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The Value of Dual Education in Italy: Evidence from the Apprenticeship Reform

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Tommaso Nannicini

The Value of Dual Education in Italy: Evidence from the Apprenticeship Reform

Simona Comi

(University of Milano-Bicocca and IZA)

The Value of Dual Education in Italy: Evidence from the Apprenticeship Reform

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October 2024

Abstract

Limited evidence exists regarding the effectiveness of dual education systems. This paper addresses this gap by investigating the impact of Italy's Level I Apprenticeship reform, which integrates apprenticeships into the school curriculum, thereby establishing Italy's first comprehensive dual education model. Exploiting the staggered regional implementation of the reform, I apply multiple quasi-experimental techniques, including inverse probability weighted regression adjustment (IPWRA) and event study methods, to estimate the reform's causal effects on labour market outcomes. The findings reveal a significant positive impact on employment probability and earnings, with considerable variation across demographic groups and firm characteristics. Specifically, dual education returns are more substantial for females and minors. Additionally, the reform has increased transitions to Level II apprenticeships and the probability of having an open-ended contract.

JEL Codes: I26, J24, J31

Keywords: Vocational Education and Training; Dual education; Apprenticeship; Returns to Education; Youth Labour Market;

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Il Valore dell'Istruzione Duale in Italia: Evidenze dalla Riforma dell'Apprendistato.

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Ottobre 2024

Abstract

L'evidenza sull'efficacia e i rendimenti dell'istruzione duale è ancora limitata. Il presente lavoro intende colmare questa lacuna indagando l'impatto della riforma dell'apprendistato di I livello, che ha integrato l'apprendistato nel curriculum scolastico introducendo l'apprendimento duale nel sistema di istruzione italiano. Questa ricerca sfrutta l'attuazione regionale scaglionata nel tempo della riforma, consentendo l'applicazione di tecniche di identificazione causale quasi-sperimentali, come l'event study e l'Inverse Probability Weighted Regression Adjustment (IPWRA), per stimare gli effetti causali della riforma sui risultati del mercato del lavoro. I risultati rivelano un impatto positivo e significativo sia sulla probabilità di occupazione sia sui salari. In particolare, i benefici sono più consistenti per le donne e per i minorenni. Inoltre, la riforma ha aumentato le transizioni verso l'apprendistato di II livello e l'ottenimento di contratti a tempo indeterminato.

JEL Codes: I26, J24, J31

Parole Chiave: Istruzione e Formazione Professionale; Apprendimento duale; Apprendistato; Rendimenti dell'istruzione; Mercato del Lavoro dei Giovani.

²I risultati e le conclusioni contenuti nel presente lavoro appartengono all'autrice e non rappresentano il punto di vista dell'INPS. Si ringraziano Arif Anindita, Annalisa Cristini, Mara Grasseni e Federica Origo, oltre ai partecipanti ai seminari presso l'Università di Milano-Bicocca e a due seminari online presso l'INPS, per i loro utili commenti. La realizzazione di questo articolo è stata resa possibile grazie alle sponsorizzazioni e alle erogazioni liberali a favore del programma "VisitINPS Scholars". Ringrazio la Direzione centrale Studi e Ricerche dell'INPS, in particolare Daniele Checchi, per l'assistenza fornita nell'accesso ai dati. Questa ricerca è parte del progetto PRIN 2022, finanziato dall'Unione Europea - Next Generation EU, Missione 4 Componente 1 (CUP H53D23002470006). Tutti gli errori sono miei.

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1. Introduction

The political agenda of the European Union (EU) as a whole, and Italy in particular, prioritizes combating school dropouts, youth unemployment, and the ‘not in education, employment, or training’ (NEET) phenomenon. To this end, the EU has set ambitious goals under the Strategic Framework for European Cooperation in Education and Training 2030 (European Commission, 2020), and, since then, substantial resources have been allocated to address these pressing challenges, which have been exacerbated by the pandemic. Despite the progress made in the last decade, reducing the share of NEET remains a significant challenge that Italy is committed to tackling. The goal is to reduce the current rate of 16.1% to below 9% by 2030, as established in the Strategic Framework for European Cooperation in Education and Training 2030 (Council of the European Union, 2021).

A core strategy to meet these objectives is to develop a robust education and training system grounded in the duality of learning, characterized by alternating between school and work at a young age. This dual approach, which is primarily achieved through apprenticeships and internships, has proven effective in combating school dropout, youth inactivity, and unemployment (Eichhorst & Rinne, 2015). These measures are critical for enhancing the quality and relevance of education, increasing employability, and facilitating a smoother transition from education into the labour market (OECD, 2020).

Over the last few decades, Italy has reformed its vocational education system to enhance the transition from school to work. One of the first of these reforms was the introduction of Istruzione e Formazione Professionale (IeFP) in 2003 as a pilot project. IeFP programs are now a well-established part of the Italian Vocational Education and Training (VET) landscape, offering three- to four-year vocational education pathways funded by regional authorities, autonomous provinces, and the Ministries of Labour and Education. These programs, provided at the secondary level by both public and private education providers, had the potential to address regional skills imbalances owing to their localized design, and, indeed, they were able to heavily reduce the length of school-to-work transition (Comi et al., 2022). One of the most important characteristics of IeFP was its strong vocational mission and intensive traineeship component, especially during the third and fourth years (OECD, 2017). However, IeFP programs face substantial issues related to geographical fragmentation and regional disparities, which undermine their effectiveness and contribute to their overall low quality. Unlike professional and technical institutes, IeFP programs suffer from a lack of visibility and status. The fragmentation of the legislative framework exacerbates these challenges, as the standards for delivering IeFP courses and the systems for quality assurance are inconsistent across regions: some

regions have developed comprehensive legislative frameworks, while others lag behind, affecting the overall quality and national recognition of the IeFP pathway (OECD, 2017).

To address these weaknesses and strengthen the IeFP track, the government further reformed the vocational education and training (VET) system in 2015, introducing a true dual system within IeFP in Italy. The traineeship schemes were extended to cover at least 40% of the school year, and Level I apprenticeship was introduced as an integral part of the IeFP system³. An additional sum of 27 million euros annually since 2015 has been allocated to support the establishment of a stable dual-learning system. These resources are provided by the Ministry of Labour and Social Affairs and managed in collaboration with regional authorities to maintain a strong connection with local needs. Many of these funds are dedicated to reinforcing the Level I apprenticeship for young Italians aged 25 years and under. The reform aims to strengthen the educational value of apprenticeships, ensuring that they are linked to formal schooling and qualifications.

Among the various types of apprenticeships, the Level I Apprenticeship (*Apprendistato di primo livello*)—introduced in Italy in 2003—emerged as a promising tool for reducing early school leaving while ensuring the transmission of high-level skills. Established by the 2003 Biagi Law and later expanded by the 2011 Consolidated Law on Apprenticeships, this apprenticeship initially aimed to provide vocational training for young people aged 15 to 25 years, enabling them to achieve professional qualifications through work-based learning and minimal formal education. Schools had no role in apprentice training, which was instead delivered by regional and provincial training centres. Despite regulatory advancements, the adoption of Level I Apprenticeship outside regions such as Bolzano remained limited, owing to transitional challenges and a widespread lack of enthusiasm for the dual training model. The 2015 reform profoundly transformed Level I Apprenticeship by integrating it into the school curriculum and establishing, for the first time, a genuine form of dual education in Italy. Yet, despite this reform and the additional funds allocated to develop the Italian dual system, this apprenticeship model remains underutilized, accounting for only 2% of apprenticeship contracts as of 2018 (INAPP, 2021). To address this gap, in 2021 Italy's National Recovery and Resilience Plan (PNRR) has earmarked 600 million euros to strengthen the dual system

³ The same reform also introduced "the simulated firm" as a teaching tool specifically designed for the most vulnerable students who were considered not yet ready to enter the labour market (Bobbai, 2016). The concept of a "simulated enterprise" is a key element of Italy's dual education approach, particularly within vocational training programs. This method allows students to participate in realistic business and administrative activities within a classroom setting, effectively simulating the operations of a real company. The simulated enterprise aims to develop practical and entrepreneurial skills by providing a controlled yet dynamic environment where students can apply theoretical knowledge to practical situations. This educational approach is intended to strengthen the connection between school and work, enhance student employability, and equip young people with the necessary competencies for the labour market.

and the apprenticeship model, positioning it as a key instrument for achieving the EU's educational and employment objectives (Component M5C1, PNRR).

However, little is known about the value of dual education in the Italian labour market, and the effectiveness of VET and dual system reforms remains unclear. The empirical economic literature agrees that, among the various employment contracts available for young workers, apprenticeships generally provide more training, reduce the likelihood of future unemployment episodes, and increase the probability of transitioning to stable employment (Quintini and Manfredi, 2009; Eichhorst et al., 2015; Samek et al., 2013; Albanese et al., 2021; d'Agostino et al., 2022; Citino, 2020; Comi and Grasseni, 2020; Filomena and Picchio, 2023). However, counterfactual evidence of their effectiveness is still limited and inconclusive, depending on the counterfactual group with which apprentices are compared (Eichhorst et al., 2015). Additionally, all the empirical evidence for Italy focuses exclusively on professional apprenticeships (or second-level apprenticeships). However, among the various types of Italian apprenticeships, the level II professional apprenticeship—which offers very little in terms of training content, with regard to both hours of training and the percentage of apprentices engaging in training activities—bears little resemblance to the internationally dominant apprenticeship model.

Furthermore, the literature on dual learning is also limited, with contributions predominantly descriptive and focused mainly on countries with a dual system (for a review, see Wolter and Ryan, 2011; and European Commission, 2013). The few other studies similar to this one primarily rely on instrumental variable (IV) strategies, highlighting the need for further research. Using vacancy data from Germany, Parey employs an IV strategy to estimate the effects of firm-based apprenticeships versus full-time vocational schooling on labour market outcomes. The analysis reveals that apprenticeships significantly reduce early unemployment, but does not find long-term wage differences between the two training paths. Using data from France and Germany, Brébion employs a comparative analysis using an IV approach to evaluate the causal impact of apprenticeship training on labor market outcomes. The study highlights that apprentices in France experience a stronger labour market advantage over full-time students compared with their German counterparts at the secondary level. In Germany, the benefit primarily comes from high retention rates within training firms, while in France, it extends to the external labour market. Using data from the Madrid region in Spain, Bentolila, Cabrales, and Jansen utilize an IV approach to estimate the causal effects of a dual VET system on youth labour market outcomes. They find that dual VET substantially increases employment days and earnings compared with school-based VET, although it does not improve job quality metrics such as the likelihood of securing a full-time or open-ended contract.

This paper contributes to the literature in three ways. First it makes a novel contribution to the literature on dual education by being the first to quantify the returns to dual education using a staggered adoption framework. Specifically, I leverage the staggered implementation of the reform across different Italian regions, which allows credible identification of causal effects. This methodological approach enables the isolation of the impact of dual education on labour market outcomes, distinguishing it from those of confounding regional factors and temporal trends.

Moreover, my study examines a robust dual education system. The reform under investigation has significantly transformed dual education by integrating apprenticeships directly into the school curriculum. This allows the identification of the effect of dual education by comparing two different types of apprenticeships: the earlier model, which primarily took place in the labour market with minimal formal training provided by training centers, and the new model, in which schools play an active role in offering school-based learning and broader general competencies. Unlike previous systems that lacked a comprehensive integration of work and education, this reform ensures that students receive practical, firm-based experience as a fundamental part of their educational journey, strengthening the alignment between the educational content of curricula and labour market needs.

Third, I show substantial heterogeneity in returns to dual education programs and reveal that personal characteristics, such as gender and age, can explain this heterogeneity.

The rest of this paper proceeds as follows: Section 2 provides background on the institutional context of dual education in Italy. Section 3 describes the dataset and sample selection. Section 4 outlines the empirical strategy, detailing the quasi-experimental approaches used to estimate the causal effects of the reform. Section 5 presents the main results and the heterogeneity of these effects, while Section 6 offers robustness checks. Finally, Section 7 concludes with a discussion of the policy implications and the overall contribution to the literature.

2. Background

The Level I Apprenticeship (*Apprendistato di primo livello*) was introduced in Italy by the 2003 Biagi Law. This law established three types of apprenticeships: Level I for initial training, Level II for professional development, and Level III for higher education and research. Initially, the Level I Apprenticeship aimed to fulfil the right/duty of young people aged 15 to 18 years to participate in education and training, enabling them to achieve professional qualifications (short secondary diplomas). Then, in 2011, the Consolidated Law on Apprenticeships (TUA, Legislative Decree 167/2011) expanded Level I apprenticeships to include adolescents (16 to 18 years) for compulsory

education and young adults (18 to 25 years) for qualifications or diplomas, marking a regulatory advancement to standardize vocational paths across Italy. Although Article 3 of Legislative Decree 167/2011 has been widely regulated across Italy, only a few regions⁴ have established dedicated training programs for young apprentices pursuing qualifications and diplomas. Implementation in 2013 revealed limited participation, especially outside Bolzano, owing to transitional regulatory challenges and slow adoption of this apprenticeship model. Despite efforts to support individual pathways and enhance employability, uptake has been low, reflecting hesitance toward dual training and the difficulties in supplying formal education and training to apprentices. In 2014, the number of Level I apprenticeship contracts was 15.465⁵; conversely, only 4068 apprentices were involved in some courses or formal training offered by regions⁶. Of these, more than 85% were in the Province of Bolzano, which had a dual education system similar to Austria. The following year, Legislative Decree 81/2015 (Jobs Act) further refined Level I Apprenticeship, incorporating provisions for qualifications, secondary education diplomas, and advanced technical certifications under Article 43. The October 2015 Interministerial Decree also specified national training standards and outlined general criteria for implementing these programs. This last decree, nestled in the 2012 State-Regions Agreement—which standardized qualifications nationally across 22 vocational profiles and 21 diploma categories within Italy’s vocational education and training (IeFP) framework—was the last input needed to introduce dual apprentices in Italy. In other words, apprenticeships were brought inside schools for the very first time.

After this reform, secondary vocational schools were given an active role in defining the content of each apprenticeship. The dual status of student and worker was introduced for students enrolled in IeFP (Education and Vocational Training) programs who complete part of their educational pathway as Level I apprentices. The school certifies the competencies acquired and awards the professional qualification (after the third year) and the professional diploma (after the fourth year). The reform has redefined the role of schools within the Level I apprenticeship pathway, positioning them at the core and assigning them the responsibility of ensuring the acquisition of the minimum competencies associated with the academic title attainable through Level I apprenticeship. The institution collaborates with companies to develop an individual training project integrating on-the-job training with classroom-based instruction.

⁴ Piemonte, Lombardia, Veneto, Emilia Romagna, Liguria, Friuli Venezia Giulia, and the Autonomous Province of Bolzano

⁵ See ISFOL (2016) page 16, Table 1.4a, column 3.

⁶ See ISFOL (2016) page 79, Table 4.1 column 3.

Because vocational training falls under regional jurisdiction, the October 2015 Interministerial Decree had to be adopted and apprenticeship laws had to be issued by each region. The adoption of national legislation occurred gradually between 2015 and 2018, and this uneven implementation forms the basis of the identification strategy to be employed in this research (see Table A1 in the Appendix).

3. Data

To study the reform's effect on individual outcomes, I use the working histories of the Italian population available at the Italian Social Security Institute. This dataset consists of the monthly employment records from the non-agricultural private sector of the Italian population at the Italian Social Security Institute. It contains detailed countrywide data that track all Italian workers. This administrative archive contains information about monthly wages, contract types, the job region, the employment industry, the size of the firm that hired the apprentices, and individual characteristics such as age, gender, and nationality. For my primary analyses, I use the first month of Level I apprenticeship contract as the treatment time. I focus on the first observed apprenticeship, and if an individual has more than one Level I apprenticeship spell, I use the dates of each spell to determine the first. I selected young workers between 15 and 25 years who worked their first Level I apprentices between January 2015 and June 2017, and followed them for 6 months before their first apprenticeship and 48 months afterward (the number of observations for each region is shown in Table A 2 in the Appendix). I excluded Molise and Valle d'Aosta from the analysis because they later adopted the 2015 Interministerial Decree, as well as the Bolzano Province, which already had a secondary vocational and education system more similar to the Austrian dual track system than the Italian one. The result is a longitudinal dataset containing detailed information about the first apprenticeship spell and monthly earnings and the employment industry before, during, and after their apprenticeship⁷.

TABLE 1 AROUND HERE

⁷ Employment and monthly earnings are both set to 0 whenever a young worker is not observed in the INPS dataset.

Table 1 presents summary statistics by treatment for all apprentices. There are notable differences in demographic composition: before the reform, apprentices were more likely to be female, older, more likely to have prior work experience, and less likely to be minors.

Panel B of Table 1 reports the average monthly labour market outcomes (based on the post-apprenticeship years). Once again, there are differences between those who had an apprenticeship before the reform and those who had it after; young apprentices post-reform are more likely to be employed, have higher earnings, and hold a Level II apprenticeship contract.

Apprentices before and after the reform differ, especially in terms of personal characteristics, and, thus, in the following analysis, it would be crucial to account for such compositional differences.

In addition to the apprentice's level dataset, I obtained information on the institutions from visits to the apprenticeship administration office in Lombardy. During these visits, I interviewed the regional administrators who distributed the apprenticeship grant to schools in the period covered by my analysis; I also visited secondary schools with active apprenticeship schemes and interviewed principals, administrative staff, teachers, and young apprentices⁸.

4. Empirical Strategy

This paper aimed to estimate the causal relationship between dual education and labour market outcomes. To achieve this, it was necessary to resolve two identification problems. First, given the differences in observable characteristics between apprentices before and after the reform, there may also be differences in the distribution of unobserved characteristics, which could point to the existence of a different selection process in an apprenticeship contract before and after the reform— this would indeed bias the estimated returns to dual education. I adopt three different quasi-experimental approaches to address the potential bias generated from self-selection based on unobservable characteristics. First, to address the challenge of selection bias in treatment assignment, the inverse probability weighted regression adjustment (IPWRA) method was utilized. The average treatment effect on the treated (ATT) was estimated, represented as:

$$ATT=E[Yi(1)-Yi(0)|Di=1] \quad (1)$$

⁸ I thank the Lombardy Regional Council who promoted the evaluation study of Level I apprenticeship in Lombardy, carried out in collaboration with the Department of Business and Law at the University of Milano-Bicocca, where this research began, and, in particular, the Office of Studies, Legislative Analysis, and Regional Policies for their support and for kindly providing access to stakeholders for the interviews.

where D_i is a binary indicator that specifies whether an apprentice received the apprenticeship before (treatment) or after the reform (control). $Y_i(1)$ and $Y_i(0)$ refer to the outcomes (being employed and earnings) with and without treatment, respectively. I focus on the ATT to measure the returns to dual education because the policy has causally influenced those who were “treated” compared with the scenario where they would not have received dual education, as was the case pre-reform. I applied a propensity score inverse weighting scheme to balance the covariates as counterfactual for the dual education apprentices⁹. Then, I model the outcome as a function of treatment status and covariates, providing a doubly robust estimation of the ATT¹⁰.

As a second approach, I follow the expanding body of literature on estimating dynamic wage equations and estimate a model that captures the time-varying aspects of wage dynamics (Carruthers and Sanford, 2018; Jepsen et al. 2014; Stevens et al. 2019; Aucejo et al, 2023). Following Jacobsen, LaLonde, and Sullivan (2005), I estimate the following equation:

$$y_{it} = \alpha + \beta post_{it} * dual_education_i + \delta post_{it} + (\lambda X_{it}) + \mu_i + \gamma_t + \omega_i * t + \varepsilon_{it} \quad (2)$$

where Y_{it} are the outcomes (being employed and earnings), $post_{it}$ is a dummy variable equal to 1 for the months following the end of the first apprenticeship, $dual_education_i$ is a dummy variable equal to 1 for individuals who started their apprenticeship after the implementation of the state-region guidelines and regulations by the region, X_{it} is a vector of time-varying characteristics of the individuals (e.g., being enrolled in an apprenticeship), μ_i are individual fixed effects, γ_t are monthly fixed effects, and $\omega_i * t$ are individual-specific trends. The standard errors are then clustered at the regional level. β is the coefficient of interest, which measures the average return from completing a Level I apprenticeship after the reform compared with those who completed it before it. One clear advantage of this approach is that I can include individual fixed effects in the equation, which control for observed and unobserved time-invariant characteristics. Additionally, I incorporate an individual time trend, which accounts for any personal attributes that change linearly over time.

The final approach I employ is the event study design developed by Sun and Abraham (2021), which is particularly suited for contexts involving staggered treatment adoption. While conceptually related to earlier event study methods, such as those used by Grogger (1995) and Dobkin et al. (2018), this approach introduces a more refined framework for handling variation in treatment timing. Intuitively,

⁹ The propensity score is computed based on gender and age dummies, Italian citizenship, firm size of the apprenticeship employer (represented by ten dummies), the firm's two-digit NACE code, a dummy variable indicating the presence of prior labour market experience, and the region of the Level I apprenticeship contract.

¹⁰ In the regression, I control for gender, a 2nd-order polynomial in age, and the month (from 1 to 30) in which the first apprenticeship started.

it compares labour market outcomes for the same individual before and after apprenticeship while controlling for unobservable, time-invariant individual traits. The objective is to estimate the reform's impact on apprentices' employment outcomes, and the model I use is specified as follows:

$$Y_{it} = \alpha_i + \gamma_t + \sum_{l=-6}^{-2} \rho_l D_{it}^l + \sum_{l=0}^{48} \rho_l D_{it}^l + \delta X_{it} + \epsilon_{it} \quad (3)$$

where Y_{it} represents outcomes such as employment status and earnings. Dummy variables are included for up to six months before starting the first Level I apprenticeship and for 48 months following it. The model also controls for worker characteristics, including the economic sector of the apprenticeship, gender, age, and Italian citizenship status, and further includes a region of apprenticeship and month-fixed effects. This model enables detailed examination of the effects of the reform on apprentices' labour market outcomes over time, leveraging the benefits of fixed effects and the Sun and Abraham (2021) event study structure, which is specifically designed for event study analysis in the context of staggered treatment adoption. A key advantage of the event study design is that it allows assessment of the existence of pre-trends, and even if they are visible, sharp changes in labour market outcomes can still be identified and the dynamics of the returns explored.

In the following section, I run some robustness tests. First, I address the validity of the assignment rule by running donut regressions. Second, I test whether our results are sensitive to specific sample definitions.

5. Results

A. Main results

Figure 1 presents the results of estimating the ATT using the IPWRA method. The figure also includes the corresponding 95% confidence intervals, which measure the statistical precision of the ATT estimates derived from equation (1).

FIGURE 1 AROUND HERE

Starting from 4 months into the apprenticeship, dual education is associated with both a higher probability of employment and increased wages. These positive returns exhibit a wave-like trend, reflecting that, under the new Level I apprenticeship legislation, young apprentices are also students and may return to school between successive apprenticeship contracts. There is a statistically

significant and positive earnings premium that does not diminish over the four years following the dual education experience.

The estimation results of equation (2), presented in Table 2, corroborate the positive returns to dual education observed in Figure 1. Four models are presented in Table 2, with columns (1) and (3) focusing on employment outcomes and columns (2) and (4) analyzing wage outcomes. All models include individual fixed effects and account for individual-specific time trends.

TABLE 2 AROUND HERE

The effect of dual education is positive and statistically significant across all models, indicating a robust positive impact on employment and wages after the apprenticeship reform. Specifically, the coefficient in column (1) suggests a 6.9 percentage point increase in employment probability, while the corresponding coefficient in column (2) indicates an increase in monthly wages by approximately 118.99 euros. When accounting for the months of enrolment in the first Level I apprenticeship (which represent months of positive employment and earnings), the effect on employment is positive, although smaller and equal to 2.2 percentage points (column 3), and the earnings effect is substantial, at 88.89 euros per month (column 4)¹¹. This figure, when compared with the average wage post-treatment (735 euros, on average, each month), corresponds to an average 12% rate of return.

Figure 2 illustrates the labour market outcomes of dual education, presented as event study estimates as in equation (3). The figure is divided into two panels: Panel A (left) depicts the effects on employment, while Panel B (right) shows the effects on earnings. The horizontal axis in both panels represents the months before and after the apprenticeship. The event study estimates reveal how employment probabilities evolve relative to the start of the apprenticeship. The estimates for the pre-apprenticeship period (left side of the panel) serve as a conditional parallel trend test, showing no significant difference between the trends of the treated and control groups, even though the difference between the two groups is significantly negative. This suggests no different anticipatory effects prior to the apprenticeship before and after the reform. Following the start of the apprenticeship, the employment effects become significantly positive, indicating a substantial and sustained increase in employment probability. The 95% confidence intervals (CIs) around the estimates are relatively

¹¹ The variable "apprenticeship enrollment" captures a crucial aspect of the individual's experience during the post-apprenticeship period. In controlling for apprenticeship enrollment, I am essentially isolating the direct effect of dual education from the impact of actually being enrolled in an apprenticeship, which is positive. This implies that a portion of the positive returns to dual education seen in the initial estimates (without controlling for enrollment) may be driven by the benefits associated with the ongoing apprenticeship itself. The fact that the positive effect survives the inclusion of this control means that dual education's positive impact lasts longer than the month of apprenticeship.

narrow, reinforcing the statistical robustness of the positive effects observed in the post-apprenticeship period.

FIGURE 2 AROUND HERE

Similarly, the earnings effects plotted in Panel B indicate that dual education leads to significant wage gains starting shortly after the apprenticeship. The estimates remain positive and statistically significant over time, with the wage effects showing a steady upward trend. This pattern suggests that the benefits of dual education, in terms of earnings, are not only immediate but also persist and even grow over time. The CIs around the earnings estimates are somewhat wider than those around employment, reflecting greater variability in wage outcomes. The figure provides strong evidence that dual education has a lasting positive impact on employment and earnings. The post-apprenticeship effects are substantial and indicate that the practical skills and experience gained during dual education translate into meaningful labour market advantages. The pre-treatment period's flat line further supports the validity of the causal inference, as it suggests that pre-existing trends do not drive the effects.

B. Heterogeneity of the results

Figure 3 examines the gender-specific effects of dual education on employment and earnings, dividing the analysis into two panels: Figure 3a for employment and Figure 3b for earnings. Each figure further separates the outcomes for females (Panel A) and males (Panel B), offering a comparative view of how gender influences the returns to dual education. The results suggest that while both females and males benefit from dual education in terms of employment and earnings, dual education provides a substantial boost to female employment probabilities and earnings, and the positive effects persist and somehow increase over time.

FIGURE 3 AROUND HERE

Figure 4 presents the impact of dual education on employment and earnings, disaggregated by age group, with separate panels for minors and young adults. The effects for minors are noticeably stronger compared to those for young adults. For minors, there is a more substantial increase in employment probability following dual education, with significant and sustained positive effects. At the same time, the magnitude is smaller for young adults, suggesting that younger apprentices

experience greater employment benefits from dual education. Similarly, the positive wage returns for minors are larger and steady over time. In contrast, the wage gains for legal adults are present but more moderate, even though there is an upward trend over time, indicating that dual education yields higher wage benefits for younger individuals. The observed pattern aligns with the predictions of the Heckman human capital investment model (Cunha and Heckman, 2007), which suggests that returns to human capital investments are higher when made earlier in life. Since minors are at a formative stage in their career development, the skills and training acquired through dual education have a more substantial and lasting impact on their employment prospects and wage trajectory. In contrast, young adults, who may already have more established work histories, experience comparatively smaller gains.

FIGURE 4 AROUND HERE

Figure 5 explores the heterogeneity of dual education effects based on firm size, distinguishing between apprenticeships conducted in small firms (less than ten employees) and large firms (ten or more employees). The employment effects for apprentices trained in large firms are generally positive but show a smaller magnitude than those in small firms (Figure 5). Furthermore, the effect is less pronounced and somewhat more variable over time and vanishes at the end of the fourth year in the case of employment. This suggests that smaller firms provide slightly more long-term employment opportunities or that the skills acquired may be more transferable or valued than in larger firms. Wage effects are positive, and somewhat significant, with an upward trend over time both in small and large firms.

FIGURE 5 AROUND HERE

C. Further outcomes

In addition to employment and earnings, I now look at the three other labour market outcomes—first, the transformation of an apprenticeship Level I contract into a Level II apprenticeship contract; then, the probability of having a permanent, open-ended contract; and, finally, the probability of working with the same firm. All three outcomes suggest that the employers find the apprentices sufficiently skilled, and consider it valuable to retain them. This implies that the training provided during the

Level I apprenticeship has led to significant human capital accumulation, making the apprentice an asset to the company rather than someone who is easily replaceable.

When apprentices continue working with the same firm, it suggests a strong alignment between the skills acquired during the apprenticeship and the firm's specific needs. Figure 6 presents the results from estimating equation (3) on the probability of remaining employed with the same firm in which the initial Level I apprenticeship was completed. This figure illustrates the difference in retention probability between apprentices before and after the reform. At the start of the apprenticeship, post-reform apprentices have a significantly higher likelihood of staying with the same firm than pre-reform apprentices, as indicated by the positive difference. Although this difference decreases over time, it remains positive, indicating that the reform has influenced job retention within the same firm. This suggests that the dual education reform has strengthened the development of firm-specific skills among apprentices. An employer's decision to retain a Level I apprentice reflects a commitment to the apprentice's professional development, recognizing their potential, demonstrating trust in their abilities, and exhibiting willingness to invest in their future within the organization.

FIGURE 6 AROUND HERE

The transition from a Level I apprenticeship into a Level II apprenticeship can be seen as an advancement in the individual's career and skill development. This transition signifies the accumulation of human capital, as the apprentice has likely demonstrated sufficient competence and mastery of foundational skills to progress to more complex training, which may occur with a different firm. This progression can lead to better job prospects, higher wages, and increased employability, as Level II apprenticeships are considered some of the most secure and beneficial temporary contracts available. These contracts offer higher job stability and enhanced opportunities for professional development than other temporary forms of employment, which are often associated with lower job security and wage stagnation (Filomena and Picchio, 2023).

Figure 7 illustrates the difference in the probability of transitioning from a Level I to a Level II apprenticeship between apprentices before and after the reform. Initially, pre-reform apprentices have a higher probability of obtaining a Level II apprenticeship, as reflected by the negative difference. This may be because, post reform, young apprentices are still students who may complete their school program with only a Level I apprenticeship. However, post-reform apprentices show a notable increase in the probability of transitioning to a Level II apprenticeship, peaking around 20 months

after the initial apprenticeship. This indicates that the reform has significantly improved their chances of moving to a more advanced apprenticeship; although this effect gradually decreases over time, it remains higher than pre-reform levels.

FIGURE 7 AROUND HERE

Figure 8 illustrates the difference in the probability of obtaining an open-ended contract between apprentices before and after the reform. Initially, pre-reform apprentices are less likely to secure an open-ended contract, as indicated by the negative difference. Following the start of the apprenticeship, post-reform apprentices experience a significant increase in the probability of transitioning to an open-ended contract, which peaks shortly after. Over time, the effect gradually diminishes but eventually rises again, suggesting a sustained positive impact of the reform on the likelihood of apprentices securing more stable, long-term employment. This trend highlights the reform's success in promoting job stability and enhancing the quality of employment outcomes for apprentices.

To sum up, our results show the positive effects of dual education introduced by the reform and the substantial effectiveness of the new school-based apprenticeship programs. They demonstrate that the system is providing a clear pathway for young workers to gain progressively higher skills, which is essential for fostering a well-trained workforce that can meet the demands of a dynamic labour market.

FIGURE 8 AROUND HERE

6. Robustness

The results in Figure 9 align with the argument made by Jepsen et al., which emphasizes the importance of focusing on a sample of individuals already employed before their apprenticeship to identify the effect of dual education correctly. Figure 6 illustrates the employment and earnings effects of dual education for individuals with prior work experience before starting their apprenticeship. The impact of dual education on employment probability is still substantial and positive. The increase in employment is significant and persists over time, suggesting that individuals already integrated into the labour market before their apprenticeship benefit more from dual education in maintaining or

securing employment. The effect size and the confidence intervals indicate a robust and lasting improvement in employment prospects for this group. The earnings effects for individuals with prior work experience are also noteworthy. The figure demonstrates a clear and significant increase in wages following the apprenticeship. The upward trend in earnings suggests that prior labour market experience enhances the economic benefits of dual education. This could be due to the accumulation of both work-related and general skills provided during the apprenticeship, which makes the accumulation of human capital more intense and, thus, more valuable in the labour market.

FIGURE 9 AROUND HERE

Figure 10 presents the impact of dual education on employment and earnings for apprentices holding a short VET diploma. The employment probability shows a clear positive effect shortly after the apprenticeship begins, indicating that dual education significantly enhances the likelihood of employment for apprentices with a short VET diploma. This effect is strong and persists over time, suggesting that the competencies provided in dual education effectively improve employability for individuals with this level of education. The earnings impact also demonstrates a notable upward trend following the apprenticeship, with wages increasing steadily. This indicates that dual education not only boosts employment rates but also provides earnings returns, possibly due to the acquisition of skills that are highly valued in the labour market.

FIGURE 10 AROUND HERE

Table 3 presents the results from a robustness check using a donut regression approach, where apprenticeship spells within a 4-month window around the adoption of the national law in each region are excluded from the analysis. This approach aims to ensure that the estimated effects of dual education are not driven by immediate short-term fluctuations around the reform's adoption. Dual education is associated with a 4.9 percentage point increase in the probability of employment and an average wage increase of 102.575 €, figures that are quite similar to the baseline estimates reported in Table 2. The robustness check confirms that the positive effects of dual education on employment and wages remain significant even after excluding observations close to the adoption date.

TABLE 3 AROUND HERE

7. Conclusions

My analysis reveals that the reform of the Level I Apprenticeship (*Apprendistato di I livello*) in Italy has significantly and positively affected employment probability and earnings for apprentices. Specifically, the reform has improved outcomes by integrating school-based learning with firm-based training, resulting in more robust skills development. The findings show that post-reform apprentices are more likely to be employed and earn higher wages, with a greater likelihood of progressing to a Level II apprenticeship.

The heterogeneity analysis reveals that dual education significantly generates particularly strong and sustained gains for females. Age-wise, the impact is more pronounced for minors than young adults: minors show greater and longer-lasting increases in employment probability and wages, consistent with the human capital investment model, which suggests that earlier skill acquisition yields higher returns.

Despite these promising findings, participation in Level I apprenticeships still needs to improve, with only a very small percentage of IeFP students taking advantage of this pathway. To fully leverage the benefits of dual education, there is a need for more significant incentives and a cultural shift that recognizes the value of apprenticeships. Promoting widespread adoption and addressing regional disparities will be crucial for maximizing the potential of this educational model and supporting Italy's broader economic and employment goals.

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Table 1: Descriptive statistics

Wolter, S. and P. Ryan (2011), “Apprenticeship”, in E.A. Hanushek, S. Machin, and L. Woessman (eds.), Handbook of the Economics of Education vol. 3, Elsevier: 521-576

	Pre reform	Post reform
<i>Panel A: demographic characteristics</i>		
Female (percentage)	39.1	36.0
Minors (percentage)	28.4	45.9
Average length of the apprenticeship contract (months)	10.3	10.7
Average age (years)	21.1	20.00
Work experience before the Type I appr. (percentage)	44.9	32.4
Not Italian citizen (percentage)	15.1	18.8
<i>Panel B: monthly labour market outcomes</i>		
Employment (percentage)	58.9	63.6
Average earnings after the first month of Type 1 apprenticeship (€)	718	765
Apprenticeship type II	24.3	31.3
N obs	5707	4805

Table 2: Labour market effects of dual education. individual FE and time trends Model.

Variables	(1) Employment	(2) Earnings	(3) Employment	(4) Earnings
Post*dual education	0.069*** (0.014)	118.989*** (12.639)	0.022*** (0.003)	88.886*** (12.790)
Post	-0.326*** (0.016)	-303.938*** (19.912)	0.154*** (0.002)	40.303** (14.189)
Enrollment in apprenticeship			0.616*** (0.002)	441.512*** (14.832)
Costant	0.838*** (0.011)	870.128*** (13.618)	0.404*** (0.002)	558.759*** (8.338)
Obs	566,161	566,161	566,161	566,161
R ²	0.540	0.706	0.641	0.732
Individual FE	YES	YES	YES	YES
Individual time-trends	YES	YES	YES	YES

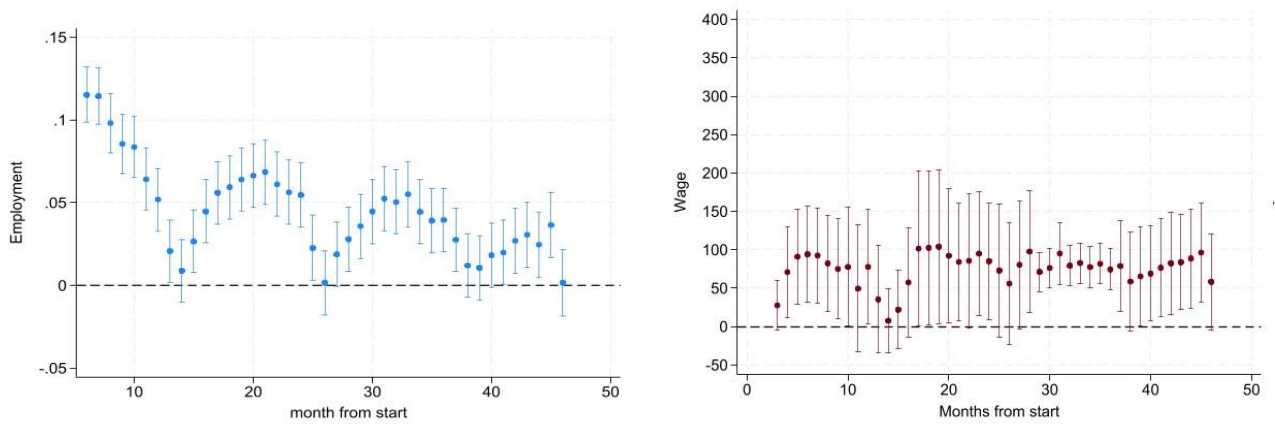
Notes: This table reports the estimated coefficients and 95% standard errors (in parenthesis) for the regressions corresponding to equation (2), with employment and earnings as the dependent variables. Each regression includes individual fixed effects and individual time trends. Regression in Columns (3) and (4) also includes a dummy variable equal to one for the month the individuals are enrolled in their first Type I apprenticeship contract. Standard errors are clustered by individuals. Source: Results based on calculations by the author using INPS data.

Table 3. Robustness check: Donut regression excluding -4/+4 months from adoption.

Variables	Employment	Wage
Post*dual education	0.049** (0.020)	102.575*** (15.693)
Post	-0.320*** (0.012)	-302.751*** (14.315)
Costant	0.842*** (0.011)	878.420*** (11.102)
Obs	427,341	427,341
R2	0.541	0.704
Individual FE	YES	YES
Individual time-trend	YES	YES

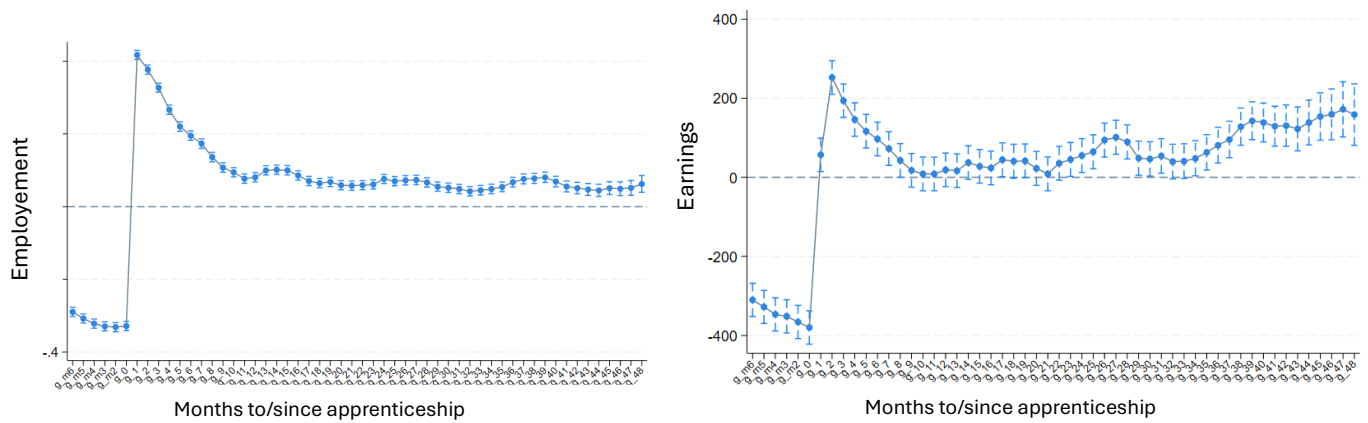
Notes: This table reports the estimated coefficients and 95% standard errors (in parenthesis) for the regressions corresponding to equation (2), with employment and earnings as the dependent variables. We excluded from the sample apprenticeship spells started within a 4-month radius from the month of regional adoption of the national law. Each regression includes individual fixed effects and individual time trends. Standard errors are clustered by individuals. Source: Results based on calculations by the author using INPS data.

Figure 1: Labour market outcomes of dual education. IPWRA.



Notes: In this figure, the estimated ATET and 95% confidence intervals (CIs) for the regressions corresponding to equation (1) are plotted, with employment (panel A- left) and earnings (Panel B- right) as the dependent variables. Source: Results based on calculations by the author using micro-level data derived from INPS data.

Figure 2: Labour market outcomes of dual education. Event study.



Notes: This figure plots the estimated β_s and 95% confidence intervals (CIs) for the regressions corresponding to equation (3) with employment (panel A- left) and earnings (Panel B- right) as the dependent variable. Source: Results based on calculations by the author using micro-level data from INPS data

Figure 3a: Employment effects of dual education by gender

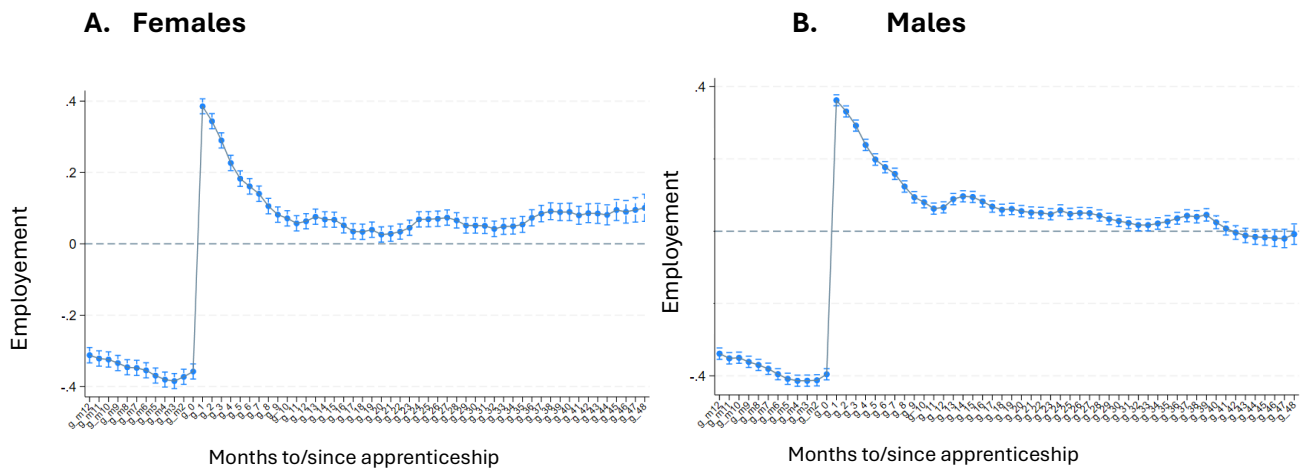
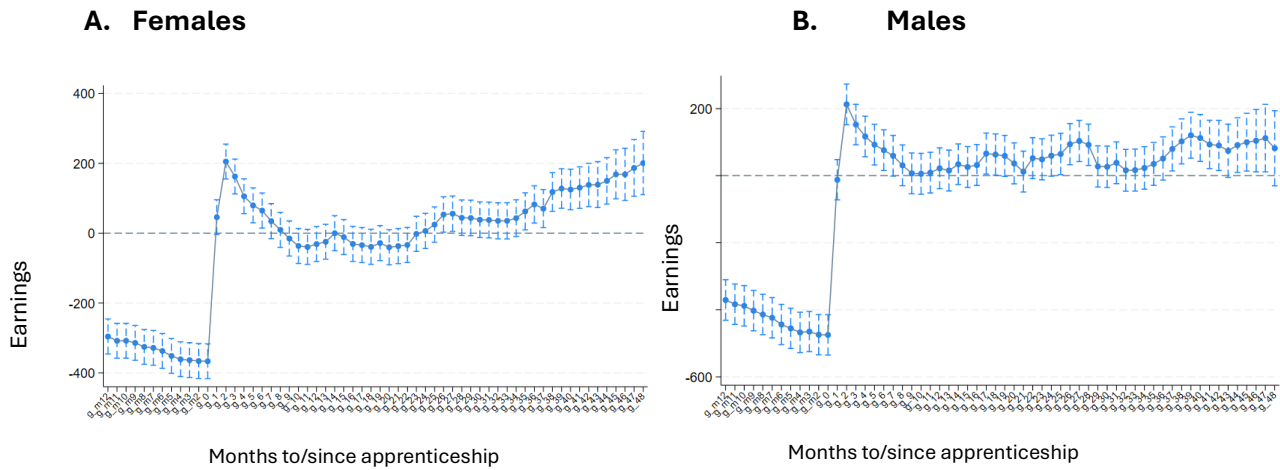


Figure 3b: Earnings effects of dual education by gender



Notes: This figure plots the estimated ps and 95% confidence intervals (CIs) for the regressions corresponding to equation (3) with employment (Figure 3a) and earnings (Figure 3b) as the dependent variable, estimated separately for females (panel A- left) and males (Panel B- right). Source: Results based on calculations by the author using micro-level data from INPS data.

Figure 4a: Employment effects of dual education by Age

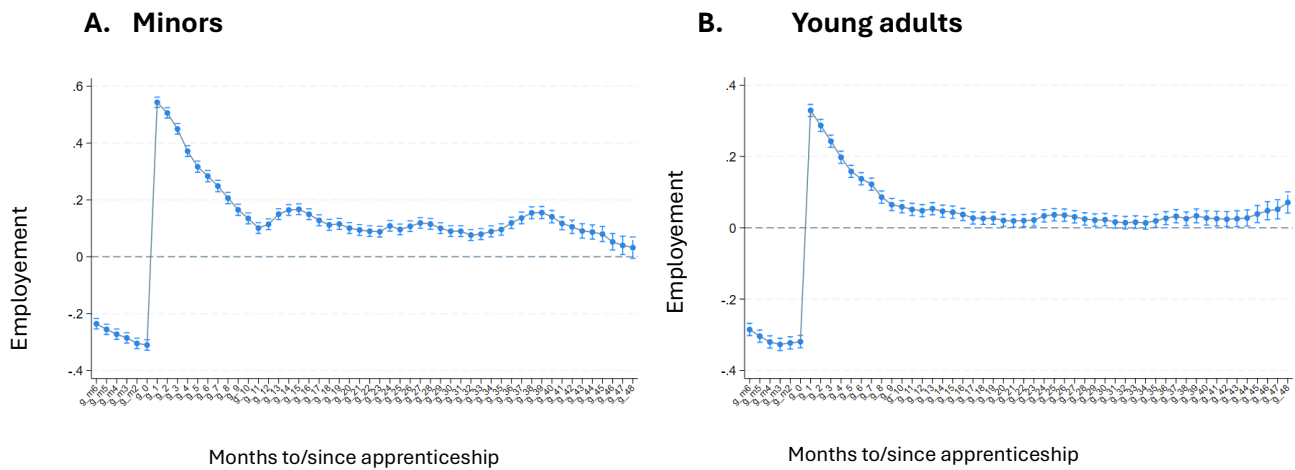
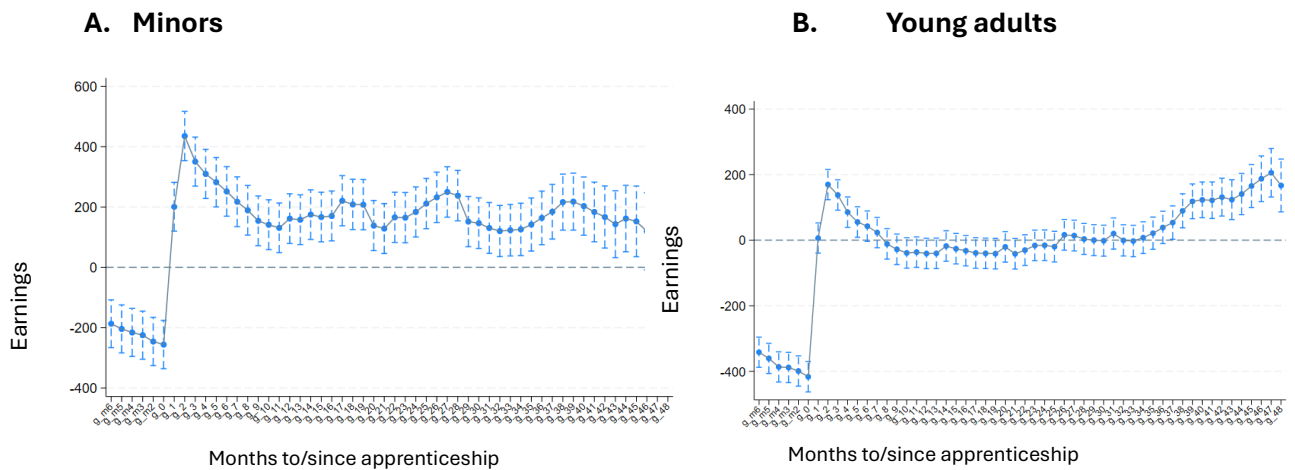


Figure 4b: Earnings effects of dual education by Age



Notes: This figure plots the estimated ps and 95% confidence intervals (CIs) for the regressions corresponding to equation (3) with employment (Figure 3a) and earnings (Figure 3b) as the dependent variable, estimated separately for minors (panel A- left) and young adults (Panel B- right). Source: Results based on calculations by the author using micro-level data from INPS data

Figure 5a: Employment effects of dual education by Firm size

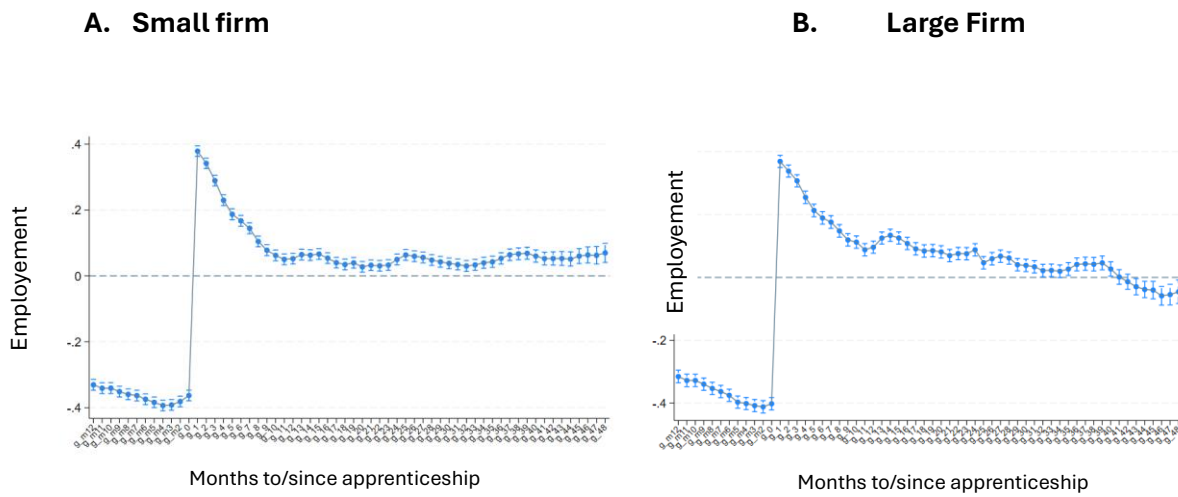
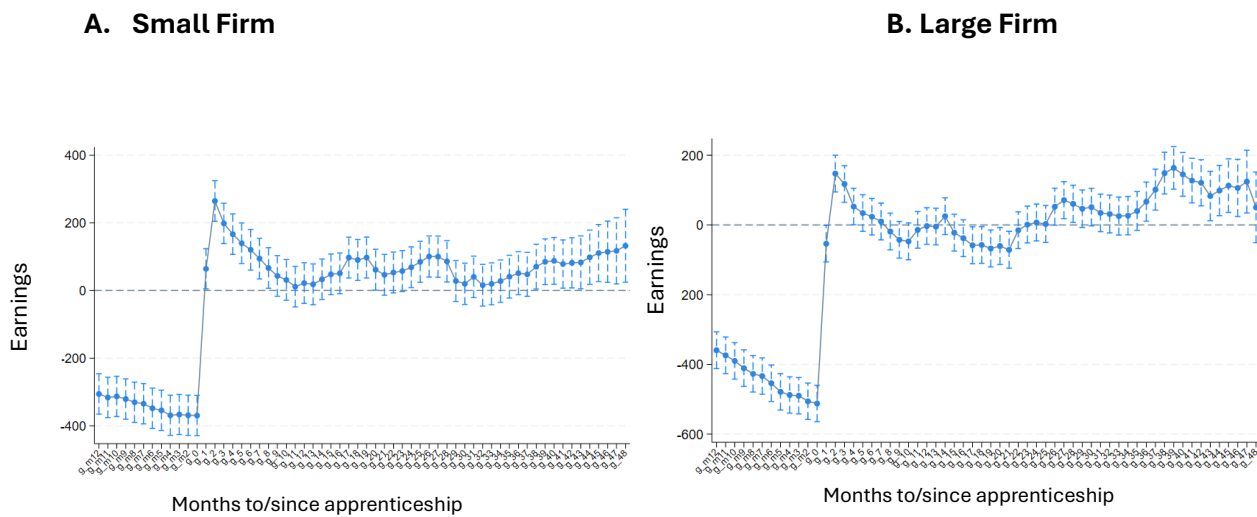
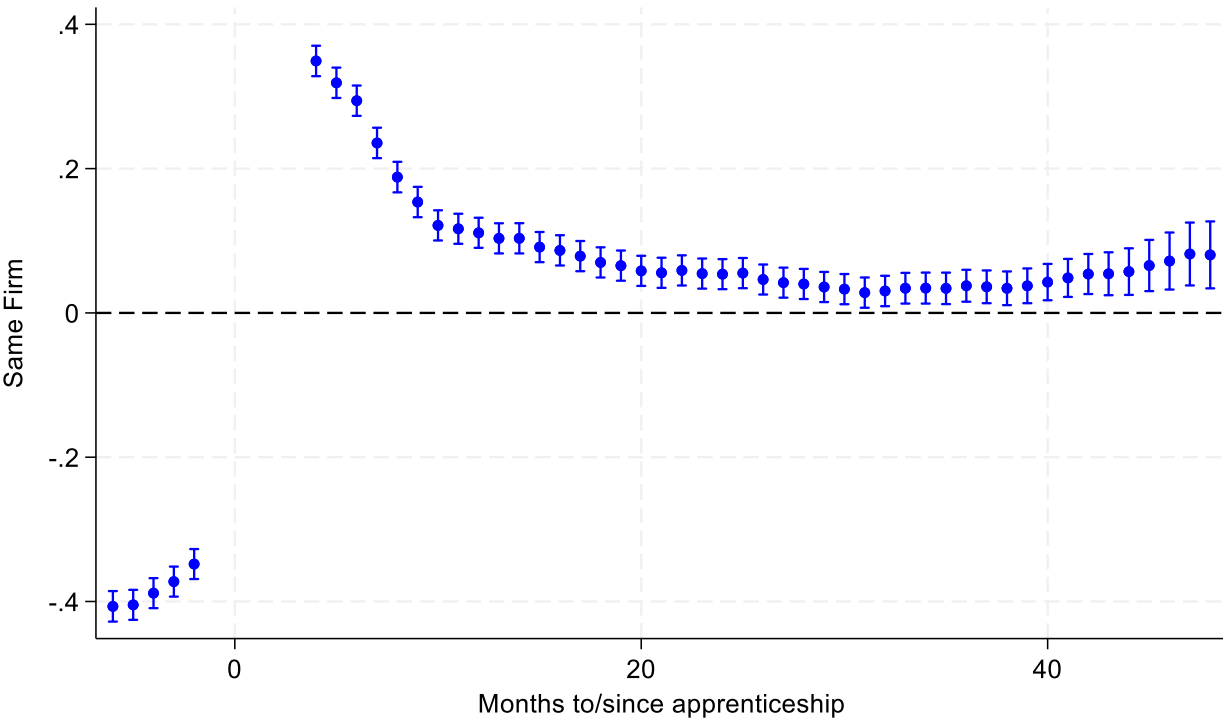


Figure 5b: Earnings effects of dual education by Firm size



Notes: This figure plots the estimated ps and 95% confidence intervals (CIs) for the regressions corresponding to equation (3) with employment (Figure 3a) and earnings (Figure 3b) as the dependent variable, estimated separately for apprentices done in firm with less than 10 (panel A- left) and more than 10 employees (Panel B- right). Source: Results based on calculations by the author using micro-level data from INPS data

Figure 6: Effect of dual education on the probability of still working in the same firm. Event study.



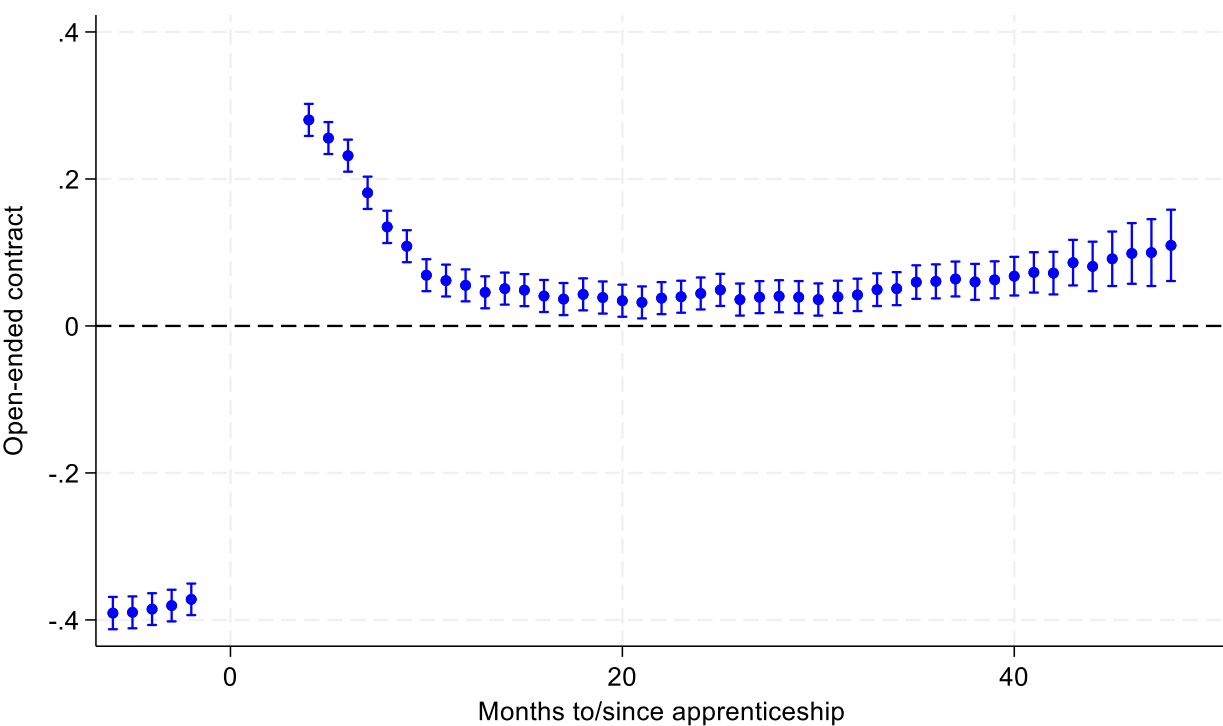
Notes: This figure plots the estimated ps and 95% confidence intervals (CIs) for the regressions corresponding to equation (3) with the probability of working in the same firm as the dependent variable. Source: Results based on calculations by the author using micro-level data from INPS data

Figure 7: Effect of dual education on the probability of having a type II apprenticeship. Event study.



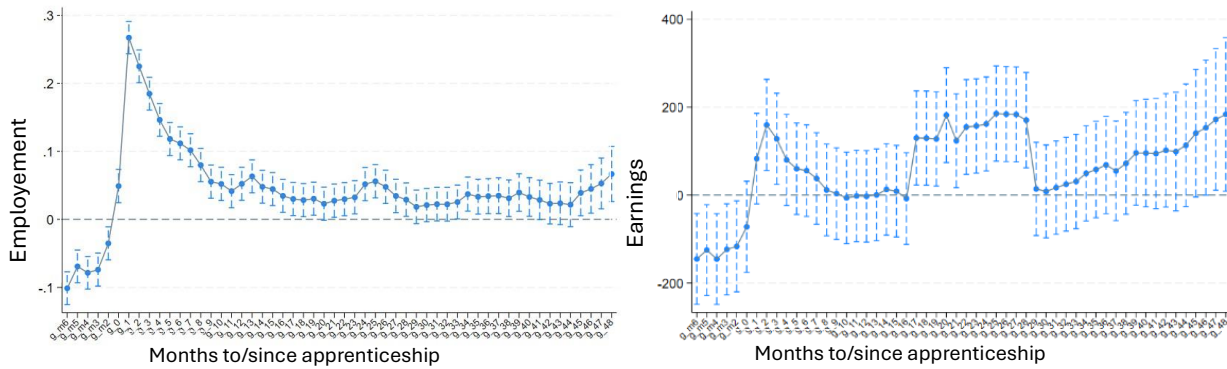
Notes: This figure plots the estimated ps and 95% confidence intervals (CIs) for the regressions corresponding to equation (3) with the probability of having a Level II apprenticeship as the dependent variable. Source: Results based on calculations by the author using micro-level data from INPS data

Figure 8: Effect of dual education on the probability of having an open-ended contract, based on event study



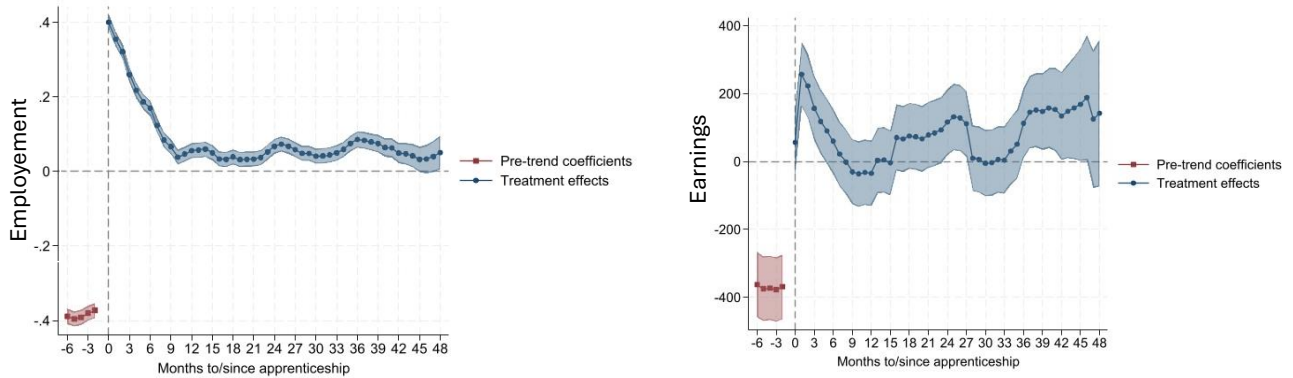
Notes: This figure plots the estimated ps and 95% confidence intervals (CIs) for the regressions corresponding to equation (3) with the probability of having and open-ended contract as the dependent variable. Source: Results based on calculations by the author using micro-level data from INPS data

Figure 9: Effect of dual education on apprentices with previous labour market experience.
Event study



Notes: This figure plots the estimated ps and 95% confidence intervals (CIs) for the regressions corresponding to equation (3) with employment (panel A- left) and earnings (Panel B- right) as the dependent variable for the sub-sample of apprentices with previous labour market experience. Source: Results based on calculations by the author using micro-level data from INPS data.

Figure 10: Effect of dual education on apprentices with short VET diploma. Event study



Notes: This figure plots the estimated ps and 95% confidence intervals (CIs) for the regressions corresponding to equation (3) with employment (panel A- left) and earnings (Panel B- right) as the dependent variable for the sub-sample of apprentices with short VET diploma. Source: Results based on calculations by the author using micro-level data from INPS data.

Appendix

Table A1: Regions uptake of the reform

Semester of Implementation of regulations and guidelines of the State-Region agreement.	Regions
2nd Semester 2015	Lombardia, Toscana
1st Semester 2016	Basilicata, Calabria, Emilia Romagna, Friuli Venezia Giulia, Marche, Piemonte, Sicilia, Umbria, Veneto, Trento
2nd Semester 2016	Abruzzo, Campania, Liguria, Puglia
1st Semester 2017	Lazio, Sardegna
2nd Semester 2017	Molise
1st Semester 2019	Valle d'Aosta

Table A2: Number of observations for each region

Region	Apprentices pre-reform	Apprentices post-reform	Total
Abruzzo	143	31	174
Basilicata	21	60	81
Calabria	161	160	321
Campania	728	286	1014
Emilia Romagna	333	258	591
Friuli Venezia Giulia	79	77	156
Lazio	940	81	1021
Liguria	229	62	291
Lombardia	793	2218	3011
Marche	94	53	147
Piemonte	331	287	618
Puglia	398	171	569
Sardegna	95	6	101
Sicilia	527	316	843
Toscana	234	295	529
Trento	87	73	160
Umbria	61	50	111
Veneto	395	305	700
Total	5678	4789	10467