend and a reaction to exogenous shocks. A central question for this analysis is whether the observed resetting process is a structural phenomenon, i.e., an established strategic response to staff shortages, or a cyclical dynamic, mainly linked to the unprecedented shock of the COVID-19 pandemic.

To answer this question, the analysis was specifically designed to separate these two potential components. A Chow test was performed to formally verify the presence of a structural break during the pandemic period. The test confirmed a statistically significant change, both for Wallonia and Flanders, in the relationship starting in 2020 ($p < 0.05$). This result shows that the pandemic has effectively altered the underlying dynamics and, as a result, enables a more granular analysis to study how the model behaved specifically around the pandemic period.

Accordingly, the model was re-estimated by excluding the pandemic years (2020–2021, **Table 9**). This additional analysis yields results of considerable importance: the signs of the coefficients remain consistent with the initial estimate, but their magnitude increases: the negative impact on the share of highly skilled personnel is almost thirty times larger ($\beta = -5.60$), as is the positive impact on the share of medium-skilled personnel ($\beta = +6.20$). This indicates that the deskilling process is not a marginal phenomenon but a powerful structural lever whose intensity had been substantially underestimated in the full-sample model, probably due to the volatility introduced by the pandemic.

To explore the temporal profile of this adjustment further, a model with a two-year lag ($t-2$) was also estimated (**Table 8**). Again, the results confirm the robustness of the relationship, showing large and significant coefficients. This suggests that staff substitution is not merely a short-term tactical reaction but a human-resource management policy whose effects consolidate and manifest over a medium- to long-term horizon.

5.3.5 Discussion of limitations

These results must be interpreted in light of several inherent limitations. First, the small sample size, although statistically sufficient for significant estimates, should caution against generalizing the conclusions to the entire Belgian healthcare system. Secondly, a placebo test (**Table 9**), re-estimating the regressions with the *future* shortage ratio ($t+1$) in place of the lagged value, yields coefficients that remain statistically significant but exhibit an *opposite sign configuration*: the share of high-qualified staff increases, the share of medium-qualified staff declines and the share of low-qualified staff rises. Rather than invalidating the deskilling story, this pattern suggests that part of the relationship may run in the other direction as well, with today's skill composition reflecting expectations about staffing pressures that will materialise in the following year. In other words, departments that currently employ many specialists, or, at the other extreme, many low-qualified nurses, are precisely those that tend to register higher shortages later on, possibly because highly skilled staff are more mobile or because hiring plans already incorporate anticipated gaps. The placebo therefore underlines the presence of anticipatory dynamics and the notable persistence of the shortage indicator, inviting a cautious, though still consistent, reading of the deskilling mechanism as one element within a more complex, potentially bidirectional process.

In conclusion, despite methodological caveats, the body of empirical evidence converges on a coherent and robust narrative. The econometric region-level analysis demonstrates that nursing staff shortages are associated with a persistent process of deskilling. Healthcare institutions appear to respond strategically to shortages not so much by increasing overall recruitment but by reshaping entry requirements and favoring the employment of intermediate-level staff at the expense of more specialized profiles.

5.4 DiD Analysis on Foreign Nurse Inflows

After analyzing the relationship between staff shortages and qualifications at the regional and national levels, the analysis has been extended with a **Difference-in-Differences** model based on the 2016 reform, which extended the nursing program to four years in the French Community, leading to a sharp decline in graduates in 2019. The aim is to verify whether this shock triggered a compensation mechanism through increased recruitment of nurses from non-EU countries, whose qualifications are not automatically recognized under Directive 2005/36/EC (European Parliament and Council, 2005)[36]. In this case, the increase in inflows from third countries could represent an **indirect** form of degree resetting. The analysis relies on the OECD Health Workforce Migration dataset, which provides annual inflow data for foreign-trained health professionals (MINU category for nurses) by

[36]For qualifications obtained outside the EU, recognition is granted through national assessment and not through an automatic procedure.

origin and destination country for the period 2007–2022 (OECD, 2024b). The treatment group is Belgium, while France, Germany and the Netherlands are used as control countries. The selection of these countries as a control group is justified by a preliminary analysis of vacancy rates in the healthcare sector (**Figure 12**): prior to 2019, the levels and dynamics observed in the four countries were comparable, while in the subsequent period all recorded a sharp increase in vacancy rates, likely linked to demand shocks induced by the pandemic. This convergence in trends supports the validity of the assumption of parallel trends and allows any divergences in personnel flows to Belgium to be interpreted as effects of the reform rather than spurious trends.

5.4.1 Methodology and Results

An inflow is defined as potentially reflecting *degree resetting* if the following conditions are jointly met: (i) the destination country is Belgium; (ii) the year is post-reform, i.e., $Post_{it} = \mathbb{1}[\text{Year} \geq 2019]$; and (iii) the country of training is outside the EU/EEA system and therefore not eligible for automatic recognition under Directive 2005/36/EC. Origin countries are grouped into two categories: the first includes EU countries with comparable healthcare systems and qualification frameworks (referred to as *EU spillover*), while the second comprises Non-EU countries whose degrees are not automatically recognized (referred to as *Non-EU*). The inflow is normalized by total population using OECD demographic tables

$$InflowPC_{it} = \frac{Inflow_{it}}{Population_{it}} \times 100{,}000 \tag{25}$$

The main specification relies on a triple-difference (DDD) model:

$$\begin{aligned} InflowPC_{it} = {} & \beta_0 + \beta_1 Treat_i + \beta_2 Post_t + \beta_3 NonEU_{it} + \beta_4 (Treat_i \cdot Post_t) \\ & + \beta_5 (Treat_i \cdot NonEU_{it}) + \beta_6 (Post_t \cdot NonEU_{it}) \\ & + \beta_7 (Treat_i \cdot Post_t \cdot NonEU_{it}) + \gamma_t + \delta_i + \varepsilon_{it} \end{aligned} \tag{26}$$

where $Treat_i = \mathbb{1}[i = \text{BEL}]$ identifies the treated country, $Post_t$ captures the post-reform period, and $NonEU_{it}$ flags non-EU origin countries. Year and destination fixed effects are denoted by γ_t and δ_i. The coefficient of interest is β_7, which captures the net change in non-EU inflows to Belgium relative to control countries following the reform.

To validate the identification strategy, a pre-trend check is carried out by estimating the following equation for the pre-reform period (2007–2018):

$$InflowPC_{it} = \alpha + \beta_1 Treat_i + \beta_2 Trend_t + \beta_3 (Treat_i \cdot Trend_t) + \delta_i + \varepsilon_{it} \tag{27}$$

The result $\hat{\beta}_3 = -1.88 \times 10^{-5}$ with $p = 0.196$ indicates no significant divergence in pre-reform trends between Belgium and the control countries, supporting the validity of the parallel trends assumption and, consequently, of the DDD estimator.

Identification Assumptions. The causal interpretation of the effect estimated by the triple-difference (DDD) model requires that certain key assumptions be met:

- **Parallel Trends**: in the absence of the reform, the trajectory of nurse inflows from non-EU countries to Belgium would have followed a pattern similar to that observed in the control countries (France, Germany and the Netherlands).
  → This assumption is supported by the pre-trend check for the 2007–2018 window, the results of which do not show significant differences between Belgium and the control countries (Equation 17).

- **Absence of confounding shocks specific to Belgium**: there must be no events, reforms, or structural changes other than the 2016 reform that have affected Belgium alone since 2019 and that could have independently influenced non-EU healthcare worker flows.
  → Controlling for the effect of COVID (variables $COVIDID_t$ and $COVIDID \times NonEU$) reduces the risk of attributing pandemic effects to the reform, showing that the results are robust even to such heterogeneity.

- **Stability in the composition of groups**: the classification of countries of origin into "EU" and "non-EU" must remain stable over time, so that the indicator $NonEU_{it}$ is consistent and is not altered by changes in the list of automatically recognized countries.
  → In this case, the extra-EU definition is consistent with Directive 2005/36/EC, which establishes the automatic recognition mechanism only for EU/EEA countries.

- **Absence of spillover**: the intervention (2016 reform) must not indirectly affect the control countries (e.g., through crowding-out effects); otherwise, the assumption of independence between groups would be violated.
  → The selection of countries with similar but independent healthcare systems, combined with a focus on inflows to Belgium, minimizes the risk of geographical or institutional spillovers.

Results. The main coefficient of interest from the triple-difference model is negative and statistically significant:

$$\hat{\beta}_7 = -0.0057 \quad (p = 0.014) \tag{28}$$

This estimate implies that, after 2019, the inflow of nurses from Non-EU countries into Belgium declined by 0.0057 per 100,000 inhabitants relative to the counterfactual trend in control countries and EU-origin flows.
Two additional tests are performed to verify the stability of the results:

1. **Excluding COVID years (2020–2021):** This isolates the effect of the reform from pandemic-related disruptions.

2. **Controlling for COVID shock heterogeneity:** Two dummies are included to allow for pandemic-specific effects:

$$COVID_t = \mathbb{I}[t \in \{2020, 2021\}] \tag{29}$$

$$COVID\_NonEU_{it} = COVID_t \cdot NonEU_{it} \tag{30}$$

These variables account for the possibility that Non-EU migration may have been more strongly affected by pandemic-related restrictions.

In both specifications, the estimate on $\hat{\beta}_7$ remains negative and statistically significant, albeit slightly attenuated. The COVID-related terms are not significant, strengthening the credibility of the baseline DDD result.

Graphical Evidence. A visual inspection of normalized inflow trends supports the identification strategy:

- Before 2019, Belgium consistently attracted more foreign-trained nurses, especially from Non-EU countries, than the selected control countries.
- After 2019, contrary to the deskilling hypothesis, **Non-EU inflows into Belgium declined**, whereas Germany experienced a sharp increase.
- EU-origin inflows into Belgium remained stable or slightly increased, indicating a possible substitution effect in favor of degrees subject to automatic recognition.

Discussion of Results. The results of this analysis reject the initial hypothesis. Contrary to expectations, the shock of the nursing shortage in Belgium did not lead to an increase, but rather to a reduction in the inflow of personnel from **non-EU countries**. This outcome is **counterintuitive** when considering the theory of degree resetting, which would predict an increase in personnel with non-automatically recognized qualifications. The theory of degree resetting posits that employers relax formal requirements during a shortage to meet operational needs. In this context, non-EU nursing qualifications are not subject to the automatic recognition guaranteed to EU credentials under **Directive 2005/36/EC.** Tapping into this non-EU talent pool would therefore represent a functional relaxation of standards, which is why an increased inflow was the expected response to the shortage. The analysis suggests this unexpected result can be explained by a combination of factors that prevailed over the simple need to fill vacancies:

1. **Bureaucratic Barriers:** The process of recognizing a non-EU qualification is a national assessment rather than an automatic procedure, which can be long and uncertain, discouraging both employers and candidates.
2. **Substitution Effect with EU Staff:** Faced with shortages, recruitment efforts likely intensified towards EU countries, whose qualifications are automatically recognized, representing a lower-friction recruitment channel.
3. **International Competition:** Belgium competes for the same pool of global talent as other countries. The graphic analysis (**Figure 13**) shows, for example, that Germany significantly increased its non-EU recruitment during the same period, probably diverting candidates who would otherwise have gone to Belgium. In fact, Germany has implemented proactive policies in this regard, such as the Skilled Labor Immigration Act *(Fachkräfteeinwanderungsgesetz)* of 2020 and direct recruitment programs such as the 'Triple Win' (GIZ – Deutsche Gesellschaft für Internationale Zusammenarbeit, 2023), (Federal Government, 2020).

4. **Language and Integration Costs:** The specific language requirements of the Belgian healthcare system may represent an additional barrier and a significant cost for the integration of personnel from a global talent pool.

5.4.2 Conclusion

The empirical analysis conducted in this second part of the paper, provides solid and detailed evidence of the existence of a structural adjustment mechanism within the Belgian healthcare system in response to the growing shortage of qualified nursing staff. At the aggregate level, the use of the Job Vacancy Rate as a measure for shortages confirms that, when faced with an increase in vacancies, healthcare facilities tend to re-balance the composition of their workforce: there is a **significant increase** in the share of intermediate-level profiles, accompanied by a **decline** in highly qualified profiles and, to a lesser extent, in less qualified profiles. This shift suggests a targeted adjustment, in which the system favors candidates with average skills, probably for reasons of operational efficiency and lower training requirements.

These findings are confirmed and further explored in the panel analysis based on regional data, which uses a synthetic shortage indicator constructed at the territorial level. The fixed-effects regression model shows a statistically significant relationship between shortages and workforce composition: an increase in the shortage ratio is associated with a reduction in the share of highly skilled workers and an increase in medium-skilled profiles. Furthermore, robustness checks confirm that this relationship is not a cyclical phenomenon linked to the pandemic context, but rather a **persistent and structural mechanism**, which also manifests itself with a delay of one or two years. The Chow test identifies a structural break in 2020, but excluding the pandemic years further strengthens the intensity of the effect, suggesting that recent volatility has actually masked the true extent of deskilling.

Finally, causal analysis of the inflow of nursing staff trained abroad, using a difference-in-differences model, shows an unexpected result: contrary to the initial hypothesis, the number of nurses from non-EU countries decreased after the 2019 training crisis in the French Community. This rejection of the degree resetting theory on an international scale can be attributed to various institutional and market obstacles: the bureaucratic complexity of recognizing non-EU qualifications, a preference for EU candidates subject to automatic recognition, more aggressive international competition (e.g., Germany) and linguistic and cultural barriers that limit the integration of non-EU personnel.

In other words, the results converge towards a coherent narrative: in Belgium, the process of adaptation to supply constraints in the healthcare sector takes the form of internal deskilling, i.e., through the gradual lowering of the actual qualification requirements for new hires. Nonetheless, this form of adaptation cannot be easily applied to international channels, which are still constrained by regulatory rigidities and structural obstacles. Degree resetting is therefore a domestic and selective strategy, made possible by a flexible institutional context at the domestic level but still heavily constrained in the area of migration.

6 Final Conclusions

This dissertation aimed to explore a phenomenon that is as widespread as it is understudied in the European context: "degree resetting," or the systematic reduction of formal educational requirements in response to growing labor shortages. Through an in-depth analysis of the education and healthcare sectors in Belgium, the research has not only confirmed the existence of this mechanism, but has also revealed its complex nature, heterogeneous dynamics and profound structural implications. The conclusions paint a picture of a system that, faced with institutional rigidity, has identified professional qualifications as its most flexible margin for adjustment, triggering a silent but profound transformation in recruitment practices.

6.1 The Education Sector: A History of Structural and Segmented Adaptation

The analysis of the education sector provided a robust and multifaceted evidence of "degree resetting." The first phase of the study, based on aggregated PISA data, revealed a clear and systemic dynamic: an increase in the perceived shortage of teachers corresponds to a statistically significant decrease in the share of formally certified staff (PROPCERT). This result, which is stable across different model specifications, suggests that this is not a cyclical or transitory phenomenon, but a structural adjustment mechanism. Schools, in order to cope with the difficulty of finding candidates, seem willing to sacrifice pedagogical certification in order to maintain high academic qualification standards (PROPQUAL), in a delicate strategic compromise. However, a disaggregated analysis of data from the Wallonia-Brussels Federation reveals the profound heterogeneity of this phenomenon. Degree resetting is not a monolithic process, but manifests itself with varying intensity and in different ways depending on the school level and subject area. In secondary education, the response to shortages is exceptionally intense, almost an automatic mechanism of downgrading requirements. This vulnerability is exacerbated by critical shortages in specific subjects and a rigid system that offers few other tools for flexibility, such as salary adjustments. In contrast, in primary education, the reaction is much more contained. Here, the 'generalist' profile of teachers and structural incentives, which do not reward higher qualifications (such as Master's degrees associated with Bareme 501), create a labor market that is inherently more homogeneous and less sensitive to the shortage of hyper-specialized profiles. Finally, the analysis by subject area made it possible to map the most critical areas with precision, showing how the phenomenon is concentrated in technical and vocational subjects in secondary education and in subjects such as physical education and philosophy in primary education. In summary, the education sector is adapting its standards in a heterogeneous and segmented manner, responding to labor market frictions through targeted downgrading of qualifications.

6.2 The Healthcare Sector: Internal Deskilling and External Barriers

At the same time, analysis of the healthcare sector, with a focus on the nursing profession, confirmed the existence of a structural adjustment mechanism, even if with peculiar dynamics. The increase in vacancies is associated with a rebalancing of the workforce, with an increase in the share of intermediate-skilled profiles at the expense of highly skilled ones. Here too, stress tests confirm that this is a persistent trend and not a contingent reaction to the COVID-19 pandemic; indeed, the volatility of the pandemic period has probably masked the real intensity of the deskilling phenomenon.

The most surprising and counterintuitive conclusion emerged from the analysis of flows of personnel trained abroad. Contrary to the initial hypothesis, the supply shock generated by the reform of nursing courses did not lead to an increase in recruitment from non-EU countries. This "unexpected result" reveals a fundamental truth: "degree resetting" in Belgium is a predominantly domestic strategy. The adjustment takes place through a lowering of internal requirements ("internal deskilling"), but does not easily extend to international channels. Bureaucratic obstacles related to the recognition of qualifications, strong competition from other European countries (such as Germany) and linguistic and cultural barriers make global recruitment a complex and uncertain path. The healthcare system therefore responds to the shortage by changing the composition of its internal workforce, as external borders remain rigid and difficult to penetrate.

6.3 Final Thoughts: A Silent Compromise and Challenges for the Future

Beyond sector-specificities, a powerful thread emerges from this thesis: in sectors such as education and healthcare, characterized by rigid wages and stringent professional regulations, educational qualifications become the de facto adjustment variable. Degree resetting is not an explicit policy, but an emerging strategy, a pragmatic response born out of the daily need to ensure the continuity of essential services. This observation opens up crucial reflections on two interconnected fronts. The first concerns the quality of services. While this mechanism of implicit flexibility allows systems to avoid collapse, it also introduces a risky trade-off between present efficiency and future quality. What is the cumulative impact of hiring teachers without full pedagogical certification on the quality of learning? What are the long-term consequences of a progressive "deskilling" of nursing staff on the safety of care? The second, perhaps even more profound, area for reflection concerns the very value of education and the future careers of students. What signal does a labor market that systematically lowers its standards send? If the "signaling value" of a degree weakens and the "salary premium" for graduates decreases, as highlighted in the literature, will students still be incentivized to pursue long, expensive and demanding educational paths? A decline in enrolment in master's degree courses or specialisations could emerge, triggering a dangerous vicious circle: lower demand for high qualifications from companies could lead to a lower supply of highly qualified graduates, further normalising the recruitment of profiles with lower skills and leading to a structural 'de-skilling' of the entire workforce. The question, therefore, is whether this trend will ultimately erode the country's human capital, reducing the overall level of education of the working population. The resulting policy implications are complex and cannot be limited to a simple call to 'train more graduates'. Action is needed on two levels. On the one hand, the structural rigidities that force this compromise must be addressed: revising career paths and pay scales in these sectors to make professions more attractive, simplifying procedures for recognizing foreign qualifications to open up alternative recruitment channels and investing more in continuing education to bridge skills gaps. On the other hand, it is essential to support the value of higher education: policies must protect and strengthen incentives for students to pursue excellence, ensuring that investment in education continues to translate into better career opportunities and economic rewards. In conclusion, this study is not a point of arrival, but a fundamental starting point. It has validated and quantified a phenomenon that has been little explored until now, offering a detailed map of its mechanisms. Future research should focus on longitudinal analyses to track the professional outcomes of 'reset' staff and rigorously measure the impact of these

practices on the quality of services provided to citizens. 'Rethinking degrees' is a process already underway, driven by market forces. The real challenge now is to manage it wisely, to transform an adaptation dictated by necessity into an opportunity for innovation, without sacrificing the excellence that citizens and students deserve.

7 Appendix

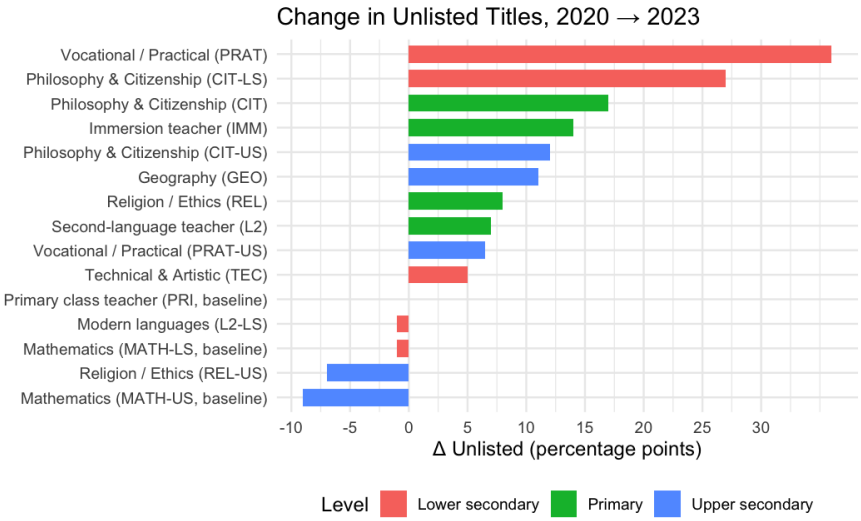

Figure 1: Variation in the share of newly hired teachers holding unlisted titles (i.e., degrees not formally recognised in current decrees) across subjects and education levels in the Fédération Wallonie-Bruxelles.

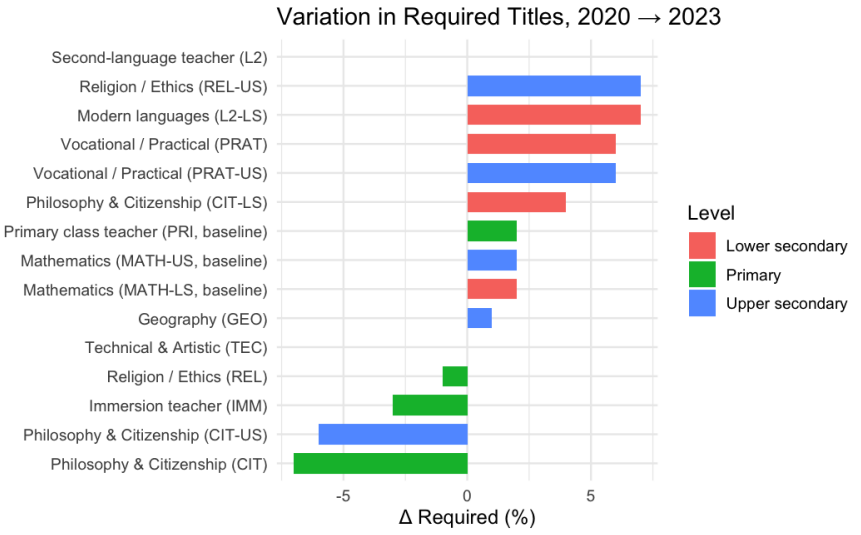

Figure 2: Change in the share of newly hired teachers holding a required title aligned with their subject and level.

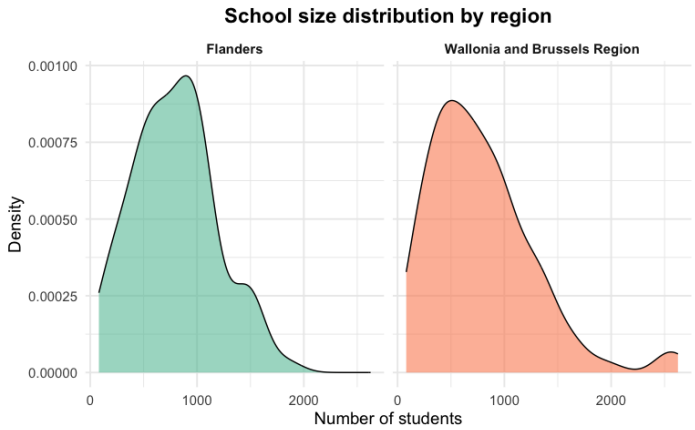

Figure 3: Distribution of school size by region (number of students per school in 2022).

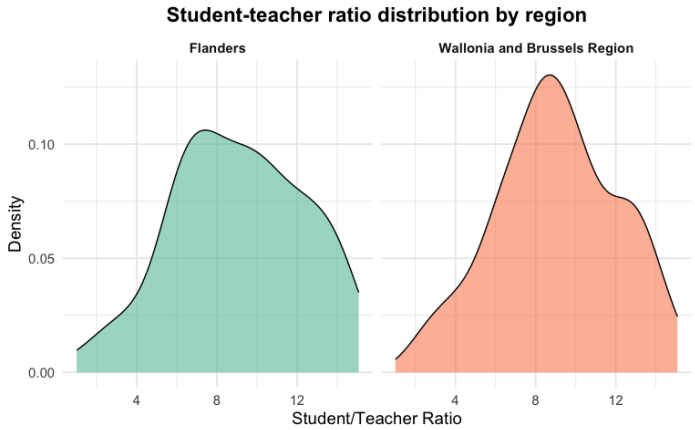

Figure 4: Distribution of the student-teacher ratio across regions, highlighting a higher ratio in Wallonia and Brussels.

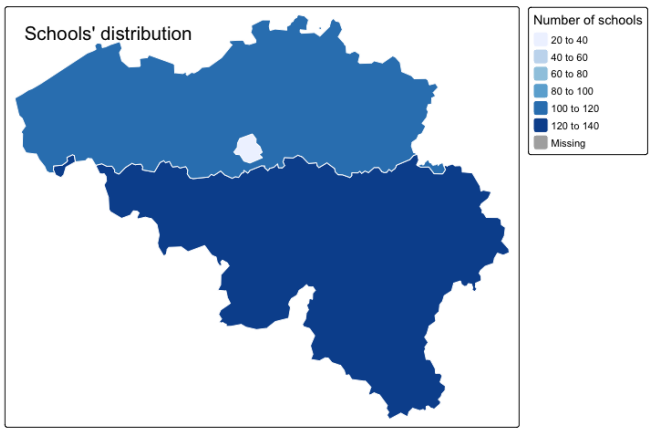

Figure 5: Geographical distribution of surveyed schools in Belgium (PISA 2022), by NUTS1 region.

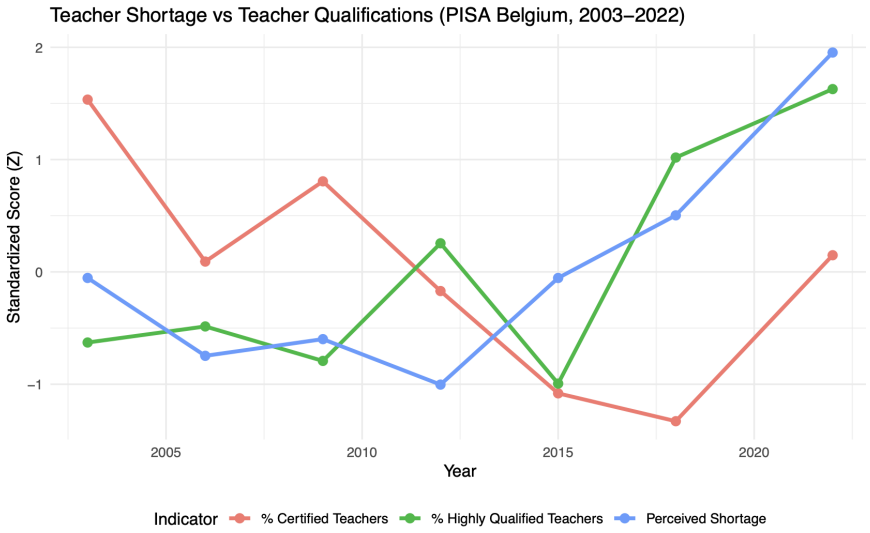

Figure 6: Evolution, from 2003 to 2022, of three key indicators in the Belgian school system: teacher shortage (blue line), percentage of certified teachers (red line) and percentage of highly qualified teachers (green line).

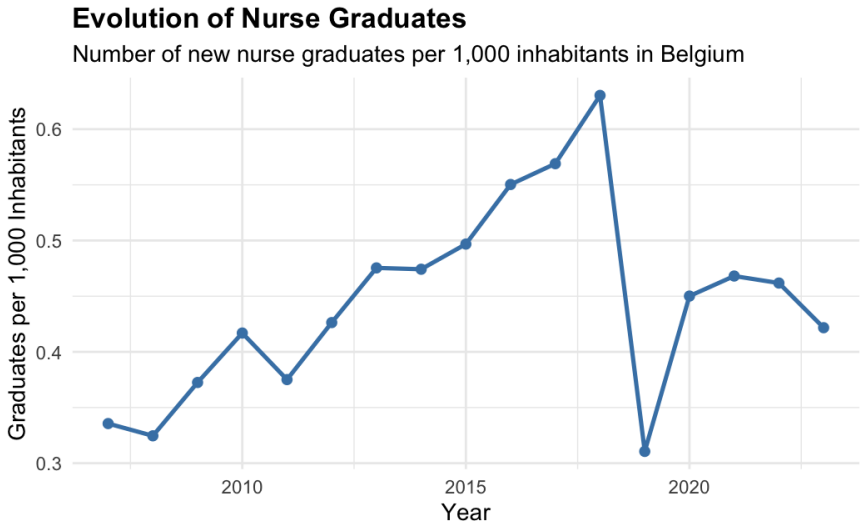

Figure 7: Evolution from 2007 to 2023, of the per-capita flow of new nurses graduating into the Belgian labor market.

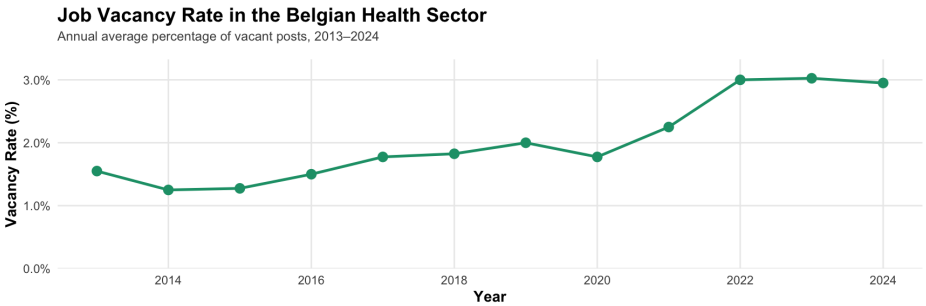

Figure 8: Annual trend of unfilled positions in the health sector

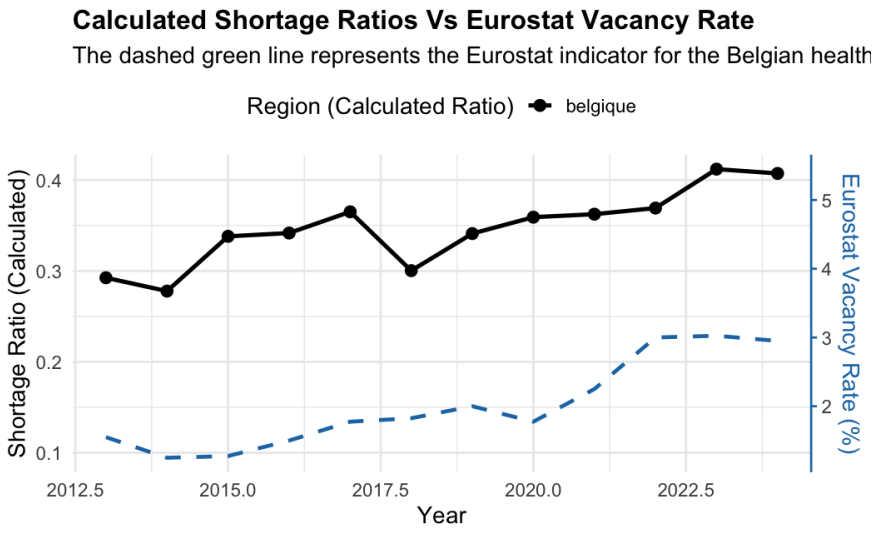

Figure 9: Comparison between calculated nurse shortages and Eurostat's health vacancy rate

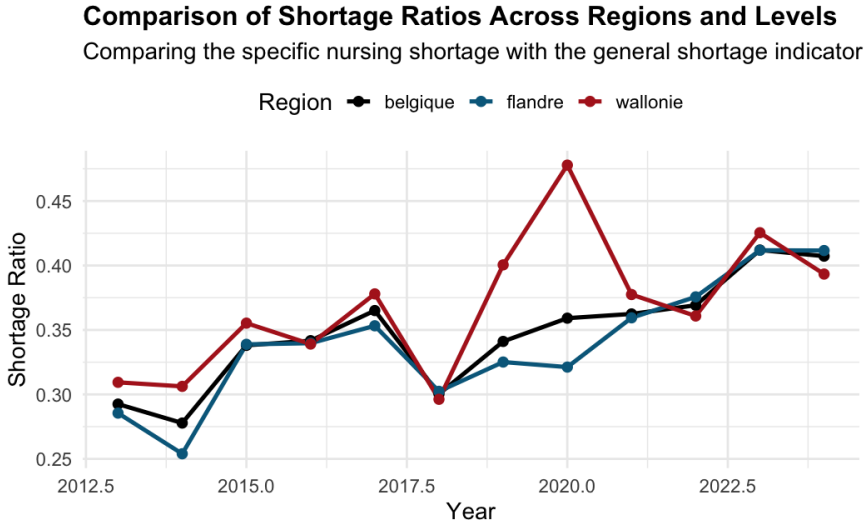

Figure 10: Shortage ratios for nurses across Belgium, Flanders and Wallonia from 2013 to 2024

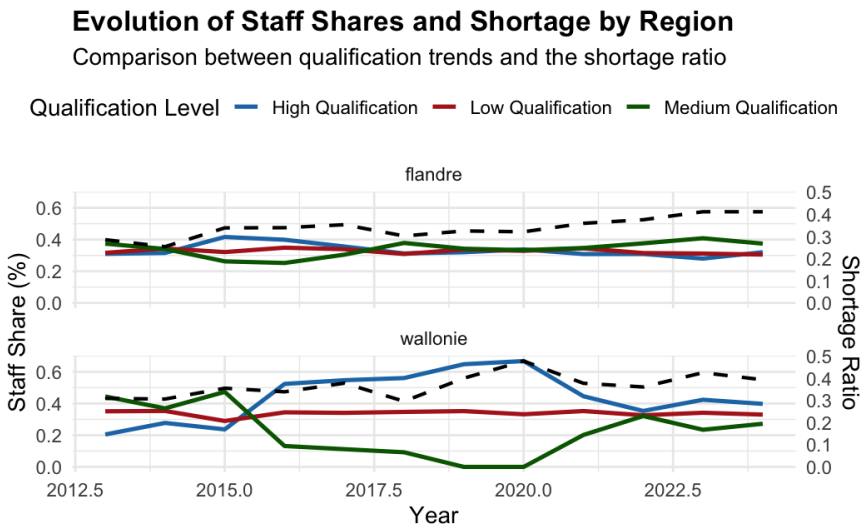

Figure 11: Evolution of staff shares by qualification level and shortage ratio in Flanders and Wallonia

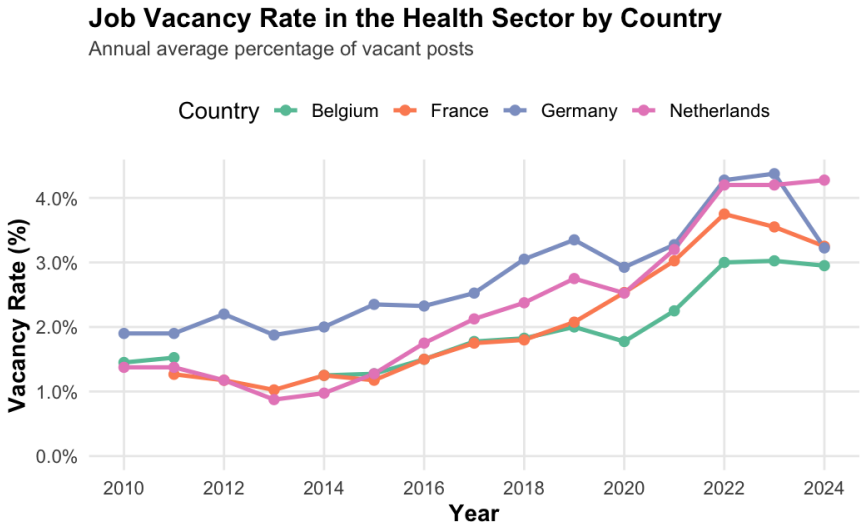

Figure 12: Annual Job Vacancy Rate in the Health Sector by Country

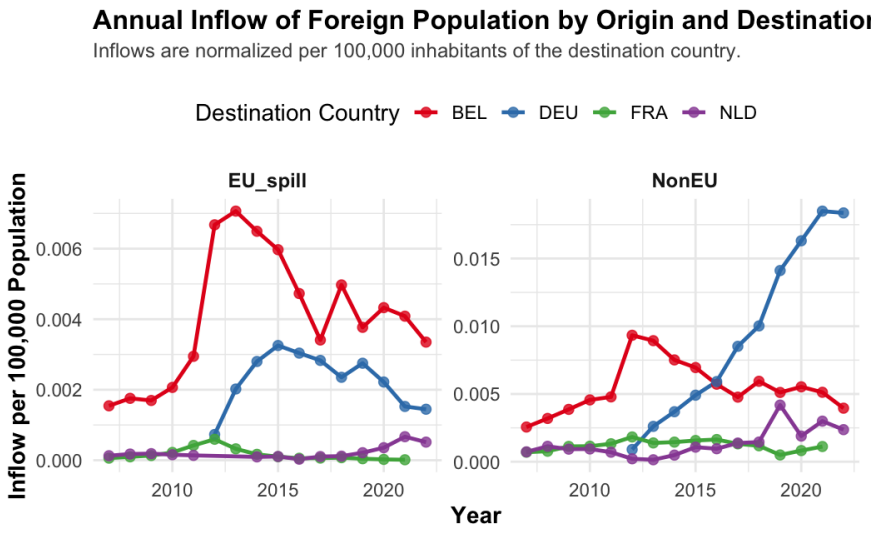

Figure 13: Per-Capita Inflow of Migrants by Origin and Destination. Each line represents a destination country, while each panel corresponds to a different origin group. Inflows are normalized by the destination country's population

Table 1: Distribution by School Type

School Type	n	%
Private government-dependent	51	17.9
Private independent	11	3.9
Public	44	15.4
NA	179	62.8

Table 2: Distribution by Area

Area	n	%
City (100k–1M)	43	15.1
Large city (1M–10M)	17	6.0
Small town (3k–15k)	68	23.9
Town (15k–100k)	135	47.4
Village (¡3k)	5	1.8
NA	17	6.0

Table 3: Original Distribution by Region

Region	n	%
Flanders	113	39.6
Wallonia and Brussels Region	172	60.4

Table 4: Effect of Perceived Shortage on Teacher Certification (PROPCERT)

	Baseline	Interaction	No 2022	Weighted
index_shortage	-0.025^{***}	-0.066	-0.025	-0.024^{***}
	(0.0047)	(0.0555)	(0.0550)	(0.0071)
log(SCHSIZE)	0.018	0.0061	0.018	0.016
	(0.0120)	(0.0210)	(0.0210)	(0.0240)
index_shortage × *log(SCHSIZE)*	–	0.0063	–	–
	–	(0.0091)	–	–
Year FE	Yes	Yes	Yes	Yes
Clustering	Year	Year	Year	Year
Observations	1,563	1,563	1,546	1,563
Adjusted R^2	0.028	0.027	0.028	0.024

Note: Year fixed effects included. Standard errors clustered by year in parentheses.
$^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$

Table 5: Effect of Perceived Shortage on Teacher Qualification Level (PROPQUAL)

	Baseline	**Interaction**	**No 2022**	**Weighted**
index_shortage	–0.014*	0.0026	–0.011	–0.012 †
	(0.0071)	(0.0555)	(0.0555)	(0.0071)
log(SCHSIZE)	**0.079*****	**0.084*****	**0.077*****	**0.061***
	(0.0072)	(0.0204)	(0.0204)	(0.0244)
index_shortage × *log(SCHSIZE)*	–	–0.0026	–	–
	–	(0.0091)	–	–
Year FE	Yes	Yes	Yes	Yes
Clustering	Year	Year	Year	Year
Observations	1,563	1,563	1,546	1,563
Adjusted R^2	0.053	0.052	0.046	0.028

Note: Year fixed effects included. Standard errors clustered by year in parentheses.
$^{\dagger}p < 0.1$ $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

Table 6: National-Level/Health Sector: OLS with structural break in 2020

Term	**Estimate**	**Std. Error**	***t* value**	***p*-value**
(Intercept)	−96.4142	29.3044	−3.290	0.0017**
time_index	0.0486	0.0145	3.345	0.0015**
post_2020	−531.1153	99.5576	−5.335	< 0.0001***
time_post_2020	0.2629	0.0492	5.340	< 0.0001***

Table 7: National-Level: impact of Job Vacancy Rate (t–1) on nurse qualification shares

	share_medium	**share_high**	**share_low**
Constant	0.200*** (0.041)	0.449*** (0.034)	0.351*** (0.009)
Vacancy (t–1)	0.050* (0.017)	–0.041* (0.014)	–0.010* (0.004)
S.E. type	Newey–West (L=1)	Newey–West (L=1)	Newey–West (L=1)
Observations	11	11	11
R^2	0.38761	0.35928	0.22958
Adj. R^2	0.31106	0.27919	0.13327

Note: Newey–West standard errors in parentheses. Significance levels: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 8: Regional-Level: Effect of the nurse–shortage ratio on qualification shares: baseline and lag–($t-2$) estimates

	Baseline – Lag ($t-1$)			**Robustness** – Lag ($t-2$)		
	Low	Medium	High	Low	Medium	High
Shortage coeff.	-0.106^{***}	0.282^{***}	-0.175^{***}	-0.063^{***}	0.929^{***}	-0.866^{***}
Observations	22	22	22	20	20	20
R^2	0.749	0.632	0.625	0.708	0.685	0.676
Within R^2	0.077	0.007	0.003	0.026	0.085	0.086

Note: Dependent variables are the regional shares of personnel with low, medium, or high qualification. All specifications include region and year fixed effects; standard errors are clustered at the regional level. *** $p < 0.01$.

Table 9: Robustness checks: excluding the pandemic biennium and placebo with future shortage

	No–COVID sample (excl. 2020–21)			**Placebo test** – Lag ($t+1$)		
	Low	Medium	High	Low	Medium	High
Shortage coeff.	-0.600^{***}	6.203^{***}	-5.598^{***}	0.125^{***}	-1.390^{***}	1.260^{***}
Observations	16	16	16	22	22	22
R^2	0.791	0.810	0.803	0.721	0.671	0.653
Within R^2	0.331	0.555	0.542	0.105	0.164	0.147

Note: "No–COVID" sample excludes the pandemic years 2020–2021. Placebo regressions replace the lagged shortage with the *future* shortage ratio ($t+1$).All models include region and year fixed effects and cluster standard errors at the regional level. *** $p < 0.01$.

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