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DISCUSSION PAPER SERIES

IZA DP No. 13154

Apprenticeship and Youth Unemployment

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ISSN: 2365-9793

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ABSTRACT

Apprenticeship and Youth Unemployment*

In France, two years after school completion and getting the same diploma, the employment rate of apprentices is about 15 percentage points higher than that of vocational students. Despite this difference, this paper shows that there is almost no difference between the probability of getting a callback from employers for unemployed youth formerly either apprentices or vocational students. This result indicates that the higher employment rate of apprentices does not rely, in the French context, on better job access of those who do not remain in their training firms. The estimation of a job search and matching model shows that the expansion of apprenticeship has very limited effects on youth unemployment if this is not accompanied by an increase in the retention of apprentices in their training firm.

JEL Classification: J24, M53, M51

Keywords: apprenticeship, school-to-work transitions, field experiment

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* We are grateful to Philippe Zamora, Mathilde Gaini, Marine Guillerm and Cecile Ballini for helpful guidance during the experiment. We are also indebted to Marie-Camille Alban, Elika Athari, Sarah Cohen, Karim El Charkawy, Demba Konate, Hugo Lapeyronie, Salome Leblanc, Komivi Seshie, and Loic Valck, for excellent research assistance. We thank participants from the CREST seminars and from the IREDU seminar for their helpful comments. This project has been approved and funded by the board of the chair Securisation des Parcours Professionnels and the Ministry of Labor (DARES), and has been administratively supported by the Institut Louis Bachelier.

Apprenticeship and Youth Unemployment*

Pierre Cahuc† Jérémy Hervelin‡

Abstract

In France, two years after school completion and getting the same diploma, the employment rate of apprentices is about 15 percentage points higher than that of vocational students. Despite this difference, this paper shows that there is almost no difference between the probability of getting a callback from employers for unemployed youth formerly either apprentices or vocational students. This result indicates that the higher employment rate of apprentices does not rely, in the French context, on better job access of those who do not remain in their training firms. The estimation of a job search and matching model shows that the expansion of apprenticeship has very limited effects on youth unemployment if this is not accompanied by an increase in the retention of apprentices in their training firm.

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I Introduction

Empirical studies often document that apprentices have better access to employment than other vocational students after leaving school.[1] These facts, together with the widely publicized success of the German apprenticeship system, motivate many public policies aiming at boosting apprenticeship to foster youth employment.[2].

However, little is known about the reasons why apprentices may perform better at the start of their career. Apprenticeship is generally more developed in occupations and areas whose labor market is tight, making it difficult to disentangle the effects of potential specific skills of apprentices from the demand of firms for these occupations. Potential selection of individuals with specific abilities into apprenticeship implies that estimating the impact of apprenticeship on access to jobs is difficult. Furthermore, the higher employment rate of apprentices may be the consequence of retention in their training firm, without providing any advantage in access to jobs in other firms. Thus, to know whether and how apprenticeship really fosters the integration of youths into employment, it is important to answer the following question: How do employers compare *a priori* identical graduates of the same diploma acquired either after apprenticeship or after vocational education in school?

This is exactly the question addressed in this paper. To answer this question, we measure the chances of getting a callback from employers for unemployed youth who were formerly either apprentices or vocational students. The method involves sending résumés, to actual job offers, of unemployed young applicants who are similar except for the pathway through which they got their secondary school diploma. This strategy ensures that résumés can vary in one dimension only, which serves to identify the effects of different education pathways on the probability of callback, and consequently the preferences of employers for these pathways.

We sent 3,110 applications from January to July 2018 to job offers posted in France for cook and bricklayer positions.[3] The choice of these occupations is motivated by several reasons. First, these occupations attract a significant share of low skill youth, who complete their education at the secondary school level. Second, the shares of apprentices and

[1] See for instance Fersterer et al. (2008) for Austria, Corseuil et al. (2019) for Brazil, Bonnal et al. (2002) for France, Winkelmann (1996) for Germany, Noelke and Horn (2014) for Hungary, Picchio and Staffolani (2019) for Italy, Mcintosh (2004) for the UK. Wolter and Ryan (2011) (p. 553) conclude their survey of the empirical evidence as follows: "The well-documented benefits of apprenticeship for the transition from school to work—once selection into different training options is taken into account—are followed by economic returns in early adulthood that in some countries are similarly favorable but that in others involve smaller pay gains and more unstable employment."

[2] See Kuczerat (2017).

[3] The experiment has been conducted under the patronage of the *Chaire Sécurisation des parcours professionnels* (http://www.chaire-securisation.fr), the partners of which are the Ministry of Labor, Pole Emploi (Public Employment Service), UNEDIC (Public Unemployment Insurance), Alpha (Consultancy firms specialized in labor relations) Sciences Po and CREST-ENSAE. The steering committee of the chair, composed of representatives of these institutions, approved this experiment without imposing any constraint on the design proposed by the authors.

vocational students are important in both occupations. Third, these occupations belong to different industries, which is relevant for assessing external validity. Fourth, the school-to-work transitions of vocational students and apprentices who intend to work in the hotel and restaurant and construction sectors are similar to those of all students and apprentices.

At the aggregate level, we detect no difference in the callback probability of apprentices and vocational students. This result holds true for both occupations. It also holds true for small and large firms and for temporary and permanent jobs. The only small difference, to the advantage of apprentices, arises in commuting zones where the unemployment rate is high. This is consistent with a situation in which employers have a slight preference for apprentices which has an impact on callback probabilities only if employers can choose among a large pool of applicants.

Relying on the *Génération* survey, which provides a large representative sample of students leaving education, we generate descriptive statistics showing that the findings of our correspondence study are consistent with the overall school-to-work transitions of apprentices and vocational students in France. On average, the unemployment rate of apprentices is 10 to 15 percentage points lower than that of their counterparts right after graduation. This figure corresponds to the difference between the share of apprentices who remain in their training firm and the share of vocational students who remain in the firm where they were interns before leaving school. Data from the *Génération* survey also show that, conditional on observable characteristics, apprentices do not perform better in getting jobs than vocational students once they are non-employed, whether unemployed or inactive.

It is possible that unemployed apprentices do not perform better than students in getting job offers because only the best apprentices remain in their training firm, implying that those who are looking for jobs are the less effective ones. To see whether this selection exists, we compare the wages of apprentices retained in their training firm with those of other apprentices. Their average wages are not statistically different, meaning that there is no evidence of selection of the best apprentices in their training firms. The absence of selection of best apprentices in their training firm may be explained by their propensity to quit their job at the end of their apprenticeship for personal reasons. We also find that the average wage of apprentices not retained in their training firm is not statistically different from that of students, indicating that the productivity gap between apprentices and students is at most small. This suggests that the higher employment rate of apprentices, compared with that of vocational students, does not originate from their higher productivity, but from retention in their training firms.

This implies that expanding the share of apprentices might have very limited impact on youth unemployment if this is not accompanied by high retention rates of apprentices in their training firm. However, expanding apprenticeship has several consequences which need to be taken into account to evaluate its impact on youth unemployment. This expansion may crowd

out vocational students facing more competition from more numerous apprentices. It may increase competition among apprentices. It may reduce the average quality of apprentices. These effects may contribute to dampen the effectiveness of apprenticeship to improving labor market performance. On the other hand, by providing more productive workers, increasing the share of apprentices may foster job creation. To evaluate these mechanisms, we build and estimate a search and matching model which allows us to reproduce the main stylized facts of a youth labor market with vocational students and apprentices. In this model, students and apprentices not retained in their training firm at the completion of their apprenticeship compete to get jobs. The estimation of this model, using data from the *Génération* survey, confirms that apprentices not retained in their training firm are only slightly more productive than students. The model also predicts, in line with the results of the correspondence study, that the exit rates from unemployment of students and apprentices are very close at the average unemployment rate, but that apprentices are more often called back for interview and then more often recruited than students when the unemployment rate is higher. Counterfactual exercises show that expanding the share of apprentices has limited impact on youth unemployment if this is not accompanied by an improvement in the retention rate of apprentices in training firms. It is worth noting that these are conservative results when it comes to the effectiveness of apprenticeship expansion in decreasing youth unemployment insofar as it is likely that apprenticeship attracts students more motivated by professional careers. Hence, the expansion of apprenticeship may attract less motivated students, leading to a decrease in its effectiveness.

These results have important consequences for policy. If the main advantage of apprenticeship is the creation of better matches between labor market entrants and jobs, policies should be more focused on this dimension. The collaboration between schools and public employment services can be a powerful lever, as discussed in our concluding comments which highlight the apparently very successful German and Japanese experiences in this domain.

Our paper is related to several strands of the literature. Many contributions analyze the labor market performance of apprentices and vocational students (see the surveys of Wolter and Ryan (2011) and Riphahn and Zibrowius (2016)). As far as we are aware, only a few studies aim at identifying the causal impact of apprenticeship on job access or remuneration. Those which do so find higher returns to apprenticeship in terms of remuneration or access to stable jobs (see Fersterer et al. (2008) in Austria, Bonnal et al. (2002) for France, Plug and Groot (1998) for the Netherlands, Albanese et al. (2019) for Italy). The contributions focused on labor market transitions after apprenticeship generally stress the importance of retention of apprentices in their training firms (Riphahn and Zibrowius (2016), Albanese et al. (2019)). In particular, Von Wachter and Bender (2006) find that wage losses of German apprentices who do not remain in their training firm are initially 15 percent, and then drop to zero within five years. This indicates that retention in training firms does play a key role in the success

of apprentices at the outset of their careers. Although our analysis is focused on a different country, our results are consistent with the findings of Von Wachter and Bender (2006). These results are also consistent with previous studies which find that apprentices not hired by their training firm do not have better positions than vocational students in France (Bonnal et al. (2002); Léné and Cart (2018)). Our approach allows us to conclude that this situation does not stem from lower job search activity by non-retained apprentices, but from the recruitment behavior of firms. This suggests that the time spent in firms during apprenticeship does not provide specific skills which are valuable outside training firms, compared to time spent in vocational schools.

Our analysis contributes to the literature based on correspondence studies devoted to the effect of work experience and education on the likelihood of being invited to an interview. This approach is useful to evaluate the impact of different education or training pathways on school-to-work or training-to-work transitions, leaving aside the analysis of their long run impact.[4] From this perspective, Nunley et al. (2016) find that the internship experience significantly increases the interview rate of college graduates in the US. Gaulke et al. (2019) find that post-baccalaureate business certificates do not improve chances of receiving a callback in the US. Cahuc et al. (2019a) show that, compared to those who have stayed unemployed since leaving school in France, the callback rate of high school dropouts unemployed four year after leaving school is not raised for those with employment experience, whether it is subsidized or non-subsidized, if there is no training accompanied by skill certification. The contribution of Hervelin et al. (2020), also focused on high school dropouts in France, finds that only dropouts with both job related experience and training leading to a qualification manage to catch up with their non-dropout peers. Our paper contributes to this strand of the literature by examining the callback rates of graduates low-skilled in a context where the same diploma can be obtained either through apprenticeship or the vocational school pathway.

Finally, our paper is related to the literature which analyzes the link between callback to interviews and hiring decisions. Jarosch and Pilossoph (2018) show that differences in callbacks of unemployed workers depending on their unemployment spell can have limited consequences for hiring decisions. Cahuc et al. (2019b) set out a model showing that the difference in callback rates between two groups of workers at the stage of invitation to interviews can be a poor predictor of eventual hiring differences. We complement this approach by providing and estimating a search and matching model which allows us to infer eventual hiring decisions from the callback to interviews of apprentices and vocational students. This approach eventually helps to relate the results of the correspondence study to the hiring decisions of firms, and to show that the higher employment rate of apprentices after leaving

[4]The analysis of the long run impact, which is beyond the scope of this paper, can be useful in identifying the signaling and human capital accumulation components of the returns to education and training as shown by Farber and Gibbons (1996); Altonji and Pierret (2001); Aryal et al. (2019) among others.

school is almost entirely due to the retention rate in the firms where they were trained.

The paper is organized as follows. Section II presents the school system and the features of vocational students and apprentices in France. Section III describes the experimental design. Section IV presents the main findings of the correspondence study. Section V discusses the external validity and the interpretation of these findings by examining the school-to-work and the labor market transitions of all vocational secondary school graduates from the *Génération* survey. Section VI presents the conceptual framework which enables us to empirically explore the consequences on youth unemployment of expanding the share of apprentices. Section VII provides concluding comments about the policy implications of our results.

II Background

Since our analysis is focused on youth who completed their vocational education at the upper secondary level, we start by presenting the main features of the upper secondary vocational education system before describing the characteristics of apprentices and vocational students.

II.A The vocational education system

In France, at the end of lower secondary education (ninth grade), students have the choice between two education paths. First, they can choose three-year general education programs to prepare for the high school diploma (*baccalauréat*). About 62% of students choose this path.[5] Second, about 33% choose vocational programs for two or three years either in vocational schools (*Lycée professionnel*, 28%) or in apprenticeship centers (*Centre de formation des apprentis*, CFA, 5%). The two-year vocational programs, which are chosen by 11% of students, lead to a diploma called *certificat d'aptitude professionnelle* (CAP), with different specializations. The three-year programs, chosen by 22% of students, lead to the *professional baccalauréat*. Our study is focused on young people from the two-year vocational programs because the share of apprentices, which represents about half of these young people, is large relative to the three-year programs, in which there is a tiny fraction of apprentices.[6]

During their ninth grade, students have to list the different specializations for the CAP they want to apply for. These lists are addressed to their school. The schools then send some students files to the targeted vocational schools. While there can be some selection into some specializations due to budgetary constraints or behavioral standards, registration into a vocational school is otherwise automatic. However, students seeking to become apprentices need to find a firm willing to hire them for two years. If the young person is hired, the two parties settle a contract which stipulates the task contents of the occupation, the wage as a percentage of the floor wage in the sector, and the content of the training provided by

[5] See Testas et al. (2018) for data about the paths of students at the end of lower secondary education.

[6] Vocational education and apprenticeship can also take place at higher education levels.

the employer. Apprentices are registered with an apprenticeship center (known under the acronym CFA, for *Centre de Formation des Apprentis*) which provides general and vocational education. In most cases, apprentices spend between half and two-thirds of their time in the firm each month, and the remainder in the apprenticeship center.

Vocational students who are not apprentices study in vocational high schools. About one third study in the classroom exclusively, while the other two thirds combine education in their vocational schools with internships in training firms. According to French labor law, training firms do not have the obligation to pay students if the total number of weeks of internship during a year does not exceed eight weeks. Accordingly, the duration of internships for vocational students is usually no longer than eight weeks. The only obligation training firms face is the commitment to an internship agreement, which describes the task contents and working conditions. This internship agreement has to be signed by the training firm, the student and the vocational school. Since the *circulaire numéro 2015-035 du 26 février 2015* and the *circulaire numéro 2016-055 du 29 mars 2016*, teachers in each specific training program have to create an internship center to reinforce equity among students and to help them find a training firm. Teachers also have to conduct a preparation week before the first period of internship. During this week, students participate in workshops and talks to prepare for their internship.

Whatever the chosen path, students and apprentices have to pass the *same* national exam at the end of the two-year program. Depending on the courses, exams can be written, oral, or both. Some bonus points can be awarded during the two-year program through a system of continuous evaluation, depending on the specialization. The CAP diploma is obtained if the average grade is at least 10/20. The CAP certifies the skills that any worker in the specified occupation must master to be employable.

Table I displays the main features of the two-year education programs of vocational students and apprentices. On average, apprentices spend half as much time in the classroom as vocational students. Conversely, apprentices work 35 hours per week in training firms, during 22 months for a monthly wage of about €515. Academic courses are given by apprenticeship centers at their discretion. The only obligation apprenticeship centers face is to ensure a minimum of 400 hours of lessons per year of training. Apprenticeship centers can decide the amount of time allocated to each course.

Overall, vocational students spend between thirty-two and thirty-four hours per week in the classroom. The number of hours of academic lessons is split evenly between general and vocational education. The exact total number of hours of academic lessons depends on the specialization of students. The higher the total duration of internships, the lower the number of hours of academic education. While the content of general education is common to all specializations, the content of vocational lessons is specialization specific,[7] as is the number

[7]See Tables A.4.1.1 and A.4.2.1 in Appendix A.4 for details regarding the targeted cook and bricklayer

TABLE I

TRAINING CONTENTS IN VOCATIONAL SCHOOL AND APPRENTICESHIP CENTER

		Vocational school		**Apprenticeship center**	
	Academics				
Courses	Description	1^{st}-year	2^{nd}-year	1^{st}-year	2^{nd}-year
French	Oral (listen, react, express), written (read, analyze, write)				
History	French workforce and republics, world discoveries, world wars	3h30 - 4h	3h30 - 4h	-	-
Geography	Globalization, inequality, agriculture, technological risks				
Morality, Civic education	Rights and duties, citizenship, discrimination, medias	30min	30min	-	-
Art, Culture	Product design, communication design, space design	2h	2h	-	-
Health, Environment	Manage one's health, budget, working and leisure time	1h	1h30	-	-
Foreign language	Objective: A2 level in 1 among 6 languages	2h	2h30	-	-
Sport	3 disciplines among the academic and national lists	2h30	2h30	-	-
Mathematics	Calculus, graphics, proportionality, equations, statistics	3h30 - 4h	3h30	-	-
Sciences	Matter, pH, kinematic, waves, electricity			-	-
Technical, Professional	Lessons, practical work and workshops defined by schools	17h - 18h	17h - 18h	-	-
Total (weekly)		32h - 34h	32h - 34h	-	-
Total (yearly)		**896h - 1,140h**	**812h - 1,026h**	**438h**	**439h**
	Professional				
Type		Internships		Apprenticeship	
Legal document		Internship agreement		Contract of apprenticeship	
Duration		From 12 to 16 weeks		22 months	
Working time		Set by the training firm		35 hours per week	
Salary		None if total duration $\leq$ 8 weeks		€515.15 per month	

Note: This table reports information about the vocational education system in France depending on whether the CAP diploma is obtained in vocational school or in apprenticeship. The information comes from the following sources: *Bulletin officiel spécial numéro 6 du 25 juin 2015*, *Bulletin officiel spécial numéro 8 du 25 février 2010*, *Bulletin officiel spécial numéro 2 du 19 février 2009*, Bull*etin officiel numéro 42 du 12 novembre 2009*, *Circulaire numéro 2015-035 du 26 février 2015*, *Circulaire numéro 2016-055 du 29 mars 2016* for vocational students and *Ari@ne 2015* for apprentices. As indicated in the text, each apprenticeship center can decide the amount of time allocated to each course under the constraint that there is a minimum of 400 hours of lessons per year. There is no available information on the time schedule in apprenticeship centers.

of weeks for internships. The manner in which the number of weeks for internships needs to be completed is decided by each vocational school.

II.B Characteristics of apprentices and vocational students

Table II reports the main characteristics of students and apprentices who obtained their CAP in 2000s. We rely on the national surveys *Enquête Génération* run in 2004, 2010, 2013 and 2016,[8], which asks questions to a representative sample of around 25,000 youngsters who completed school at the end of a specific academic year.[9] About half of youngsters who obtain their CAP are apprentices. Apprentices are more often males and come from a more favorable environment compared with vocational students: their parents are less often immigrants, are more educated and are more often employed. Moreover, data from the Ministry of education[10] show that apprentices are more skilled in French and mathematics than vocational students. They also have a better subjective self-judgment of their abilities in the social sphere (participation in activities, creation of social relations...). Although apprentices are overall in more favorable situations than vocational students, Table II indicates that their graduation rates are almost identical.

Table II reports that almost half of vocational students declare that they would have preferred apprenticeship. 66% of those who would have preferred apprenticeship either did not find any apprenticeship center (CFA), or employer, or found neither. In addition, about 20% of vocational students did not do an internship during their training in a vocational school. For the others, about half of them had to do at least three internships to meet the legal duration of internships during the vocational program. We are not able to see from the data whether these different internships had been done within the same training firm or not. Around 66% of vocational students declared that their last training firm was found thanks to their private network (self, family or friends), and 22% thanks to a public network (teacher or a school service). On the contrary, these proportions rose to 81% and declined to 15% respectively for apprentices.

All in all, it seems that apprentices are more employable than vocational students: they get the same diploma, but they come from more favorable backgrounds, they were better students in lower secondary schools, they have better subjective self-judgments of their social abilities and their acquired more work experience.

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occupations respectively in the field experiment.

[8] https://www.cereq.fr/enquetes-et-donnees/insertion-professionnelle-generation.

[9] All young people who went back to school for a specific training within a year after the one they were supposed to finish are excluded from the survey. We also exclude youngsters who obtained another diploma before their CAP, irrespective of the field of training. Overall, the selected sample is purged of any potential school dropouts or multi-graduated youths, who both constitute specific sub-samples. Finally, we are able to observe at least 10,000 youths followed during 34 months after they ended school whether in 2001, 2007, 2010, or 2013 within the *Génération* surveys 2004, 2010, 2013 and 2016 respectively.

[10] See Testas et al. (2018).

TABLE II

STATISTICAL PORTRAIT OF STUDENTS AND APPRENTICES

Component	Information	Students	Apprentices
		57.55%	**42.45%**
Individual	Sex (male)	54.62%	72.17%
	Age	20 y.o.	20 y.o.
	Handicap	1.79%	2.36%
	Driving license	33.49%	55.40%
Family	District area		
	Downtown	33.71%	26.25%
	Suburb	31.61%	32.98%
	Small city	10.93%	11.54%
	Village	23.75%	29.22%
	Siblings	92.72%	90.32%
	French language	92.62%	96.07%
	Birthplace of father		
	France	74.32%	84.17%
	European countries	4.53%	5.10%
	Arabic countries	15.39%	8.36%
	African countries	4.31%	1.49%
	Rest of the world	1.44%	0.88%
	Birthplace of mother		
	France	76.85%	87.09%
	European countries	4.72%	4.18%
	Arabic countries	13.12%	6.49%
	African countries	4.16%	1.57%
	Rest of the world	1.15%	0.67%
	School level of father		
	No diploma	45.53%	33.46%
	Cap/Bep	40.43%	47.31%
	Bac	8.94%	12.63%
	Bac+	5.09%	6.60%
	School level of mother		
	No diploma	43.77%	34.69%
	Cap/Bep	38.32%	39.00%
	Bac	13.41%	17.97%
	Bac+	4.49%	8.34%
	Father works	80.46%	86.28%
	Mother works	61.65%	72.46%
Education	Repeat year before 6th grade	37.87%	38.48%
	Normal middle school program	59.24%	59.75%
	Would have preferred apprenticeship	47.03%	-
	Reason of non-apprenticeship		
	No CFA	4.80%	-
	No employer	31.50%	-
	Neither CFA, nor employer	29.60%	-
	Other	34.09%	-
	Internships / Apprenticeship Tutor	83.83%	87.96%
	Number of internships		
	1	24.55%	-
	2	28.91%	-
	3 or more	46.54%	-
	Contact with the (last) training firm		
	Self	41.90%	46.40%
	Family and friends	27.58%	35.17%
	School / Apprenticeship center	21.46%	10.62%
	Other Public Structure	0.16%	5.73%
	Other	8.89%	2.07%
	Graduated	93.02%	91.47%

Note: This table reports descriptive statistics for both apprentices and vocational students. Shares of students who made interships and the mode of contact with the last training firm are computed from the *Génération 2010* survey only, while the respective shares for apprentices are computed from the *Génération 2001* survey, because of variation in the specific questions. The share of graduated students and apprentices are computed with both the *Génération 2010-2013* surveys because of changes in the content of the level V diploma in 2009 in France.

Source: pooled *Génération 2001-2007-2010-2013* surveys, CEREQ ($N = 10,947$ individuals)

III Experimental design

The experiment aims at comparing the probability of callback to job applications of otherwise identical apprentices and vocational students. We start by presenting the applicants before describing the applications.

III.A The applicants

The applicants, who are all unemployed at the time of their response to job offers, are identical in all points, with the exception of their education path while they were in upper-secondary vocational education. The characteristics of the fictitious applicants were chosen so as to match those of real apprentices and vocational students when they leave school.

Applicants are young males aged 18 at the date of graduation. We focus on males because it is much less common for women to be apprentices, especially in construction, where almost all apprentices are males. Their names have been chosen among those most commonly encountered in the French population. According to the *Fichier des prénoms* (INSEE), the two first names used in the experiment, Alexis and Théo, were respectively ranked 13 and 9 in the most given first names in 1999.[11] And according to the *Fichier patronymique* (INSEE), the surnames, Dubois and Petit, were respectively ranked 7 and 6.[12]

Given financial and organizational constraints, two occupations were selected. The choice of occupations relies on the following criteria: belonging to different industries, existence of an official state certification for the diploma that is normally a prerequisite to be hired, having sufficient shares of former upper-secondary vocational students and apprentices, having a sufficiently large number of job offers, being present in both market and non-market sectors to enlarge the potential number of job offers, having school-to-work transitions similar to those of the overall apprentices and vocational students displayed in the previous section.[13] This led us to select cook (ROME G1602) and bricklayer (ROME F1703) occupations. The features of the young people belonging to these two occupations and of their school-to-work transitions are documented in Tables A.4.1.2 and A.4.2.2 for cooks and bricklayers in Appendix A.4. Although there are more males and the share of apprentices is much larger in construction (69.7% versus 49.5% for all occupations and 50.7% for food services), CAP graduates from construction and food services share important common features with all apprentices and vocational students, for our purpose. For both occupations, the employment rate of apprentices is higher than that of vocational students from the date of school completion. Moreover, the employment rate difference between apprentices and vocational students vanishes when

[11] The first names have been chosen randomly among the top 20.

[12] The same has been done for surnames.

[13] We used various sources, including the Labor Force Survey (*Enquête emploi, INSEE)* and the *Répertoire National des Certifications Professionelles* (RNCP), to verify the existence of national diploma, the *Pôle emploi* database to evaluate the number of job offers.

individual characteristics and retention in the training firms are taken into account.

The profiles of applicants were then designed for these two occupations. They obtained the *CAP cuisine* for cook and the *CAP maçon* for bricklayer occupations in June 2017. Since then, they have been unemployed without any work experience from the date of graduation to the dates of job applications, which are sent from 22 January 2018 to 23 July 2018. They have a mix of soft skills (the ones expected in a firm) and hard skills (the ones expected in the occupation).[14]

III.B The applications

All applications included a résumé and a cover letter. They were accompanied by a short email message. Two templates have been created to ensure that callbacks do not depend on employers' preferences for a given presentation.[15] The templates have been inspired by different samples taken from the *Pôle emploi CVthèque*,[16] a youth center sample, and Google searches. The cover letters contained five paragraphs each. Sentences were written in a similar way so there was no apparent literacy difference among the two templates.[17]

Since applications were sent to job offers in all French *départements*, applicants' addresses were chosen to be in the center of whatever city serves as the administrative capital (préfecture) of the department in which the job was posted, in order to ensure that candidates live sufficiently close to their potential future job.[18] Since the diploma is national, there is no information about the school, which is common in résumés for this type of application. The address of training firms where students and apprentices worked during their studies is not provided, to avoid detection of fictitious applications. These training firms are large well known firms (Flunch, Hyppopotamus for cooks and Bouygues Construction and Lafarge for construction) for which it is unusual to mention the address of the establishment in which one has been employed.

Job offers for both occupations were identified using mainly the website of *Pôle emploi*, the French public employment agency.[19] Applications were sent only when it was possible to contact the recruiter directly by email, hence job offers issued by temporary work agencies or other intermediaries were not considered. Moreover, the same recruiter could never be contacted more than once, even if he posted different job positions in different areas of France

[14] These skills have been taken from the *fiches métiers Pôle emploi*. Occupation related hobbies are cuisine, pastry, international cuisine for cook and DIY, for bricklayer. Other hobbies are: cinema, sport, handball, music. More details here for cooks and here for bricklayers.

[15] See Appendix A.1 for examples of résumés and cover letters.

[16] This public databank is available to help recruiters in selecting different available profiles. More details at https://www.pole-emploi.fr/employeur/consultez-librement-des-cv-de-candidats.

[17] We check that the callback rates are not correlated with the layout types to avoid the potential issues of "template bias", addressed in Lahey and Beasley (2009).

[18] Addresses have been collected and verified via *Google maps*.

[19] A few private job search websites, such as *Le Bon Coin* or *Indeed* were also used when the number of offers available on the *Pôle emploi* platform was too low on a given day.

throughout the entire experiment period. The same goes for offers providing only a *Pôle emploi* counselor email address. If a job vacancy met these criteria, one (and only one) application was sent from one of the two fictitious candidates. The name of the applicant, the applicant profile (apprentice or student), and the layout type were all selected at random.

Replies from recruiters were collected up to the last recorded phone call and email message on 10 October 2018. When recruiters provided a positive answer to an application by inviting the applicant to an interview or requesting additional information about the application, an email was sent in order to thank the recruiter and inform him that the applicant had signed an open-ended contract with a different employer.

In total, 3,110 applications were sent from 22 January 2018 to 13 July 2018. As shown in Table III, there are 2542 applications from cooks and 568 from bricklayers. The relatively low number of applications for positions as bricklayers stems from the large share of job ads posted by temporary work agencies in the construction industry. Since our fictitious candidates could not apply to these job offers without a high probability of being detected, the number of applications for this occupation was limited.[20] Table A.2.1 in Appendix A.2 provides randomization tests. Due to the randomized design of the field experiment, this table confirms that the covariates characterizing the job vacancies are balanced between apprentices and vocational students.

IV Results

We start by presenting the callback rates to all applications before analyzing whether the results obtained at the aggregate level depend on the type of applications (temporary versus permanent jobs; job ads posted by large versus small firms) and on the local unemployment rate.

IV.A Callbacks to all applications

A reply from a recruiter who stated that he did not select the application for the job vacancy is classified as a negative callback, like the absence of callback. Any other reply is considered as positive callback, but we distinguish two grade of positivity. "Positive callbacks" show some interest in the application, ranging from the vague request "please call me back" to more precise inquiries about the training or experience of the applicant, or his means of transportation if the worksite is located more than a few kilometers away from where he (supposedly) lives. We regard these requests as positive because they are likely motivated by

[20] The sample size has been chosen to detect a difference of 0.05 at 5% significance level and power of 80% between the baseline callback rate of vocational students and that of apprentices. It appeared quickly that the baseline callback rate was around 25% for both occupations. In this context, the minimum sample size is equal to 1,251 per group, which is reached for the whole sample and also for cooks as shown by Table III. This target was clearly unreachable for bricklayers, given the availability of job offers to which it was possible to apply.

genuine interest in the application on the part of the recruiter, and indeed some replies we classify as positive may not only request information, but may suggest an interview or even a hire. "Propositions" are more positive in that they straightforwardly propose an interview or a hire.

Then, we consider two categories of positive callbacks. First, "positive callbacks", which include propositions for interview, for hiring or a demand for complement information. Requirements for complementary information could be quite vague, asking "Please, call me back". They could also ask more precise information about the training or the experience of candidates, their means of locomotion when the job was located quite far from the address of the candidate. We interpret these types of callbacks as positive insofar as it is likely that they are motivated by the potential interest of the recruiter for the candidate. Second, we consider the category entitled "proposition" for callbacks which propose an interview or hiring.

The mean callback rates by category of callback and by profile of applicant are displayed in Table III. Callback rates are relatively high, about 28% for "positive callbacks" and 23% for "propositions", despite the relatively low level of education of applicants. Actually, like in all occupations where apprenticeship is well developed, the market of cooks and bricklayers is quite tight, which provides good employment opportunities to applicants. Indeed, apprenticeship, which is partly funded by employers, is more developed in sectors where employers face hiring difficulties.

It is clear from Table III that there are no statistically significant callback rate differences between apprentices and students. There is a tiny non-statistically significant positive difference in favor of apprentices taken as a whole and for cooks, of about 1 percentage point. Compared with the baseline callback rate, which is above 25% for "positive callbacks", this difference would be economically negligible if it were statistically significant.[21]

To analyze the data more extensively, we estimate the following linear probability model:

$$y_{ij} = \alpha + \beta \mathbb{1}_{i=apprentice} + x_j' \gamma + \varepsilon_{ij}$$

where y_{ij} is an indicator variable equal to one if applicant i gets called back for job j. $\mathbb{1}_{i=apprentice}$ is an indicator variable equal to one if applicant i is an apprentice. β measures the callback rate difference between apprentices and vocational students. x_j is a vector of department and month fixed effects. ε_{ij} is a residual term.

The OLS estimates of β are reported in Table IV. The three first columns report the estimates for occupations pooled together, for different specifications including department and month fixed effects, and for the two categories of callbacks: "positive callbacks" and

[21] Detection of such small difference is beyond the reach of this paper. Two-sample proportion tests imply that the sample size of each group must be equal to more that 29,800 to detect a difference of 0.01 at 5% significance level and power of 80% between the baseline callback rate of vocational students equal to 25% and that of apprentices.

TABLE III
CALLBACK RATES DESCRIPTIVE STATISTICS BY PROFILE

	Students	Apprentices	Difference (2)−(1)	p-value
	(1)	(2)	(3)	(4)
All				
# Observations	1,541	1,569		
Positive callback	.2745	.2830	.0085	.5979
	(.0114)	(.0114)	(.0161)	
Proposition	.2284	.2390	.0106	.4858
	(.0107)	(.0108)	(.0152)	
Cook				
# Observations	1,278	1,264		
Positive callback	.2793	.2975	.0181	.3133
	(.0126)	(.0129)	(.0180)	
Proposition	.2316	.2532	.0216	.2050
	(.0118)	(.0122)	(.0170)	
Bricklayer				
# Observations	263	305		
Positive callback	.2510	.2230	-.0280	.4341
	(.0268)	(.0239)	(.0358)	
Proposition	.2129	.1803	-.0326	.3294
	(.0253)	(.0221)	(.0334)	

Note: This table reports the number of observations per profile and the mean value of the primary dependent variables. A positive callback is equal to one if the fictitious candidate received a demand for complementary information, sometimes with a suggestion for interview or hiring. Proposition corresponds to callbacks which straightforwardly propose an interview or hiring. Standard error of the mean is reported in parentheses below the mean. Column (3) reports the difference between column (2) and column (1) and column (4) displays the p-value for the test $H_0 : \{\Delta =$ callback[apprentices] - callback[students] $= 0\}$ vs $H_1 : \{\Delta \neq 0\}$.

"propositions". The results, which are very stable across specifications and callback categories, confirm the absence of statistically signficant callback rates differences between apprentices and vocational students. Columns (4) displays the results for cooks and column (5) for bricklayers. Once again, the estimates of the β parameter are not statistically different from zero.[22]

[22]To address concerns about non-linear effects, we report the results of Table IV replacing the linear probability model with a Probit model in Appendix A.3. The Probit results in Table A.3.1 show that the estimated marginal effects are very similar to the OLS results. This similarity holds for all the results in the paper.

Table IV
Effects of apprenticeship on callback probability

	All applicants			Cook	Bricklayer
	(1)	(2)	(3)	(4)	(5)
Dep var: Positive callback					
Apprenticeship	0.00849	0.00766	0.00903	0.0172	-0.0309
	(0.0170)	(0.0168)	(0.0172)	(0.0196)	(0.0444)
Student mean	0.2745***	0.2745***	0.2745***	0.2793***	0.2510***
	(0.0114)	(0.0114)	(0.0114)	(0.0126)	(0.0268)
Observations	3,110	3,110	3,110	2,542	568
R-squared	0.000	0.003	0.043	0.050	0.197
Dep var: Proposition					
Apprenticeship	0.0106	0.00993	0.0119	0.0223	-0.0330
	(0.0146)	(0.0145)	(0.0147)	(0.0169)	(0.0411)
Student mean	0.2284***	0.2284***	0.2284***	0.2316***	0.2129***
	(0.0107)	(0.0107)	(0.0107)	(0.0118)	(0.0253)
Observations	3,110	3,110	3,110	2,542	568
R-squared	0.000	0.003	0.043	0.050	0.184
Month FE	No	Yes	Yes	Yes	Yes
Department FE	No	No	Yes	Yes	Yes

Note: The dependent variable is a dummy variable equal to one if the application gets a positive callback or a proposition. Positive callback corresponds to cases in which the fictitious candidate received a request for complementary information or a suggestion for interview or hiring. Proposition corresponds to callbacks with interview or hiring proposition. Apprenticeship is a dummy variable equal to one if the application was from an apprentice. Robust standard errors are clustered at the department level and reported below the coefficients. * significant at 10 percent, ** significant at 5 percent, *** significant at 1 percent.

IV.B Callbacks from large and small firms

Employers in small and large firms might have different preferences for apprentices versus vocational students, implying that the similarity of callback rates for apprentices and vocational students observed at the aggregate level could be the consequence of composition effects, stemming from relatively high callback rates for apprentices in small firms and relative low callback rates for apprentices in large firms. Indeed, apprentices might be more valuable in small firms, which need workers who are immediately productive and have less possibility to provide complementary on-the-job training. It is also likely that vocational students, whose education is more classroom-oriented than that of apprentices, have more transferable skills, which could be more valuable for large firms which can offer more varieties of jobs.

Table V shows that there is no difference in the callback rates of apprentices and vocational students between large and small firms. Therefore, the absence of difference between callback rates of apprentices and vocational students observed at the aggregate level is not the consequence of composition effects in the population of firms stemming from different

Table V

Effects of apprenticeship on callback probability given different firm sizes

	Small Firms			Large Firms		
	(1)	(2)	(3)	(4)	(5)	(6)
Dep var: Positive callback						
Apprenticeship	0.0316	0.0252	0.0294	0.00396	0.00223	-0.00428
	(0.0293)	(0.0307)	(0.0328)	(0.0212)	(0.0211)	(0.0223)
Student mean	0.2984***	0.2984***	0.2984***	0.2652***	0.2652***	0.2652***
	(0.0204)	(0.0204)	(0.0204)	(0.0156)	(0.0156)	(0.0156)
Observations	1,015	1,015	1,015	1,617	1,617	1,617
R-squared	0.001	0.009	0.116	0.000	0.003	0.071
Dep var: Proposition						
Apprenticeship	0.0201	0.0139	0.0183	0.00534	0.00484	-0.000404
	(0.0268)	(0.0276)	(0.0306)	(0.0195)	(0.0197)	(0.0205)
Student mean	0.2549***	0.2549***	0.2549***	0.2243***	0.2243***	0.2243***
	(0.0194)	(0.0194)	(0.0194)	(0.0147)	(0.0147)	(0.0147)
Observations	1,015	1,015	1,015	1,617	1,617	1,617
R-squared	0.001	0.009	0.122	0.000	0.003	0.059
Month FE	No	Yes	Yes	No	Yes	Yes
Department FE	No	No	Yes	No	No	Yes

Note: The dependent variable is a dummy variable equal to one if the application gets a positive callback or a proposition. Positive callback corresponds to cases in which the fictitious candidate received a request for complementary information or a suggestion for interview or hiring. Proposition corresponds to callbacks with interview or hiring proposition. Apprenticeship is a dummy variable equal to one if the application was from an apprentice. Small firms have less than 10 employees and large firms have at least 10 employees. Robust standard errors are clustered at the department level and reported below the coefficients. * significant at 10 percent, ** significant at 5 percent, *** significant at 1 percent.

behaviors of small and large firms.[23]

IV.C Callbacks to applications for temporary and permanent jobs

It is possible that temporary jobs, which need employees immediately operational, are more suited for apprentices than for vocational students, whose abilities are less operational inasmuch they have much less work experience. On the other hand, permanent jobs, often associated with career perspectives within the firm, could be more suited for vocational students, whose spectrum of competencies might be wider than that of apprentices. Hence, one could expect that employers favor apprentices relative to vocational students for temporary jobs and make the opposite choice for permanent jobs.

Table VI reports the callback rates for temporary and permanent jobs. The similarity of callback rates for apprentices and vocational students observed at the aggregate level is also observed for temporary jobs and permanent jobs.[24]

[23] Similar results are displayed in Tables A.4.1.3 and A.4.2.3 for cooks and bricklayers respectively.

[24] Similar results are displayed in Tables A.4.1.4 and A.4.2.4 for cooks and bricklayers respectively.

Table VI
Effects of apprenticeship on callback probability given different contracts

	Temporary Jobs			Permanent Jobs		
	(1)	(2)	(3)	(4)	(5)	(6)
Dep var: Positive callback						
Apprenticeship	0.0237	0.0227	0.0259	-0.0117	-0.0131	-0.00694
	(0.0198)	(0.0194)	(0.0198)	(0.0255)	(0.0259)	(0.0274)
Student mean	0.2871***	0.2871***	0.2871***	0.2564***	0.2564***	0.2464***
	(0.0150)	(0.0150)	(0.0150)	(0.0175)	(0.0175)	(0.0175)
Observations	1,820	1,820	1,820	1,286	1,286	1,286
R-squared	0.001	0.006	0.065	0.000	0.004	0.083
Dep var: Proposition						
Apprenticeship	0.0208	0.0205	0.0238	-0.00363	-0.00544	0.00293
	(0.0174)	(0.0175)	(0.0181)	(0.0245)	(0.0246)	(0.0261)
Student mean	0.2336***	0.2336***	0.2336***	0.2212***	0.2212***	0.2212***
	(0.0140)	(0.0140)	(0.0140)	(0.0166)	(0.0166)	(0.0166)
Observations	1,820	1,820	1,820	1,286	1,286	1,286
R-squared	0.001	0.004	0.061	0.000	0.004	0.091
Month FE	No	Yes	Yes	No	Yes	Yes
Department FE	No	No	Yes	No	No	Yes

Note: The dependent variable is a dummy variable equal to one if the application gets a positive callback or a proposition. Positive callback corresponds to cases in which the fictitious candidate received a request for complementary information or a suggestion for interview or hiring. Proposition corresponds to callbacks with interview or hiring proposition. Apprenticeship is a dummy variable equal to one if the application was from an apprentice. Temporary jobs comprise all offers for a seasonal contract or a determined duration contract. Permanent jobs are the complement. Robust standard errors are clustered at the department level and reported below the coefficients. * significant at 10 percent, ** significant at 5 percent, *** significant at 1 percent.

IV.D The impact of local labor market conditions

On tight labor markets, employers face hiring difficulties which imply that they tend not to be choosy when they select their workers. Since the callback rates of our applicants are quite high, about 25%, we can consider that our experiment concerns relatively tight labor markets. This may imply that we do not observe callback rate differences between apprentices and vocational students because employers have little choice. But it might be that callback rate differences show up on less tight labor markets.

To deal with this issue, we analyze how the callback rate difference between apprentices and vocational students varies according to the local unemployment rate. We estimate the difference in callback rate between apprentices and vocational students for each tercile of the unemployment rate at the commuting zone level.[25] The youth unemployment rate varies from 9.6% in the bottom tercile to 39.7% in the top tercile. The callback rate of students goes from 36.0% in the top tercile of unemployment rate to 22.6% in the bottom tercile. Table VII shows that the callback rate of apprentices is not different from that of students,

[25] We use the "zones d'emploi" from "INSEE". There are 304 "zones d'emploi" in metropolitan France.

Table VII
Effects of apprenticeship on callback probability given different labor markets

	All	T1 (7.2%)	T2 (8.5%)	T3 (10.8%)
	(1)	(2)	(3)	(4)
Youth unemployment rate	0.2500	0.0964	0.2050	0.3973
Dep var: Positive callback				
Apprenticeship	0.0184	-0.00668	-0.00178	0.0545**
	(0.0201)	(0.0423)	(0.0346)	(0.0270)
Student mean	0.2966***	0.3600***	0.3013***	0.2259***
	(0.0136)	(0.0248)	(0.0231)	(0.0220)
Observations	2,281	763	759	759
R-squared	0.079	0.103	0.091	0.091
Dep var: Proposition				
Apprenticeship	0.0152	-0.0133	0.0188	0.0399*
	(0.0169)	(0.0379)	(0.0283)	(0.0226)
Student mean	0.2524***	0.3147***	0.2456***	0.1956***
	(0.0129)	(0.0240)	(0.0217)	(0.0209)
Observations	2,281	763	759	759
R-squared	0.069	0.085	0.090	0.091
Month & Department FE	Yes	Yes	Yes	Yes
Firm & Job Characteristics	Yes	Yes	Yes	Yes

Note: The dependent variable is a dummy variable equal to one if the application gets a positive callback or a proposition. Positive callback corresponds to cases in which the fictitious candidate received a request for complementary information or a suggestion for interview or hiring. Proposition corresponds to callbacks with interview or hiring proposition. Apprenticeship is a dummy variable equal to one if the application was from an apprentice. TX corresponds to the Xth tercile of the unemployment rate at the commuting zone level. Youth unemployment rates are computed from the French labor force survey, for youth aged 16 to 25, with secondary school vocational diploma, over 2014-2018 to get a sufficient number of observations at the commuting zone level. Robust standard errors are clustered at the department level and reported below the coefficients. * significant at 10 percent, ** significant at 5 percent, *** significant at 1 percent.

except in the top tercile of local unemployment rate. It is about 5 percentage points higher for positive callbacks and 4 percentage points higher (and significant at 10% confidence level only) for callbacks with a proposition for interview or hiring. This result holds when firms and job characteristics are controlled for. This indicates that apprentices have a comparative advantage which arises only when the local unemployment rate is very high, so that employers can be choosy because they have access to abundant job offers.[26]

V External validity and interpretation

Our correspondence study indicates that the callback rates of apprentices and students who apply for jobs as cooks and bricklayers are identical at the aggregate level. A small differ-

[26]Similar results are displayed in Table A.4.1.5 for cooks but not for bricklayers in A.4.2.5, probably due to the low number of available observations.

ence arises only when the local unemployment rate is high, suggesting that the employers have a slight preference for hiring apprentices. To interpret our results and explore whether the absence of comparative advantage for apprentices at the aggregate level may apply to other professions, we analyze the school-to-work and labor market transitions of vocational secondary school graduates using the *Génération* survey.[27]

Figure 1 displays the evolution of the employment rates of apprentices and vocational students who graduated in June-July of the year they left school.[28] The employment rates are displayed from October (month one) to September three years later. Apprentices perform much better: their employment rate is about 15 percentage points higher than that of vocational students over the whole period. The time profiles of employment rates are similar: they increase steadily during the first year and are approximately stable the two following years. The employment rate difference between apprentices and vocational students is approximately stable over the three years after graduation. The difference originates mostly from the start of the period, i.e. just after graduation. It reflects the difference between the share of apprentices who remain in their training firm and the share of vocational students who remain in the firm where they were interns before leaving school. 33.6% of apprentices have been hired by their training firm while 8.5% of vocational students have been hired after graduation in a firm where they were interns. Figure 1 shows that the profile of unemployment rates follows the same pattern. The unemployment rate of apprentices is lower than that of students just after graduation and the difference remains stable over three years.

Table VIII, column 2, shows that the employment rate difference between apprentices and vocational students drops by half when observable characteristics, including gender, family background, industry and past school performance are accounted for. This is the consequence of the selection of the most advantaged students into apprenticeship described in section II.B. Column 3 shows that the employment rate difference between apprentices and vocational students is no longer significantly different from zero over the three-year post-school period when observable characteristics *and* the retention rate in the training firms are accounted for. The three last columns of Table VIII show that the employment rate difference three years after leaving school vanishes when the observable characteristics and retention rates are taken into account. A similar pattern arises for the unemployment rates. The unemployment rate difference drops when the individual characteristics and the retention rates are accounted for.

These facts are consistent with the findings of our correspondence study: the higher employment rate of apprentices after leaving school arises from their high retention rate in training firms compared with that of vocational students. Indeed, once they have been unemployed, apprentices do not get jobs at higher rate than vocational students. Table IX,

[27] The external validity of our findings outside the French context is discussed in the conclusion of the paper.

[28] Figures A.4.1.1 and A.4.2.1 in Appendix A.4.1 and A.4.2 display similar graphs for youths in the food sector and construction sector respectively with a similar interpretation.

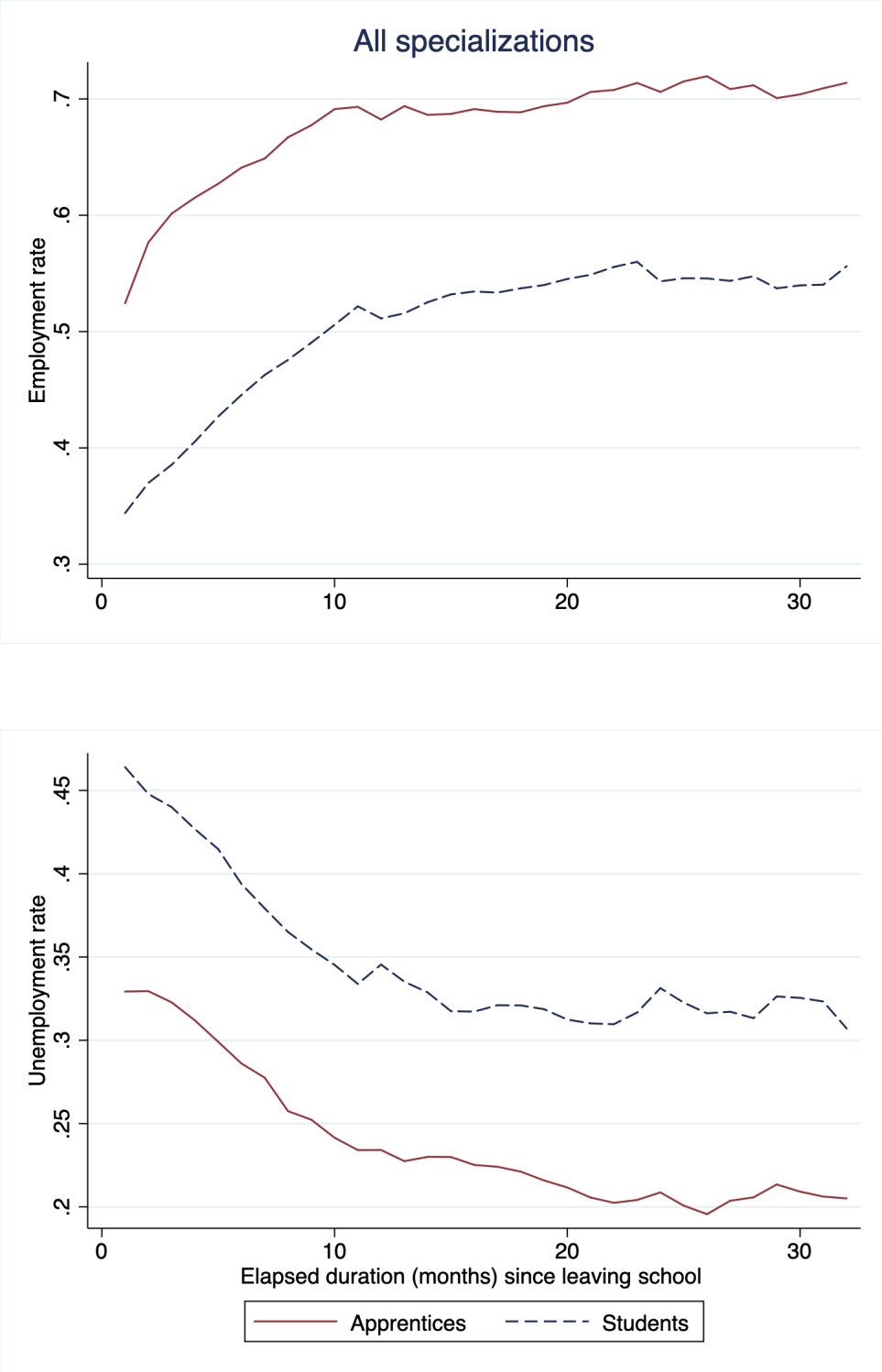


FIGURE 1: EVOLUTION OF THE SHARE OF STUDENTS AND APPRENTICES IN EMPLOYMENT OR UNEMPLOYMENT AFTER LEAVING SCHOOL.
Note: Students got their CAP diploma in June-July. Month zero stands for September.
Source: pooled *Génération 2001-2007-2010-2013* surveys, CEREQ.

TABLE VIII
OLS REGRESSIONS

Situations	All Years			3 Years After		
	(1)	(2)	(3)	(4)	(5)	(6)
Dep var: Employment						
Apprenticeship	0.145***	0.0789***	0.0336	0.118***	0.0459	0.0211
	(0.0224)	(0.0240)	(0.0238)	(0.0279)	(0.0303)	(0.0307)
Male		0.0908***	0.0756***		0.0635*	0.0552*
		(0.0261)	(0.0249)		(0.0330)	(0.0323)
Driving license		0.0931***	0.101***		0.121***	0.125***
		(0.0230)	(0.0216)		(0.0291)	(0.0288)
Graduated		0.0852**	0.0676*		0.0803	0.0709
		(0.0419)	(0.0391)		(0.0532)	(0.0521)
Firm retention			0.259***			0.142***
			(0.0236)			(0.0338)
Constant	0.551***	0.549***	0.572***	0.602***	0.621***	0.632***
	(0.0159)	(0.0241)	(0.0231)	(0.0203)	(0.0197)	(0.0196)
Observations	42,318	42,318	42,318	8,771	8,771	8,771
R-squared	0.022	0.172	0.204	0.016	0.214	0.224
Dep var: Unemployment						
Apprenticeship	-0.0888***	-0.0574***	-0.0210	-0.0776***	-0.0413	-0.0246
	(0.0206)	(0.0218)	(0.0217)	(0.0250)	(0.0274)	(0.0276)
Male		-0.0424*	-0.0303		-0.0190	-0.0134
		(0.0244)	(0.0237)		(0.0302)	(0.0300)
Driving license		-0.0813***	-0.0877***		-0.111***	-0.114***
		(0.0211)	(0.0203)		(0.0264)	(0.0263)
Graduated		-0.0728*	-0.0586		-0.0385	-0.0321
		(0.0397)	(0.0380)		(0.0516)	(0.0509)
Firm retention			-0.208***			-0.0959***
			(0.0208)			(0.0284)
Constant	0.328***	0.338***	0.319***	0.281***	0.283***	0.275***
	(0.0148)	(0.0248)	(0.0240)	(0.0184)	(0.0184)	(0.0182)
Observations	42,318	42,318	42,318	8,771	8,771	8,771
R-squared	0.010	0.147	0.171	0.008	0.183	0.189
Control Variables	No	Yes	Yes	No	Yes	Yes

Note: This table reports OLS estimates, where the dependent variable is a dummy variable equal to one if the individual is in employment, zero otherwise. "Apprenticeship" is a dummy variable equal to one if the individual has followed his vocational education as an apprentice. Columns (1) to (3) include all available years after leaving school, while columns (4) to (6) yield results three years after leaving school. We control for additional covariates in columns (2), (3), (5), and (6). Unreported control variables include demeaned dummies for the age at school end, being disabled, school level of father, school level of mother, father in employment, mother in employment, birthplace of father, birthplace of mother, department of residency, region of the training establishment, speciality of training, date. Firm retention is a demeaned dummy variable equal to one if the individual has been retained by his training firm after ending school. Robust standard errors are clustered at the individual level and presented in parentheses below the coefficients. * significant at 10 percent, ** significant at 5 percent, *** significant at 1 percent

Source: pooled *Génération 2001-2007-2010-2013* surveys, CEREQ

Table IX
Cox Regressions

Transitions	Non-Employment → Employment		Unemployment → Employment	
	(1)	(2)	(3)	(4)
Apprenticeship	1.3065***	1.0345	1.3375***	0.9344
	(0.1104)	(0.1316)	(0.1362)	(0.1653)
Male		1.1615		1.1036
		(0.1525)		(0.2044)
Driving license		1.5218***		2.0566***
		(0.1999)		(0.3811)
Graduated		1.8919***		2.3843**
		(0.4653)		(0.8244)
Observations	7,593	7,593	5,795	5,795
Control Variables	No	Yes	No	Yes

Note: This table reports probability ratio estimates from a proportional hazards model estimated with Cox regressions, where the dependent variable is a dummy variable equal to one if the individual has undergone a transition from a non-employment situation to an employment situation. "Apprenticeship" is a dummy variable equal to one if the individual has followed his vocational education as an apprentice. Columns (1) to (2) consider any situations of non-employment from employment situations. While columns (3) to (4) yield estimates from unemployment to employment situations. We control for additional covariates in columns (2) and (4). All of the control variables are fixed over time. Unreported control variables include dummies for the age at school leaving, being disabled, school level of father, school level of mother, father in employment, mother in employment, birthplace of father, birthplace of mother, department of residency, region of the training establishment, speciality of training. Robust standard errors are clustered at the individual level and presented in parentheses below the coefficients. * significant at 10 percent, ** significant at 5 percent, *** significant at 1 percent.
Source: pooled *Génération 2001-2007-2010-2013* surveys, CEREQ

which reports the estimation of proportional hazard models shows that the unemployment to employment and the non-employment to employment transitions of apprentices and vocational students are not statistically different once observable individual characteristics are controlled for.

We have also explored whether differences in unemployment rates or in exit rates from unemployment between apprentices and vocational students arise when the local unemployment rate is high, insofar as our correspondence study shows that the apprentices are more often called back than vocational students when the local unemployment rate is higher. We do not find any statistically significant difference between apprentices and vocational students for these outcomes.[29] This may be due to the insufficient number of observations.

The absence of significant advantage of unemployed apprentices compared with unemployed students may be the consequence of the selection of the best apprentices, who remain in their training firms. It is possible that employers keep the best apprentices at the end of their apprenticeship, implying that apprentices may be more productive on average than vocational students even if apprentices do not perform better than vocational students when they look for jobs. To see whether this interpretation is plausible, Table X reports the result of the estimation of wage equations. It is clear that there is no statistically significant difference between the wage of apprentices remaining in their training firms and the other apprentices, meaning that apprentices remaining in their training firms do not appear to be significantly

[29]This result, not shown in the paper to save space, is available on request.

Table X
Truncated Regressions

log(Wage)	1st year		1st + 2nd years	
	(1)	(2)	(3)	(4)
Firm retention	-0.127	-0.107	-0.110	-0.0714
	(0.112)	(0.0734)	(0.0928)	(0.0529)
Firm retention × Apprenticeship	0.0817	0.0677	0.0908	0.0347
	(0.0838)	(0.0565)	(0.0762)	(0.0456)
Apprenticeship	-0.00186	0.0425	0.0208	0.0692
	(0.0441)	(0.0376)	(0.0650)	(0.0448)
Constant	7.094***	7.422***	6.953***	7.339***
	(0.0533)	(0.191)	(0.0535)	(0.177)
Observations	8,284	8,284	19,738	19,738
Control Variables	No	Yes	No	Yes

Note: This table reports maximum likelihood estimates from a truncated regression, where the dependent variable is the logarithm of the wage earned by an apprentice on the labor market if the wage is above the net minimum wage (base 2016). "Firm retention" is a dummy variable equal to one if the apprentice has been retained by his training firm after completing his vocational training. "Apprenticeship" is a dummy variable equal to one if the individual has followed his vocational education as an apprentice. Columns (2) and (4) include control variables such as the the professional experience since completing the training in months, the type of labor contract, being graduated, the sector of the job, and month-year fixed effects. Robust standard errors are clustered at the sector level and presented in parentheses below the coefficients. * significant at 10 percent, ** significant at 5 percent, *** significant at 1 percent.
Source: pooled *Génération 2001-2007-2010-2013* surveys, CEREQ

more productive than other apprentices.

All in all, this section shows that the results of our correspondence study, according to which there is almost no difference between the probability of getting a callback from employers for unemployed young cooks and bricklayers, formerly either apprentice or vocational student, is consistent with the school-to-work and labor market transitions of overall low skilled youth. Moreover, the absence of wage difference between apprentices remaining in their training firm and other apprentices indicates that the absence of competitive advantage of apprentices compared with vocational students does not arise from the selection of the worse apprentices into unemployment. The next section builds and estimates a model to evaluate the impact of apprenticeship expansion on youth unemployment in this context.

VI The model

This section sets out and estimates a search and matching model which allows us to reproduce the main stylized facts of the French youth labor market of vocational students and apprentices who have just graduated. Then, the model is used to simulate the impact of the expansion of apprenticeship on the youth unemployment rate.

VI.A Conceptual framework

We consider a population of N young individuals who complete their initial education. There are N_a apprentices and N_s students (i.e. individuals who studied without being apprentices):

$$N = N_a + N_s \tag{1}$$

This is a static, one period model. Insofar as we focus on school-to-work transitions and the data displayed above show that the employment rate difference between apprentices and students remains almost constant over the three year period that we analyze, there is no obvious gain to considering a dynamic multi-period model.

Individuals are risk neutral and derive utility from consumption only. The timing of events is as follows. 1/ the share ρ of apprentices remain in their training firm and the complementary share look for jobs; 2/ firms create job vacancies; 3/ students and apprentices looking for jobs send applications to job vacancies; 4/ employers select the workers they want to hire: 5/ wages are bargained over and production takes place.

We start by assuming that there is an exogenous share ρ of apprentices who remain in the firm where they were apprentice. This assumptions is relaxed below. Accordingly, we now focus on youth looking for jobs. The productivity of an individual starting a job after education completion is denoted by y. This productivity is drawn in different distributions for apprentices and students. The draw is made at the instant of the match between the youth and the job. This means that the productivity is job specific. The cumulative distribution of y is denoted by G_s for students and by G_a for apprentices who apply to firms in which they did not train.

A job with productivity y yields profits

$$J(y) = y - w(y) \tag{2}$$

where $w(y)$ stands for the wage whose value is determined by bargaining. The bargaining implies that workers get the share β of job surplus. In case of agreement, workers get utility $w(y)$ and firms profits $y - w(y)$. In case of disagreement, worker get the unemployment income z and firms get zero profits. Therefore, the surplus of a job with productivity y is equal to $y - z$.

Labor costs have a lower bound induced by the minimum wage $w_{\min}$, which is larger than z the income of unemployed individuals. Therefore, wages are set by bargaining subject to the minimum wage constraint:

$$w(y) = \begin{cases} z + \beta(y - z) & \text{if } y \geq \bar{y} \\ w_{\min} & \text{if } w_{\min} \leq y < \bar{y} \end{cases} \tag{3}$$

where $\bar{y} = [w_{\min} - (1-\beta)z]/\beta$. This equation indicates that the wage is equal to $z + \beta(y-z)$ if the productivity if larger than $\bar{y}$ and to the minimum wage if it belongs to the interval $[w_{min}, \bar{y}]$. The job is not filled is the productivity is smaller than $w_{\min}$, which corresponds to the reservation productivity.

Students and apprentices who did not remain in their training firm look for jobs. To do so, they send applications to job offers. It is assumed that matches between job openings and applications are determined by an urn-ball matching process[30] where job openings are assimilated to urns, and job applications to balls tossed at the urns by job seekers. In this framework, a match occurs when a ball goes into an urn. As job seekers simultaneously apply for jobs not knowing where other job seekers are sending their applications, some vacancies get no application, while others may get one or more applications. For the sake of simplicity, it is assumed that each applicant sends one application.

For firms, the selection of applicants called back for interviews is costly. The costs can include the time needed to collect information about the applications but also the time needed to wait for the arrival of the next application insofar as applications do not arrive simultaneously in the real world. This implies that it is worth selecting the applications of apprentices for interviews if the expected gains from calling back apprentices first offset the screening costs. Insofar as our correspondence study shows that the callback rates of apprentices and students are almost identical and that we find (see below) that the productivity difference between apprentices and students is very small and non statistically significant, it is likely that the expected gains from selecting apprentices first do not offset the selection costs for many firms. In order to account for this fact in a simple way, it is assumed that there is a share of firms, denoted by η, which select applicants at random. We will see that this assumption allows us to derive predictions in line with the results of the correspondence study according to which the callback rate difference between apprentices and students can grow larger when the unemployment rate is higher.

Firms which draw applications at random select one application. Then, they interview the applicant and discover his productivity. If the productivity is above its reservation level w_{min}, the applicant is hired. If the productivity is below the reservation productivity, the firm does not keep the applicant and makes zero profits during the period. Firms which can select applicants choose to hire an apprentice if there is an apprentice among their applicants.

Firms with n_a applications of apprentices and n_s applications of students which draw an application at random draw an apprentice with probability

$$p(a|n_a, n_s) = \frac{n_a}{n_s + n_a}$$

[30] Hall (1979), Pissarides (1979), Blanchard and Diamond (1994).

and a student with the complementary probability

$$p(s|n_a, n_s) = \frac{n_s}{n_s + n_a}$$

Firms which choose among their applicants hire an apprentice if there is at least one apprentice among their applicants, which is denoted by the indicator function $\mathbf{1}_{(n_a>0)}$.

The value of job vacancies

Now that recruiters' hiring decision have been described, let us analyze the value of job vacancies. To hire workers, firms create vacant jobs. We denote by v the number of vacant jobs. The creation of each vacant job costs $h > 0$. Once jobs are posted, firms get applications. Then "nature" draws the share of firms η that draw the résumés at random and the complementary share that can choose their preferred résumé.

From the hiring behavior described above, we can compute the expected value of a vacant job that has received applications of n_a apprentices and n_s students, denoted by

$$\begin{aligned}\Pi(n_a, n_s) = \eta \left(p(a|n_a, n_s) \int_{w_{\min}}^{y_{\sup}} J(y) \mathrm{d}G_a(y) + p(s|n_a, n_s) \int_{w_{\min}}^{y_{\sup}} J(y)\ \mathrm{d}G_s(y) \right) + \\ (1-\eta) \left(\mathbf{1}_{(n_a>0)} \int_{w_{\min}}^{y_{\sup}} J(y) \mathrm{d}G_a(y) + \left[1 - \mathbf{1}_{(n_a>0)}\right] \mathbf{1}_{(n_s>0)} \int_{w_{\min}}^{y_{\sup}} J(y) \mathrm{d}G_s(y) \right)\end{aligned}$$

Since the matching between job applications and job openings is determined by the urn-ball model where each job seeker sends one application, the probability that a vacant job gets n_a applications from apprentices is defined by the binomial probability function with parameters $(1-\rho)N_a$ (the number of trials) and $1/v$ (the probability of success of each trial), denoted by $b(n_a, (1-\rho)N_a, 1/v)$. Similarly, the probability to receive n_s applications from students is defined by the binomial probability function $b(n_s, N_s, 1/v)$. Therefore, the value of a vacant job is

$$V = -h + \sum_{n_a=0}^{(1-\rho)N_a} b(n_a, (1-\rho)N_a, 1/v) \sum_{n_s=0}^{N_s} b(n_s, N_s, 1/v) \Pi(n_a, n_s) \tag{4}$$

Job creation

Free entry implies that firms create jobs until the value of vacant jobs is equal to zero: $V = 0$. From equation (4) the free entry condition implies that:

$$h = \sum_{n_a=0}^{(1-\rho)N_a} b(n_a, (1-\rho)N_a, 1/v) \sum_{n_s=0}^{N_s} b(n_s, N_s, 1/v) \Pi(n_a, n_s) \tag{5}$$

Labor market equilibrium

The equilibrium value of the number of vacant jobs is determined by equation (5). This value is unique (assuming its existence), since the binomial probability function necessarily decreases with the number of vacant jobs.

Once v has been determined, one can compute the number of jobs won by apprentices who have not been retained in their firm and the number of jobs won by students:

$$L_a = v \sum_{n_a=0}^{(1-\rho)N_a} \sum_{n_s=0}^{N_s} b(n_a,(1-\rho)N_a,1/v)b(n_s,N_s,1/v)\left[\eta p(a|n_a,n_s)+(1-\eta)\mathbf{1}_{(n_a>0)}\right][1-G_a(w_{\min})]$$

$$L_s = v \sum_{n_a=0}^{(1-\rho)N_a} \sum_{n_s=0}^{N_s} b(n_a,(1-\rho)N_a,1/v)b(n_s,N_s,1/v)\left[\eta p(s|n_a,n_s)+(1-\eta)\mathbf{1}_{(n_a=0)}\mathbf{1}_{(n_s>0)}\right][1-G_s(w_{\min})]$$

From these two equations we can determine the hiring probability of apprentices and students, equal to $L_a/(1-\rho)N_a$ and L_s/N_s respectively. Then, the unemployment rates of apprentices and students follow

$$u_a = 1-\rho-\frac{L_a}{\alpha N} \tag{6}$$

$$u_s = 1-\frac{L_s}{(1-\alpha)N} \tag{7}$$

which yield the youth unemployment rate:

$$u = \frac{N-\rho\alpha N-L_a-L_s}{N} = \alpha u_a+(1-\alpha)u_s \tag{8}$$

and the unemployment rate of individuals who are looking for a job, i.e. those who do not remain in their training firm:

$$\tilde{u} = \frac{N-\rho\alpha N-L_a-L_s}{N-\rho\alpha N} = 1-\frac{L_a+L_s}{(1-\rho\alpha)N}$$

The callback probabilities are computed in Appendix A.5.

VI.B Estimation and calibration

To bring the model to the data and to consider a population similar to that of our correspondence study, we rely on the *Generation* surveys conducted in 2013 and 2016 that we harmonized and pooled together. In line with our correspondence study, the analysis is restricted to young males who enrolled in a CAP-equivalent program after middle school and

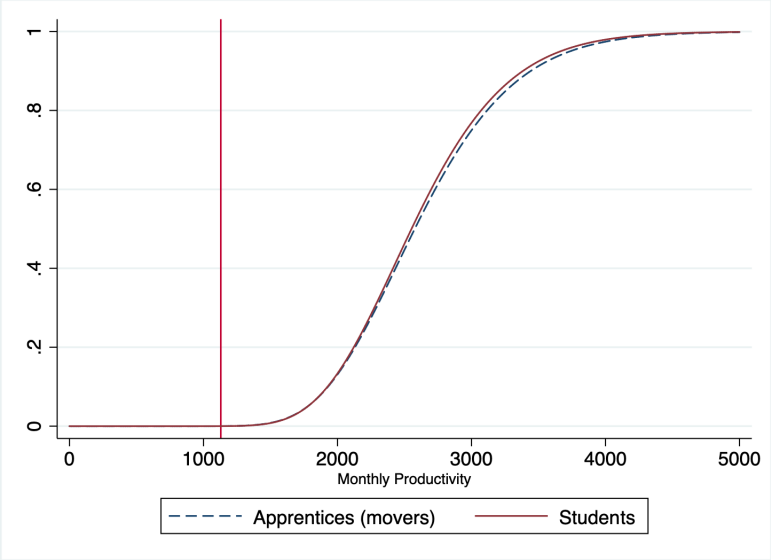


FIGURE 2: CUMULATIVE DISTRIBUTIONS OF PRODUCTIVITY OF STUDENTS AND APPRENTICES NOT RETAINED IN THEIR TRAINING FIRM
Source: pooled *Génération 2010-2013* surveys, CEREQ.

work in construction, restaurant and hotel and related sectors to get a sufficient number of observations (see Appendix A.6).

One needs to determine the value of six parameters, plus the shapes of the productivity distributions of apprentices and students.

The six parameters are: 1/ the share of apprentices, α, set to 0.5 to match the observed share in our population; 2/ the retention rate of apprentices in their training firms, ρ, set to 0.25 to match the difference between the retention rate of apprentices and the share of vocational students employed in firms in which they were interns when they studied; 3/ the income of unemployed workers, z, the value of which is set to €904;[31] 4/ the bargaining power parameter, β, set to 0.5 in the benchmark version (Appendix A.7 shows that our conclusions remain qualitatively unchanged for different values of β) ; 5/ the cost of creation of vacant jobs, h. 6/ The share η of firms which select résumés at random. The values of h and η are jointly determined to match the unemployment rates of apprentices and students, once their productivity distributions have been estimated.

The productivity distributions of apprentices and vocational students, $G^j(y),\ j = a, s$, are estimated assuming that wages are determined by the wage bargaining solution described in

[31] This corresponds to the mean value of unemployment benefits for a male unemployed worker aged below 25 years receiving unemployment benefits in 2016. More details here.

Table XI
Calibration of Exogenous Parameters

Description	Parameter	Value
Initial unemployment rate of apprentices	u_a	0.1972
Initial unemployment rate of students	u_s	0.2894
Share of apprentices	α	0.5
Share of the job surplus going to workers	β	0.5
Share of apprentices retained in their training firm	ρ	0.25
Level of unemployment benefits	z	€904
Level of net minimum wage	w_{min}	€1,129.30
Average productivity of apprentices	$\mathbb{E}[y\|G_a]$	€2,643.20 (SE=36.22)
Average productivity of students	$\mathbb{E}[y\|G_s]$	€2,627.24 (SE=44.52)
Cost of job creation	h	€433.48
Share of firms drawing applications at random	η	0.90

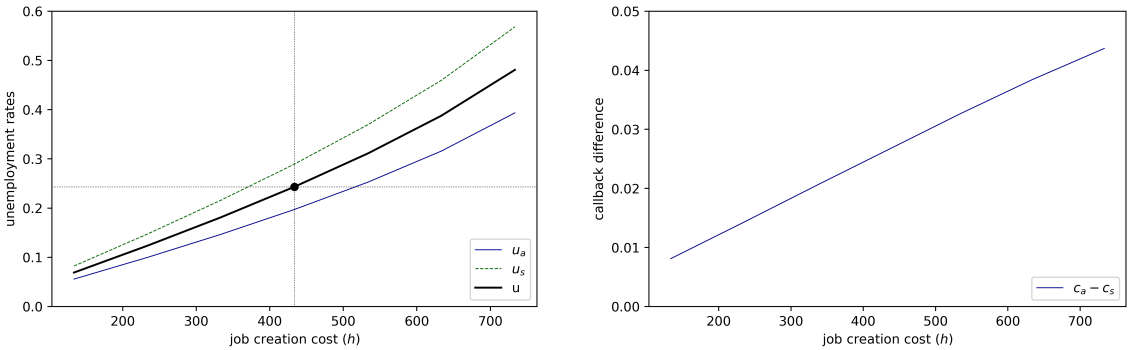
Note: This table reports the values associated with the exogenous parameters of the model. α, ρ, u_a and u_s are estimated from the pooled *Génération 2010-2013* surveys. w_{min} and z come from official sources of Insee and Pôle emploi respectively. h and η are jointly determined to match the equilibrium values of the unemployment rates of apprentices and students with their empirical values. Productivity is the monthly amount of production in euros estimated from the method described in Appendix A.6. In this table, apprentices accounted for are those not retained in their training firm.

equation (3). This implies the following relation between wage and productivity:

$$y = \frac{w(y) - z(1-\beta)}{\beta} \text{ if } w(y) > w_{min} \quad \text{and} \quad y \leq \frac{w(y) - z(1-\beta)}{\beta} \text{ otherwise} \tag{9}$$

We start by estimating the wage distributions of apprentices not retained in their training firm and of vocational students, conditional on experience, region of residence, family situation and work environment, from which we retrieve the productivity distributions. These productivity distributions are displayed on Figure 2 (see Appendix A.6 for details about the estimation of these distributions). The two distributions are very close, which is consistent with the absence of statistically significant difference between the exit rate from unemployment of apprentices and students. Nevertheless, these distributions imply that employers prefer to invite apprentices for interview if selecting applicants is not costly, because the average productivity (conditional on being larger than the reservation productivity) of apprentices is slightly larger than that of students, as shown in Table XI, although the difference is not statistically significant (p-value= 0.81). The effects of this preference for apprentices on the callback and hiring probabilities of apprentices and students depend on the number of applicants received by each firm. If this number is small, which is the case when the unemployment rate is low, the preference for interviewing apprentices first has almost no impact on the hiring probability difference between students and apprentices, to the extent that firms have small pools of applicants. However, if the number of applicants is large, the preference for interviewing apprentices first may induce significant callback and hiring rates differences.

The values of parameters are summarized in Table XI. All in all, the model reproduces an



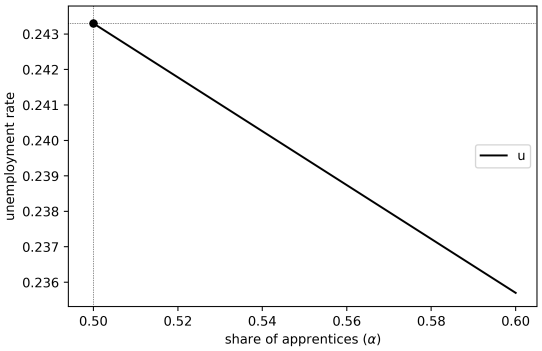
(A) Unemployment Rates (B) Callback Difference

FIGURE 3: Relation between cost of job creation, unemployment rates and callback difference between apprentices and students

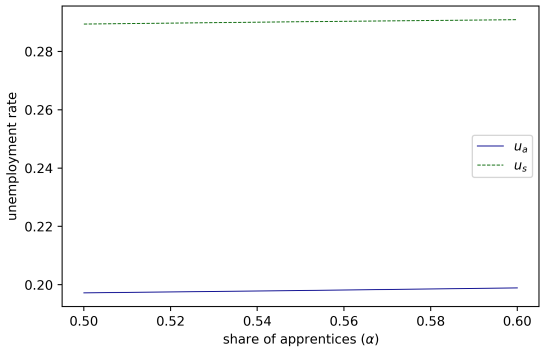
unemployment rate difference between apprentices and students that is compatible with their empirical wage distributions. The callback rate difference between apprentices and students predicted by the model, which is equal to 2.6 percentage points (as displayed in Figure 3b), is in line with the 95% interval confidence of our correspondence study, as shown in Table IV. The model is also able to reproduce the finding of our correspondence study that the callback rate difference between apprentices and students increases with the local unemployment rate. This is shown on Figure 3 which displays the effects of changes in h, the costs of job creation. Increases in job creation costs, which decrease job creation, raise unemployment for apprentices and students. This is accompanied by a rise in the apprentice/student callback rate difference consistent with the results of our correspondence study. As reported in Table VII, which displays the results of the correspondence study, the callback rate for interview difference between apprentices and students becomes significant at the 10% confidence level, with a point estimated equal to 4 percentage points, when the unemployment rate is very high, about 40%, meaning that the callback difference *slightly* increases with the unemployment rate. The model reproduces well the fact that the apprentice/student callback rate difference varies little with the unemployment rate. According to Figure 3, this difference reaches about 4 percentage points when the unemployment rate amounts to 40%, which is consistent with the results reported in Table VII.

VI.C Counterfactual exercises

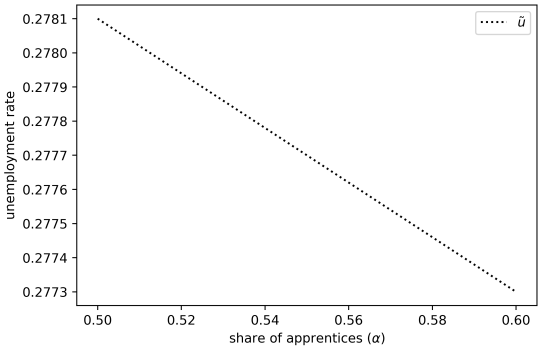
The model can be used to analyze the consequences of expansions of apprenticeship on labor market outcomes. We start by analyzing the effects of the expansion of the share of apprentices α by 10 percentage points from its benchmark value equal to 50%, assuming that the retention rate of apprentices in their training firm remains constant when the share of apprentices



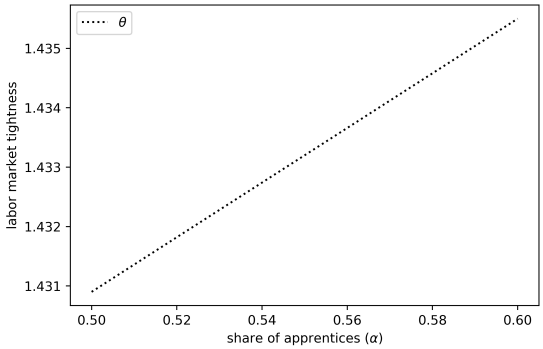
(A) Youth Unemployment Rate



(B) Apprentices' and Students' Unemp. Rates



(C) Youth Job Seeker Unemp. Rate



(D) Labor Market Tightness

FIGURE 4: Evolution of indicators when the Share of Apprentices is increasing

changes. This assumption is relaxed and discussed below.

Figure 4d shows that the expansion of the share of apprentices α raises the labor market tightness. The rise of the labor market tightness is induced by the increase in expected profits associated with the increase in the share of apprentices, whose average productivity is higher than that of students. However, the labor market tightness increases only slightly, because the productivity difference between apprentices and students is very small.

Despite the rise in the labor market tightness, the expansion of apprenticeship increases the unemployment rate of vocational students (Figure 4b), because they face a more intense competition from apprentices. The unemployment rate of apprentices also slightly increases because they compete more often with other apprentices rather than with students. Let us remark that the increase in the unemployment rate of apprentices not retained in their training firm *and* in the unemployment rate of students is compatible with a decrease in the unemployment rate of the population composed of apprentices not retained in their training firm and of students (i.e. the population of job seekers) as shown on Figure 4c, because raising the share of apprentices increases the share of individuals whose unemployment rate is lower.

Figure 4a shows that the youth unemployment rate drops from 24.3% to 23.6% when α, the share of apprentices, increases by 10 percentage points. If the unemployment rates of apprentices and student remained constant, the unemployment rate would decrease by 0.9 percentage points.[32] The model shows that the unemployment rate drops by 0.7 percentage points when the unemployment rates of apprentices and students adjust. This is a very small drop suggesting that increasing the share of apprentices has a very limited impact on youth unemployment. The small size of the drop is mainly the consequence of the relatively low retention rate of apprentices in their training firm, which is only 25 percentage points higher than that of vocational students, and of the absence of positive effects of apprenticeship on the likelihood to find jobs for apprentices not retained in their training firm. It is also due, to a lesser extent, to the increase in the unemployment rate of vocational students and of apprentices, as explained above.

Figure 5 displays the effects of larger changes in the share of apprentices, which goes from zero to one. The expansion of apprenticeship always raises the unemployment rates of students and apprentices for the reasons just explained. It is striking that very large changes in the share of apprentices induce limited changes in youth unemployment, which goes from 28.2% to 20.6% when the share of apprentices goes from zero to one. This drop is entirely due to the increase in the retention rate of youth in training firms associated with apprenticeship. Contrary to what might be expected, the expansion of apprenticeship does not sufficiently boost job creation to amplify the effects of the increase in the retention rate in training firms. Actually, the opposite occurs: the overall effects of the expansion of apprenticeship on the drop in youth unemployment is smaller than that induced by the increase in the retention of youth in their training firm. The ultimate reason for this result is that the productivity of apprentices outside their training firm is very close to that of vocational students.

VI.D Scope of results

The impact of apprenticeship expansion on the youth unemployment rate is estimated to be small by our model. We now discuss to what extent this result may hinge on specific assumptions.

First, it is assumed that there are no selection effects associated with changes in the share of apprentices. However, as shown in section II.B, young people who choose apprenticeship are generally more employable than those who choose the vocational school path. Therefore, it is likely that increasing the share of apprentices attracts less employable youth facing more difficulties in finding jobs when unemployed. This implies that not accounting for selection effects leads to overestimate the positive impact of apprenticeship expansion on

[32] According to equation (8), the unemployment rate varies by $(u_a - u_s)\mathrm{d}\alpha$ when the share of apprentices changes by $\mathrm{d}\alpha$. Using the figures reported in Table XI, we determine that the unemployment rate decreases by 0.9 percentage points if α increases by 10 percentage points.

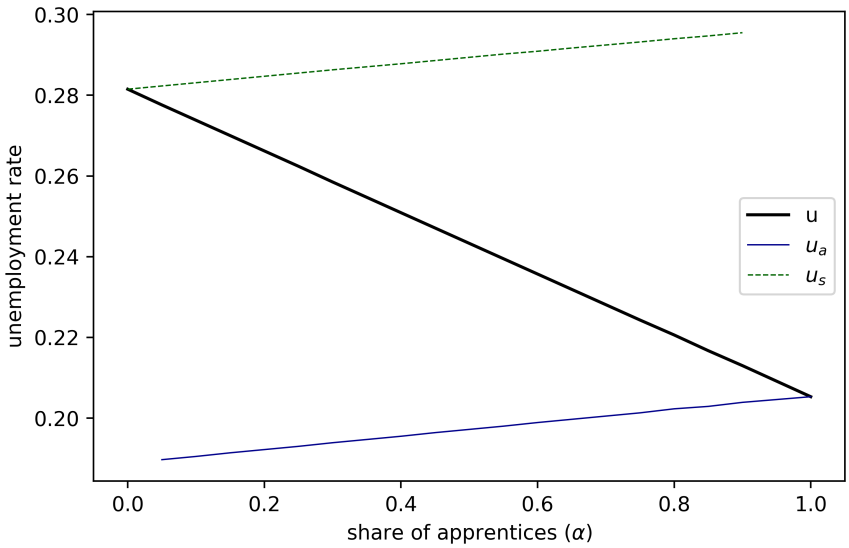


FIGURE 5: Share of Apprentices and Youth Unemployment Rates

youth employment.

Second, the retention rate in training firms has been assumed to be exogenous. It is likely that the selection of youth less motivated by apprenticeship when apprenticeship is expanded reduces the retention rate, thus reinforcing our result according to which apprenticeship expansion has a small negative impact on youth unemployment. On the other hand, the expansion of apprenticeship worsens the employment opportunities of apprentices leaving their training firms, because the unemployment rate of apprentices increases when the share of apprentices rises, as shown above.

This can be seen by making the retention rate endogenous. To do so, let us assume, in line with discrete choice models, that the utility obtained from remaining in the training firm depends on an individual specific additive preference parameter, denoted by $e \in \mathbb{R}$. Hence, the utility of remaining in the training firm is equal to the income plus e, while the utility of working elsewhere is equal to the income.

The timing of decisions is as follow. 1/ Apprentices decide either to stay or to leave their training firm at the end of their apprenticeship. If they leave, they look for another job; 2/ If they decide to remain in their training firm, they draw their productivity y in the distribution with cumulative distribution function G_0; 3/ If the productivity is above the reservation productivity, they bargain their wage, otherwise, they are unemployed.

The optimal decisions are found by backward induction. In step 3/ apprentices remain in the firm if their productivity y is larger than the minimum wage $w_{\min}$, in which case their wage is determined as for the other apprentices, i.e. by equation (3). In step 1/ apprentices decide to remain in the firm if their expected utility from doing so is larger than that obtained

from looking for a job elsewhere.

An apprentice i who decides to remain in his training firm gets the expected utility

$$\mathbb{E}[U \,|\, \text{remaining in training firm}] = \int_{w_{\min}}^{y_{\sup}} w(y) \mathrm{d}G_0(y) + G_0(w_{\min}) z + e$$

An apprentice who decides to leave his training firm gets the expected utility

$$\mathbb{E}[U \,|\, \text{leaving training firm}] = \frac{1 - \tilde{u}_a}{1 - G_a(w_{\min})} \int_{w_{\min}}^{y_{\sup}} w(y) \mathrm{d}G_a(y) + \tilde{u}_a z$$

where $\tilde{u}_a$ is the unemployment rate of apprentices who leave their training firm. In this framework, an apprentice decides to remain in his training firm if and only if

$$e \geq \bar{e} = \frac{1 - \tilde{u}_a}{1 - G_a(w_{\min})} \int_{w_{\min}}^{y_{\sup}} w(y) \mathrm{d}G_a(y) + [\tilde{u}_a - G_0(w_{\min})] \, z - \int_{w_{\min}}^{y_{\sup}} w(y) \mathrm{d}G_0(y) \qquad (10)$$

This equation implies that the threshold value $\bar{e}$ of the preference parameter below which the apprentices leave the firm decreases with the unemployment rate of apprentices, meaning that apprentices are more induced to remain in their training firm when their unemployment rate is higher. Denoting by Φ the cumulative distribution function of e, the retention rate is equal to

$$\rho = 1 - \Phi(\bar{e})$$

From this definition, one can compute the impact of changes in α, the share of apprentices on the retention rate. Insofar as equation (10) shows that changes in the share of apprentices induce changes in $\bar{e}$ only through their effects on $\tilde{u}_a$, the unemployment rate of apprentices who leave their training firm, the impact of α on ρ is given by

$$\frac{\partial \rho}{\partial \alpha} = \underbrace{-\Phi'(\bar{e})}_{<0} \underbrace{\frac{\partial \bar{e}}{\partial \tilde{u}_a}}_{<0} \underbrace{\frac{\partial \tilde{u}_a}{\partial \alpha}}_{>0} > 0.$$

This term is positive because increasing the share of apprentices increases $\tilde{u}_a$, the unemployment rate of apprentices leaving their training firms. The increase in the unemployment rate induces apprentices to remain in their training firm because the probability of finding a job on the labor market is reduced, which corresponds to the term $\partial \bar{e} / \partial \tilde{u}_a$. Hence, this mechanism implies that expanding the share of apprentices should increase the retention rate. However, it is likely that the size of this effect is very limited because the unemployment rate of apprentices reacts very little to changes in the share of apprentices, as shown by Figure 5.

All in all, the sign of the impact of changes in the share of apprentices on their retention rate in their training firms is ambiguous in theory. It depends on the relative importance of the selection effects, which yield a negative relation between the share of apprentices and

the retention rate, and of the impact of the unemployment rate response, which yields a relation of opposite sign. However, the empirical contribution of Brébion (2020) finds that policies which increased the share of apprentices in France reduced the retention rate of apprentices, suggesting that the selection effects dominate the unemployment effect. This conclusion suggests that our benchmark evaluation, which does not account for the reaction of the retention rate, overestimates the positive impact of apprenticeship on employment. This reinforces our conclusion according to which expanding apprenticeship should be accompanied by policies that increase the retention rate to effectively foster youth employment.

VII Conclusion

This paper shows that apprentices do not perform significantly better than vocational students when they look for jobs outside the firm in which they were trained. This means that the effectiveness of apprenticeship does not rely on the transmission of specific skills valuable outside the training firm that youths could not acquire in vocational schools. The true success of apprenticeship relies on its ability to create successful matches between labor market entrants and jobs.[33] Obviously, this result has been obtained in the French context and it is possible that apprentices are trained differently in firms in other contexts. Dustmann and Schönberg (2012) argue that the well-structured regulatory framework and monitoring institutions that exist in Germany entail that apprenticeship training schemes are more successful in countries like Germany rather than in Anglo-Saxon countries like the United Kingdom, because more firms are able to commit to training provision in Germany than in Anglo-Saxon countries. Ryan (2000) stresses that the involvement of trade unions and employers' associations, which is different in these two types of country, may also play a role. Hence, specific institutional features might explain the absence of comparative advantage for apprentices in France (Cahuc et al., 2014).

Nevertheless, economic theory shows that employers have limited incentives to transmit to apprentices knowledge of value outside the training firm (Becker (1964), Acemoglu and Pischke (1998), Garicano and Rayo (2017), Fudenberg and Rayo (2019), Malcomson et al. (2003)). When apprentices obtain the same diploma as vocational students and can leave their training firm after graduation, employers may have no incentive to transmit more knowledge to their apprentices than that acquired by vocational students in the classroom. Otherwise, apprentices could benefit from a competitive advantage that would allow them to bargain wage increases after graduation. Hence, economic theory suggests that the absence of significant competitive advantage of apprentices with respect to vocational students observed in the

[33]This mechanism may also explain the fact that individuals with a vocational qualification have a higher employment probability than those with a general qualification at the start of their career in OECD countries, but that this pattern can reverse in later life, as stressed by Forster et al. (2016) and Hanushek et al. (2017), although Brunello and Rocco (2017) show that empirical evidence on this issue is mixed.

French context might be true in other contexts.

The conclusion that apprentices do not perform significantly better than vocational students when they look for jobs outside the firm in which they trained has important consequences for public policy. If the main advantage of apprenticeship is the creation of better matches between labor market entrants and jobs, policies should be more focused on this dimension and favor collaboration between schools and public employment services. This collaboration, which is almost non-existent in many OECD countries, is well developed in Japan and in Germany, which share important common attributes in this respect (Ryan (2001), p. 59) and which are very successful at integrating youths into employment. In Japan, where apprenticeship very rare, high schools provide career support for their students.[34] Counselling and job search training are often part of senior high school curricula from the first year. In the second year of high school, many schools have specific career preparation classes for students who do not intend to pursue higher education. In the third year of high school, aspiring labor market entrants undergo a regulated job placement process at school in which the teachers responsible for career guidance match students to the available positions based on vacancy lists provided by public employment agencies. The application process follows a strict schedule to promote equal opportunities among graduates and to ensure that students focus on completing their studies. Students are not allowed to seek work independently, and employers are expected to cooperate with public employment agencies when hiring future graduates. The job placement of high school graduates is remarkably effective, about 90%, and there is little evidence that it comes at the cost of lower job stability. In Germany, the Federal Employment Office recommends secondary school applicants to sponsoring employers. As in Japan, there are important interactions between schools and public employment agencies. The effectiveness of this strategy is also stressed by Noelke and Horn (2014) who argue that economic liberalization in post-socialist countries like Hungary has made the transition from vocational education to work more difficult by breaking linkages from schools to employers that performed a critical matching function.

Our findings suggest that the German-Japanese strategy targets an important cause of youth unemployment: the difficulty for job market entrants in finding jobs to which they are suited. Hence, improving the job placement of school leavers thanks to the involvement of public employment services in schools may be an important lever to boost youth employment.

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[34] See OECD (2017), pp. 134 ss

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A Appendix

A.1 Examples of documents for applications

Application email messages (by layout)

For type 1 applications, the email message was the following:

Object: Application job offer n°XXX
Attached files: Curriculum_Vitae.pdf, Lettre_Motivation.pdf

Dear Madam, Sir,

With reference to your advertisement XXX for the position of YYY, I wish to submit my application.
Please find enclosed my cover letter and my resume. May I assure you, Madam, Sir, of my sincere gratitude.

First name, Last name
Phone number

For type 2 applications, the email message was the following:

Object: Application (job ads XXX)
Attached files: CV.pdf, LM.pdf

Dear Madam, Sir,

I am pleased to submit my application for the position of YYY following your advertisement XXX published on the website Pôle Emploi.
I am sending you in the attachment my resume and my cover letter.
May I assure you, Madam, Sir, that I remain faithfully yours.

First name, Last name
Phone number

Application reply email messages (by candidate)

For Alexis Dubois application reply, the email message was the following:

Greetings,

Thank you for your consideration of my application. However, I am unable to respond favourably. Indeed, I have accepted another offer.

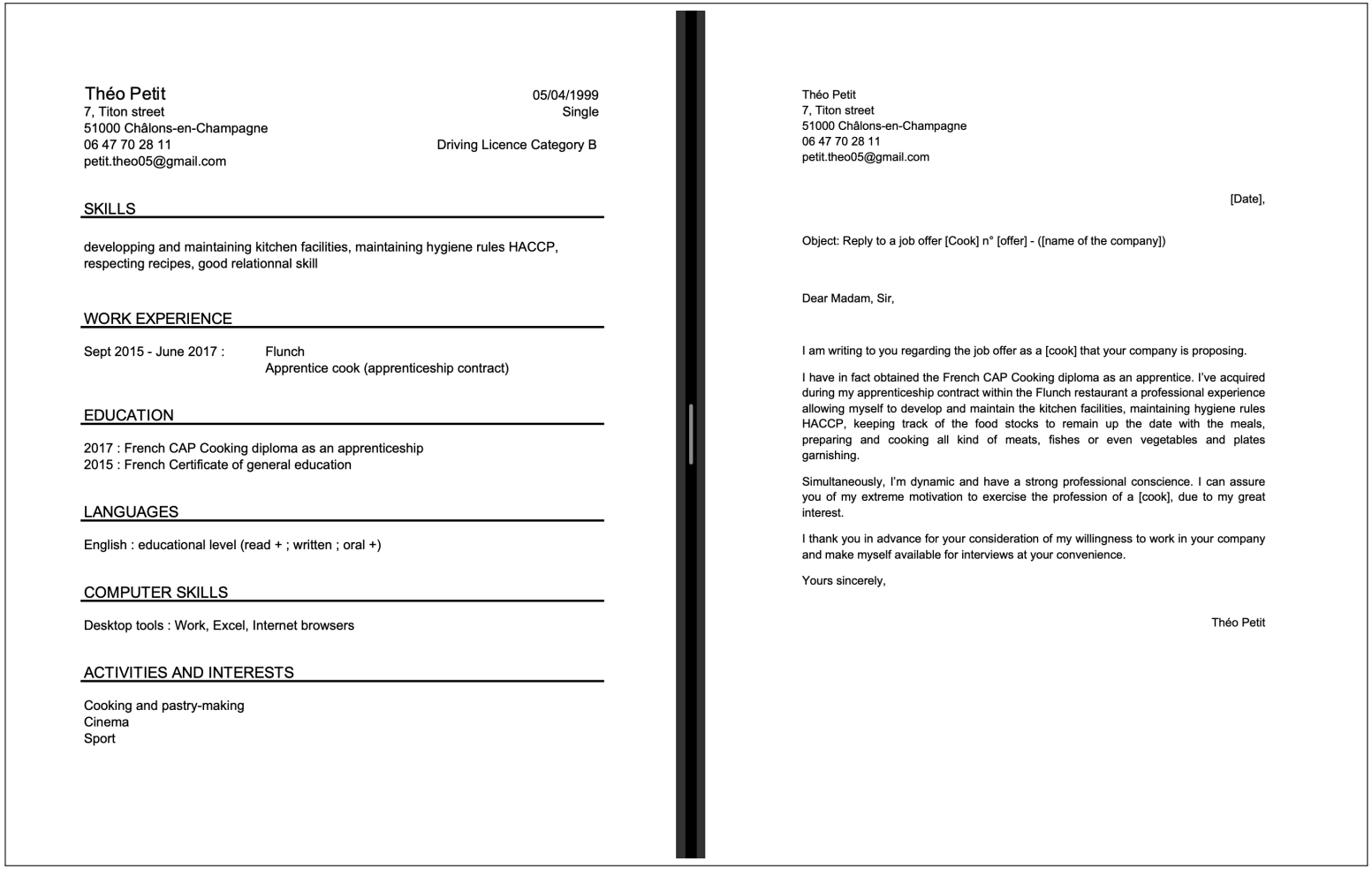
With kind regards,
Alexis Dubois

For Théo Petit application reply, the email message was the following:

Good morning,

I thank you for your answer regarding my application. Nevertheless, I have just accepted another offer.

Sincerely,
Théo Petit



Théo Petit
7, Titon street
51000 Châlons-en-Champagne
06 47 70 28 11
petit.theo05@gmail.com

05/04/1999
Single

Driving Licence Category B

SKILLS

developping and maintaining kitchen facilities, maintaining hygiene rules HACCP, respecting recipes, good relationnal skill

WORK EXPERIENCE

Sept 2015 - June 2017 : Flunch
Apprentice cook (apprenticeship contract)

EDUCATION

2017 : French CAP Cooking diploma as an apprenticeship
2015 : French Certificate of general education

LANGUAGES

English : educational level (read + ; written ; oral +)

COMPUTER SKILLS

Desktop tools : Work, Excel, Internet browsers

ACTIVITIES AND INTERESTS

Cooking and pastry-making
Cinema
Sport

Théo Petit
7, Titon street
51000 Châlons-en-Champagne
06 47 70 28 11
petit.theo05@gmail.com

[Date],

Object: Reply to a job offer [Cook] n° [offer] - ([name of the company])

Dear Madam, Sir,

I am writing to you regarding the job offer as a [cook] that your company is proposing.

I have in fact obtained the French CAP Cooking diploma as an apprentice. I've acquired during my apprenticeship contract within the Flunch restaurant a professional experience allowing myself to develop and maintain the kitchen facilities, maintaining hygiene rules HACCP, keeping track of the food stocks to remain up the date with the meals, preparing and cooking all kind of meats, fishes or even vegetables and plates garnishing.

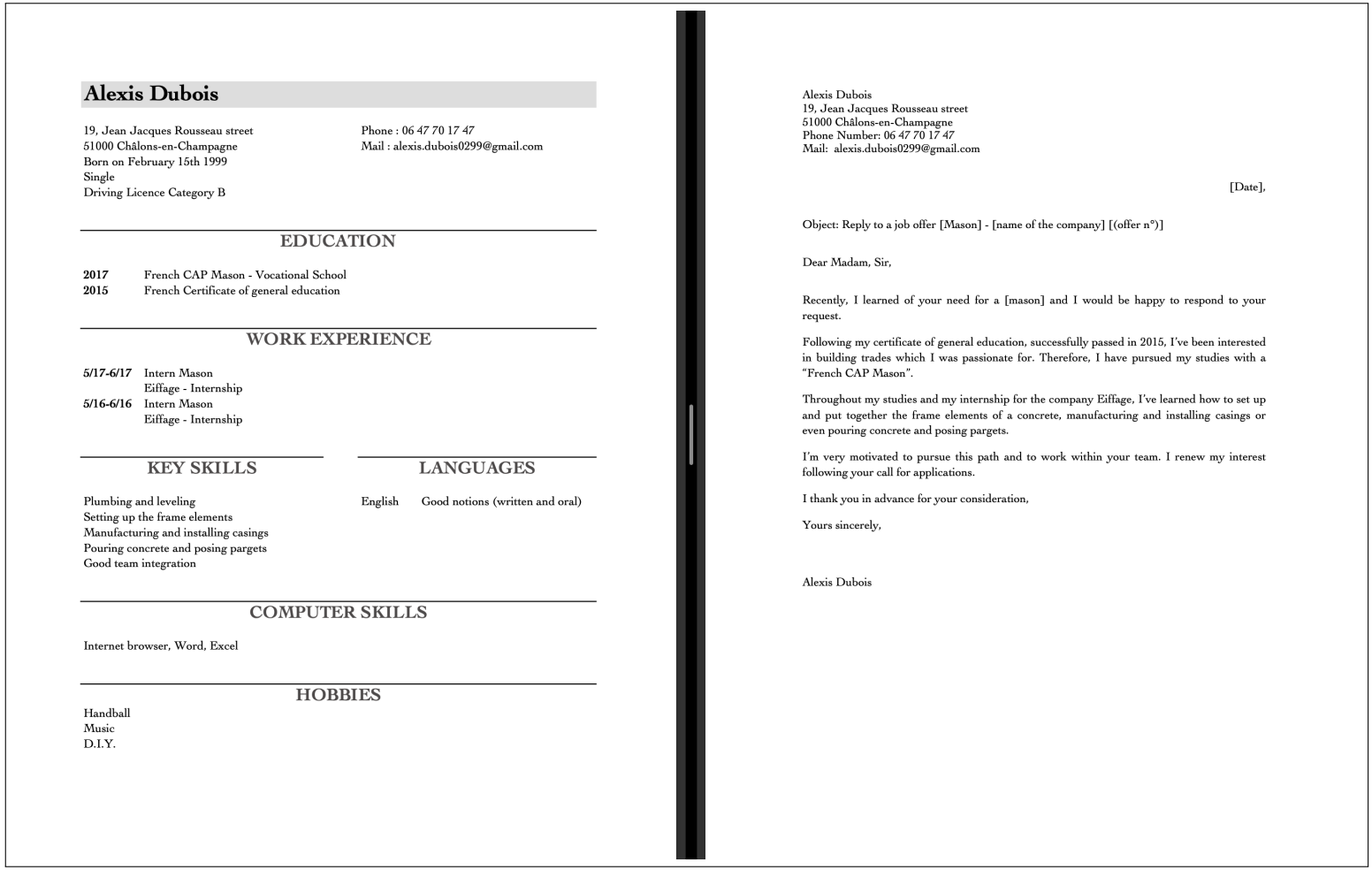
Simultaneously, I'm dynamic and have a strong professional conscience. I can assure you of my extreme motivation to exercise the profession of a [cook], due to my great interest.

I thank you in advance for your consideration of my willingness to work in your company and make myself available for interviews at your convenience.

Yours sincerely,

Théo Petit

FIGURE A.1.1: EXAMPLE OF CV AND COVER LETTER (COOK APPRENTICES - LAYOUT 1)



Alexis Dubois

19, Jean Jacques Rousseau street
51000 Châlons-en-Champagne
Born on February 15th 1999
Single
Driving Licence Category B

Phone : 06 47 70 17 47
Mail : alexis.dubois0299@gmail.com

EDUCATION

2017 French CAP Mason - Vocational School
2015 French Certificate of general education

WORK EXPERIENCE

5/17-6/17 Intern Mason
Eiffage - Internship
5/16-6/16 Intern Mason
Eiffage - Internship

KEY SKILLS

Plumbing and leveling
Setting up the frame elements
Manufacturing and installing casings
Pouring concrete and posing pargets
Good team integration

LANGUAGES

English Good notions (written and oral)

COMPUTER SKILLS

Internet browser, Word, Excel

HOBBIES

Handball
Music
D.I.Y.

Alexis Dubois
19, Jean Jacques Rousseau street
51000 Châlons-en-Champagne
Phone Number: 06 47 70 17 47
Mail: alexis.dubois0299@gmail.com

[Date],

Object: Reply to a job offer [Mason] - [name of the company] [(offer n°)]

Dear Madam, Sir,

Recently, I learned of your need for a [mason] and I would be happy to respond to your request.

Following my certificate of general education, successfully passed in 2015, I've been interested in building trades which I was passionate for. Therefore, I have pursued my studies with a "French CAP Mason".

Throughout my studies and my internship for the company Eiffage, I've learned how to set up and put together the frame elements of a concrete, manufacturing and installing casings or even pouring concrete and posing pargets.

I'm very motivated to pursue this path and to work within your team. I renew my interest following your call for applications.

I thank you in advance for your consideration,

Yours sincerely,

Alexis Dubois

Figure A.1.2: Example of CV and Cover Letter (Cook Students - layout 2)

A.2 Balancing table

Table A.2.1
Randomization tests

	Students (1)	Apprentices (2)	(3)
	Sample mean	Sample mean	p-value (2)-(1)
For-profit	.9489	.9505	.8407
Not-for-profit	.0510	.0494	.8407
Primary sector	.0006	.0006	.9940
Secondary sector	.0006	.0000	.3148
Tertiary sector	.8477	.8320	.2422
Construction sector	.1509	.1673	.2212
Small firm (vs large firm)	.6146	.6141	.9781
Permanent contract (vs temporary)	.4051	.4227	.3213
Full-time job	.9395	.9342	.5406
Part-time job	.0604	.0657	.4060
No diploma required	.0468	.0602	.2239
Cap required	.9261	.9084	.1872
Bac required	.0269	.0313	.5949
Male recruiter (vs female recruiter)	.6229	.6120	.5398

Note: This Table reports means across subsamples of the experimental sample and presents randomization tests based on comparing the means across subsamples. Column (3) displays the p-value for the test $H_0 : \{\Delta = \text{mean\_callback[apprentices] - mean\_callback[students]} = 0\}$ vs $H_1 : \{\Delta \neq 0\}$.

A.3 Probit model

Table A.3.1
Marginal Effects of Apprenticeship on the Probability of Callback

	All applicants			Cook	Bricklayer
	(1)	(2)	(3)	(4)	(5)
Dep var: Positive callback					
Apprenticeship	0.00849	0.00809	0.0102	0.0195	-0.0367
	(0.0170)	(0.0167)	(0.0172)	(0.0198)	(0.0536)
Dep var: Proposition					
Apprenticeship	0.0106	0.0102	0.0123	0.0242	-0.0501
	(0.0146)	(0.0144)	(0.0145)	(0.0168)	(0.0537)
Observations	3,110	3,105	3,105	2,531	447
Month FE	No	Yes	Yes	Yes	Yes
Department FE	No	No	Yes	Yes	Yes

Note: The dependent variable is a dummy variable equal to one if the application gets a positive callback or a proposition. Positive callback corresponds to cases in which the fictitious candidate received a request for complementary information or a suggestion for interview or hiring. Proposition corresponds to callbacks with interview or hiring proposition. Apprenticeship is a dummy variable equal to one if the application was from an apprentice. Reported estimates are marginal effects from a Probit model. Robust standard errors are clustered at the department level and reported below the coefficients.

A.4 Replicates of the tables by selected occupation

A.4.1 Cook

Table A.4.1.1
Description of the cook occupation

Occupation	**Cook**				
Diploma	CAP Cuisine				
Definition	The owner of the diploma can work in any kind of cuisine under the authority of a chef				
Uniting	**Activities**	**Skills**	**Exams**		
			Modality	**Tests**	**Coeff.**
Organization of the production in the cuisine	Participating in supply operations	Accept, control, and store the supplies	Continuous evaluation	4 case studies as written exams + 1 interview in the 2nd year	4
	Contributing to organize food preparation	Collect all the information for the recipe			
Preparation and delivery of the cuisine production	Organizing the kitchen quarters	Prepare, organize and manage the kitchen quarters all along the recipe	Continuous evaluation	1 real situation in the training center + 1 interview in the training firm	14
	Applying basic food skills	Master food techniques to realize the production			
	Engaging in food production	Analyze, control the quality of the food production and send it			
	Communicating in a professional environment	Respect the usage of the profession			
Health, environment			Continuous evaluation	1 written exam + 1 practical exam	1
French, History, Geography, and Moral			Continuous evaluation	1 written exam in French + 1 oral exam in History, Geography, and Moral	3
Mathematics, Physics, and Chemistry			Continuous evaluation	1 written exam in Maths + 2 practical exams in Physics & Chemistry	2
Sport			Continuous evaluation	3 evaluations	1
Foreign language			Continuous evaluation	1 written exam + 1 oral exam + 1 restitution exam	1

Source: *Arrêté du 17 mars 2016 portant création de la spécialité cuisine du certificat d'aptitude professionnelle et fixant ses modalités de délivrance.*

TABLE A.4.1.2

STATISTICAL PORTRAIT OF STUDENTS AND APPRENTICES IN FOOD SERVICES

Component	Information	Students	Apprentices
		31.43%	**68.57%**
Individual	Sex (male)	43.52%	54.47%
	Age	18.5 y.o.	20 y.o.
	Handicap	7.17%	9.82%
	Driving license	16.23%	30.96%
Family	District area		
	Downtown	32.52%	28.22%
	Suburb	31.99%	36.19%
	Small city	9.70%	13.77%
	Village	25.79%	21.82%
	Siblings	89.89%	95.17%
	French language	89.93%	96.41%
	Birthplace of father		
	France	76.43%	85.32%
	European countries	5.59%	3.94%
	Arabic countries	8.54%	8.72%
	African countries	4.40%	0.73%
	Rest of the world	5.05%	1.29%
	Birthplace of mother		
	France	78.35%	89.23%
	Europe	6.42%	2.02%
	Arabic countries	6.59%	7.93%
	African countries	4.33%	0.82%
	Rest of the world	4.31%	0.00%
	School level of father		
	No diploma	28.96%	43.76%
	Cap/Bep	54.79%	36.23%
	Bac	10.46%	14.76%
	Bac+	5.78%	5.24%
	School level of mother		
	No diploma	45.17%	33.18%
	Cap/Bep	37.95%	45.30%
	Bac	13.83%	15.21%
	Bac+	3.04%	6.30%
	Father works	85.75%	82.64%
	Mother works	63.91%	72.02%
Education	Repeater year before 6th grade	51.46%	46.90%
	Normal middle school program	34.24%	67.01%
	Would have preferred apprenticeship	52.84%	-
	Reason of non-apprenticeship		
	No CFA	0.00%	-
	No employer	28.16%	-
	Neither CFA, nor employer	32.70%	-
	Other	39.14%	-
	Internships / Apprenticeship Tutor	72.50%	-
	Number of internships		
	1	12.57%	-
	2	34.73%	-
	3 or more	52.70%	-
	Contact with the (last) training firm		
	Self	29.29%	-
	Family and friends	13.28%	-
	School / Apprenticeship center	46.90%	-
	Other Public Structure	0.95%	-
	Other	9.59%	-
	Graduated	93.66%	85.85%

Note: This table reports descriptive statistics for both apprentices and vocational students in the food services. Shares of students who made interships and the mode of contact with the last training firm are computed from the *Génération 2010* survey only because of the specific questions. The share of graduated students and apprentices are computed with both the *Génération 2010-2013* surveys because of changes in the content of the level V diploma in 2009 in France.

Source: pooled *Génération 2001-2007-2010-2013* surveys, CEREQ ($N = 445$ individuals)

Table A.4.1.3

Effects of apprenticeship on the probability of getting a callback given the size of firms for cook

	Small Firms			Large Firms		
	(1)	(2)	(3)	(4)	(5)	(6)
Dep var: Positive callback						
Apprenticeship	0.0322	0.0258	0.0257	0.0220	0.0208	0.0155
	(0.0314)	(0.0328)	(0.0352)	(0.0247)	(0.0245)	(0.0258)
Student mean	0.3141***	0.3141***	0.3141***	0.2644***	0.2644***	0.2644***
	(0.0223)	(0.0223)	(0.0223)	(0.0174)	(0.0174)	(0.0174)
Observations	872	872	872	1,268	1,268	1,268
R-squared	0.001	0.013	0.139	0.001	0.003	0.078
Dep var: Proposition						
Apprenticeship	0.0191	0.0126	0.0119	0.0272	0.0263	0.0235
	(0.0285)	(0.0291)	(0.0329)	(0.0225)	(0.0224)	(0.0231)
Student mean	0.2679***	0.2679***	0.2679***	0.2208***	0.2208***	0.2208***
	(0.0213)	(0.0213)	(0.0213)	(0.0164)	(0.0164)	(0.0164)
Observations	872	872	872	1,268	1,268	1,268
R-squared	0.000	0.014	0.147	0.001	0.002	0.062
Month FE	No	Yes	Yes	No	Yes	Yes
Department FE	No	No	Yes	No	No	Yes

Note: The dependent variable is a dummy variable equal to one if the application gets a positive callback or a proposition. Positive callback corresponds to cases in which the fictitious candidate received a request for complementary information or a suggestion for interview or hiring. Proposition corresponds to callbacks with interview or hiring proposition. Apprenticeship is a dummy variable equal to one if the application was from an apprentice. Small firms have less than 10 employees and large firms have at least 10 employees. Robust standard errors are clustered at the department level and reported below the coefficients. * significant at 10 percent, ** significant at 5 percent, *** significant at 1 percent.

Table A.4.1.4

Effects of apprenticeship on the probability of getting a callback for temporary and permanent jobs for cook

	Temporary Jobs			Permanent Jobs		
	(1)	(2)	(3)	(4)	(5)	(6)
Dep var: Positive callback						
Apprenticeship	0.0218	0.0190	0.0190	0.0128	0.0130	0.0176
	(0.0226)	(0.0222)	(0.0231)	(0.0281)	(0.0284)	(0.0294)
Student mean	0.2949***	0.2949***	0.2949***	0.2542***	0.2542***	0.2542***
	(0.0162)	(0.0162)	(0.0162)	(0.0199)	(0.0199)	(0.0199)
Observations	1,558	1,558	1,558	982	982	982
R-squared	0.001	0.007	0.076	0.000	0.004	0.117
Dep var: Proposition						
Apprenticeship	0.0193	0.0170	0.0199	0.0244	0.0245	0.0313
	(0.0204)	(0.0203)	(0.0214)	(0.0267)	(0.0266)	(0.0275)
Student mean	0.2409***	0.2409***	0.2409***	0.2167***	0.2167***	0.2167***
	(0.0152)	(0.0152)	(0.0152)	(0.0188)	(0.0188)	(0.0188)
Observations	1,558	1,558	1,558	982	982	982
R-squared	0.000	0.006	0.081	0.001	0.004	0.122
Month FE	No	Yes	Yes	No	Yes	Yes
Department FE	No	No	Yes	No	No	Yes

Note: The dependent variable is a dummy variable equal to one if the application gets a positive callback or a proposition. Positive callback corresponds to cases in which the fictitious candidate received a request for complementary information or a suggestion for interview or hiring. Proposition corresponds to callbacks with interview or hiring proposition. Apprenticeship is a dummy variable equal to one if the application was from an apprentice. Temporary jobs comprise all offers for a seasonal contract or a determined duration contract. Permanent jobs are the complement. Robust standard errors are clustered at the department level and reported below the coefficients. * significant at 10 percent, ** significant at 5 percent, *** significant at 1 percent.

Table A.4.1.5

Effects of apprenticeship on callback probability given different unemployment rates at the commuting zone level for cook

	All	T1 (7.2%)	T2 (8.5%)	T3 (10.8%)
	(1)	(2)	(3)	(4)
Dep var: Positive callback				
Apprenticeship	0.0293	0.0411	-0.0119	0.0508*
	(0.0217)	(0.0472)	(0.0406)	(0.0270)
Student mean	0.3029***	0.3576***	0.3127***	0.2386***
	(0.0151)	(0.0276)	(0.0258)	(0.0244)
Observations	1,869	621	616	632
R-squared	0.083	0.105	0.104	0.097
Dep var: Proposition				
Apprenticeship	0.0259	0.0200	0.0179	0.0339
	(0.0185)	(0.0410)	(0.0361)	(0.0220)
Student mean	0.2567***	0.3113***	0.2508***	0.2092***
	(0.0143)	(0.0267)	(0.0242)	(0.0233)
Observations	1,869	621	616	632
R-squared	0.078	0.087	0.103	0.099
Month & Department FE	Yes	Yes	Yes	Yes
Firm & Job Characteristics FE	Yes	Yes	Yes	Yes

Note: The dependent variable is a dummy variable equal to one if the application gets a positive callback or a proposition. Positive callback corresponds to cases in which the fictitious candidate received a request for complementary information or a suggestion for interview or hiring. Proposition corresponds to callbacks with interview or hiring proposition. Apprenticeship is a dummy variable equal to one if the application was from an apprentice. TX corresponds to the Xth tercile of the unemployment rate at the commuting zone level. Robust standard errors are clustered at the department level and reported below the coefficients. * significant at 10 percent, ** significant at 5 percent, *** significant at 1 percent.

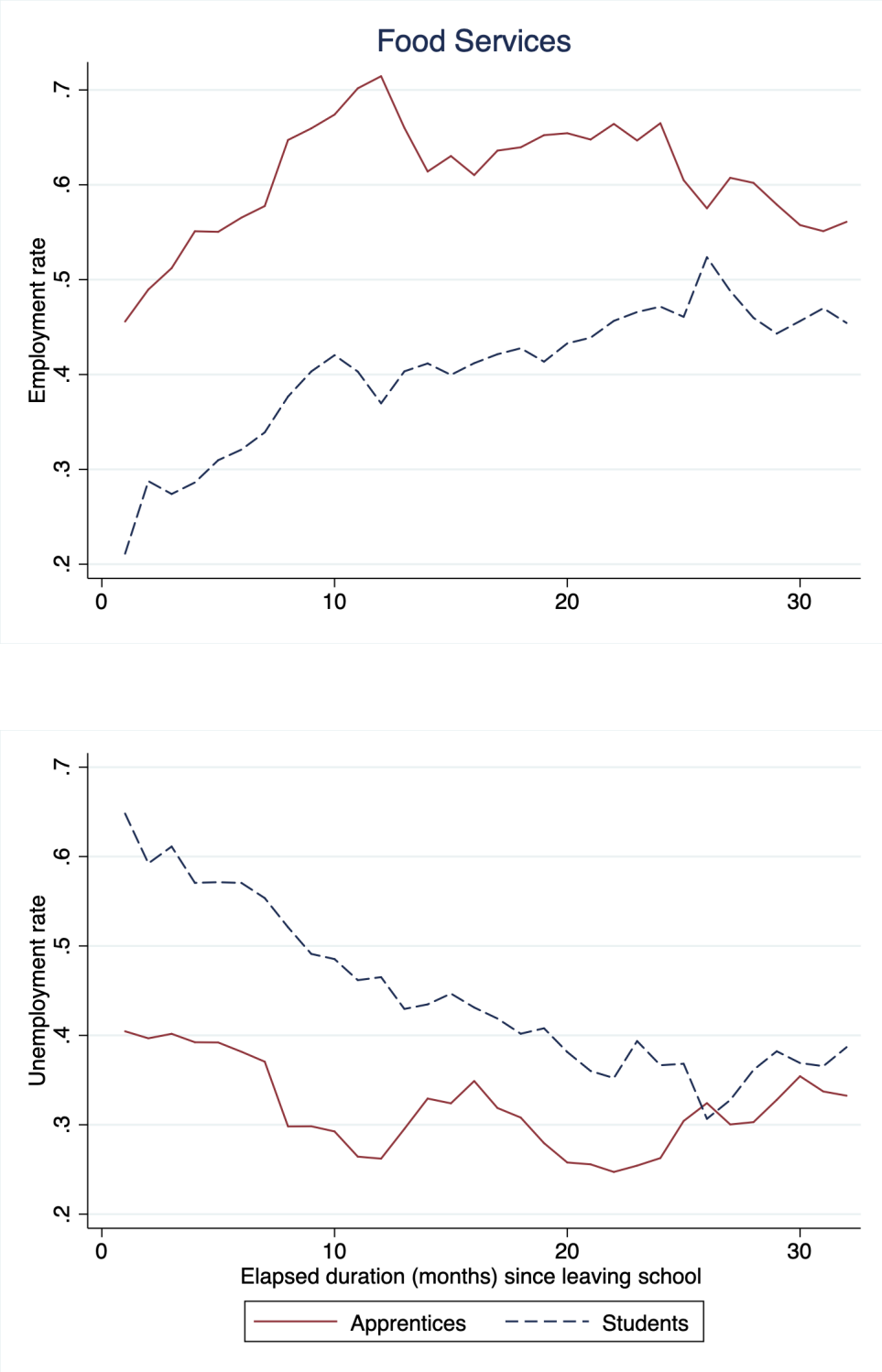


FIGURE A.4.1.1: EVOLUTION OF THE SHARE OF STUDENTS AND APPRENTICES IN EMPLOYMENT OR UNEMPLOYMENT AFTER LEAVING SCHOOL IN FOOD SERVICES.
Note: Students got their CAP diploma in June-July 2010. Month zero stands for September 2010.
Source: pooled *Génération 2001-2007-2010-2013* surveys, CEREQ.

A.4.2 Bricklayer

Table A.4.2.1
Description of the bricklayer occupation

Occupation	**Bricklayer**
Diploma	CAP Maçon
Definition	The owner of the diploma can work in any kind of building firm with structural work tasks

Uniting	**Activities**	**Skills**	**Exams**		
			Modality	**Tests**	**Coeff.**
Analysis of a professional situation	Preparing its materials on the construction site Explaining the realizations to colleagues or supervisors	Mastering rules in a building site Speak and listen in a professional context	Continuous evaluation	2 oral examinations in the training center	4
Normal working tasks	Reading and applying instructions for normal working tasks	Lay composite materials for construction	Continuous evaluation + practical exam	1 practical session in the training center + 1 practical session in the training firm	8
Additional working tasks	Reading and applying instructions for additional working tasks	Lay composite materials for construction	Continuous evaluation	1 practical session in the training center + 1 practical session in the training firm	4
French language			Written exam	text comprehension and short essay	3
Mathematics, Physics, and Chemistry			Written exam	Several exercises	2
Social and Working Life			Written exam	Real life questions	1
Sport			Continuous evaluation	3 evaluations	1

Source: *Arrêté du 17 août 2004 modifiant l'arêté du 21 août 2002 modifié, portant création du certificat d'aptitude professionnelle maçon.*

TABLE A.4.2.2
STATISTICAL PORTRAIT OF STUDENTS AND APPRENTICES IN CONSTRUCTION

Component	Information	Students	Apprentices
		22.35%	**77.65%**
Individual	Sex (male)	90.53%	99.95%
	Age	19 y.o.	21 y.o.
	Handicap	7.98%	6.70%
	Driving license	37.86%	49.16%
Family	District area		
	Downtown	30.84%	22.32%
	Suburb	27.59%	32.58%
	Small city	13.41%	15.98%
	Village	28.16%	29.12%
	Siblings	86.70%	84.32%
	French language	89.01%	95.07%
	Birthplace of father		
	France	83.95%	88.67%
	European countries	6.00%	3.11%
	Arabic countries	6.13%	7.73%
	African countries	2.96%	0.32%
	Rest of the world	0.96%	0.18%
	Birthplace of mother		
	France	85.33%	88.92%
	Europe	4.72%	3.52%
	Arabic countries	7.23%	6.95%
	African countries	1.78%	0.42%
	Rest of the world	0.95%	0.18%
	School level of father		
	No diploma	44.29%	29.49%
	Cap/Bep	43.94%	48.08%
	Bac	4.20%	12.90%
	Bac+	7.57%	9.53%
	School level of mother		
	No diploma	31.70%	36.13%
	Cap/Bep	29.20%	42.43%
	Bac	34.03%	16.29%
	Bac+	5.07%	5.15%
	Father works	82.86%	88.14%
	Mother works	70.13%	72.25%
Education	Repeater year before 6th grade	50.03%	44.34%
	Normal middle school program	52.60%	62.67%
	Would have preferred apprenticeship	60.46%	-
	Reason of non-apprenticeship		
	No CFA	3.51%	-
	No employer	20.79%	-
	Neither CFA, nor employer	22.92%	-
	Other	52.78%	-
	Internships / Apprenticeship Tutor	75.05%	-
	Number of internships		
	1	15.46%	-
	2	33.41%	-
	3 or more	51.13%	-
	Contact with the (last) training firm		
	Self	35.64%	-
	Family and friends	45.40%	-
	School / Apprenticeship center	7.70%	-
	Other Public Structure	0.62%	-
	Other	10.64%	-
	Graduated	71.90%	93.27%

Note: This table reports descriptive statistics for both apprentices and vocational students in the construction sector. Shares of students who did interships and the mode of contact with the last training firm are computed from the *Génération 2010* survey only because of the specific questions. The share of graduated students and apprentices are computed with both the *Génération 2010-2013* surveys because of changes in the content of the level V diploma in 2009 in France.
Source: pooled *Génération 2001-2007-2010-2013* surveys, CEREQ ($N = 418$ individuals)

Table A.4.2.3

Effects of apprenticeship on the probability of getting a callback given the size of firms for bricklayer

	Small Firms			Large Firms		
	(1)	(2)	(3)	(4)	(5)	(6)
Dep var: Positive callback						
Apprenticeship	0.0159	0.0314	0.0839	-0.0567	-0.0609	-0.0805
	(0.0673)	(0.0693)	(0.143)	(0.0497)	(0.0501)	(0.0727)
Student mean	0.2029***	0.2029***	0.2029***	0.2739***	0.2739***	0.2739***
	(0.0488)	(0.0488)	(0.0488)	(0.0357)	(0.0357)	(0.0357)
Observations	133	133	133	332	332	332
R-squared	0.000	0.030	0.581	0.004	0.017	0.294
Dep var: Proposition						
Apprenticeship	0.0136	0.0268	0.0894	-0.0649	-0.0665	-0.0727
	(0.0642)	(0.0633)	(0.141)	(0.0437)	(0.0442)	(0.0631)
Student mean	0.1739***	0.1739***	0.1739***	0.2420***	0.2420***	0.2420***
	(0.0460)	(0.0460)	(0.0460)	(0.0341)	(0.0341)	(0.0341)
Observations	133	133	133	332	332	332
R-squared	0.000	0.034	0.563	0.006	0.023	0.283
Month FE	No	Yes	Yes	No	Yes	Yes
Department FE	No	No	Yes	No	No	Yes

Note: The dependent variable is a dummy variable equal to one if the application gets a positive callback or a proposition. Positive callback corresponds to cases in which the fictitious candidate received a request for complementary information or a suggestion for interview or hiring. Proposition corresponds to callbacks with interview or hiring proposition. Apprenticeship is a dummy variable equal to one if the application was from an apprentice. Small firms have at most 10 employees and large firms have more than 10 employees. Robust standard errors are clustered at the department level and reported below the coefficients. * significant at 10 percent, ** significant at 5 percent, *** significant at 1 percent.

Table A.4.2.4

Effects of apprenticeship on the probability of getting a callback for temporary and permanent jobs for bricklayer

	Temporary Jobs			Permanent Jobs		
	(1)	(2)	(3)	(4)	(5)	(6)
Dep var: Positive callback						
Apprenticeship	0.0286	0.0328	0.0377	-0.0856	-0.0879	-0.0835
	(0.0632)	(0.0623)	(0.0953)	(0.0525)	(0.0529)	(0.0861)
Student mean	0.2424***	0.2424***	0.2424***	0.2598***	0.2598***	0.2598***
	(0.0431)	(0.0431)	(0.0431)	(0.0391)	(0.0391)	(0.0391)
Observations	206	206	206	259	259	259
R-squared	0.001	0.026	0.478	0.011	0.037	0.328
Dep var: Proposition						
Apprenticeship	0.00359	0.00692	0.0223	-0.0771	-0.0791	-0.0827
	(0.0547)	(0.0545)	(0.0835)	(0.0490)	(0.0499)	(0.0817)
Student mean	0.2020***	0.2020***	0.2020***	0.2362***	0.2362***	0.2362***
	(0.0406)	(0.0406)	(0.0406)	(0.0378)	(0.0378)	(0.0378)
Observations	206	206	206	259	259	259
R-squared	0.000	0.032	0.475	0.009	0.035	0.345
Month FE	No	Yes	Yes	No	Yes	Yes
Department FE	No	No	Yes	No	No	Yes

Note: The dependent variable is a dummy variable equal to one if the application gets a positive callback or a proposition. Positive callback corresponds to cases in which the fictitious candidate received a request for complementary information or a suggestion for interview or hiring. Proposition corresponds to callbacks with interview or hiring proposition. Apprenticeship is a dummy variable equal to one if the application was from an apprentice. Temporary jobs comprise all offers for a seasonal contract or a determined duration contract. Permanent jobs are the complement. Robust standard errors are clustered at the department level and reported below the coefficients. * significant at 10 percent, ** significant at 5 percent, *** significant at 1 percent.

Table A.4.2.5

Effects of apprenticeship on callback probability given different unemployment rates at the commuting zone level for bricklayer

	All	T1	T2	T3
	(1)	(2)	(3)	(4)
Dep var: Positive callback				
Apprenticeship	-0.0578	-0.308***	0.0501	0.0392
	(0.0561)	(0.0988)	(0.114)	(0.106)
Student mean	0.2673***	0.3699***	0.2500***	0.1579***
	(0.0312)	(0.0569)	(0.0514)	(0.0487)
Observations	412	142	143	127
R-squared	0.291	0.419	0.339	0.302
Dep var: Proposition				
Apprenticeship	-0.0564	-0.275**	0.0384	0.0203
	(0.0515)	(0.107)	(0.111)	(0.0874)
Student mean	0.2327***	0.3288***	0.2222***	0.1228***
	(0.0298)	(0.0554)	(0.0493)	(0.0439)
Observations	412	142	143	127
R-squared	0.260	0.382	0.326	0.254
Month & Department FE	Yes	Yes	Yes	Yes
Firm & Job Characteristics FE	Yes	Yes	Yes	Yes

Note: The dependent variable is a dummy variable equal to one if the application gets a positive callback or a proposition. Positive callback corresponds to cases in which the fictitious candidate received a request for complementary information or a suggestion for interview or hiring. Proposition corresponds to callbacks with interview or hiring proposition. Apprenticeship is a dummy variable equal to one if the application was from an apprentice. TX corresponds to the Xth tercile of the unemployment rate at the commuting zone level. Robust standard errors are clustered at the department level and reported below the coefficients. * significant at 10 percent, ** significant at 5 percent, *** significant at 1 percent.

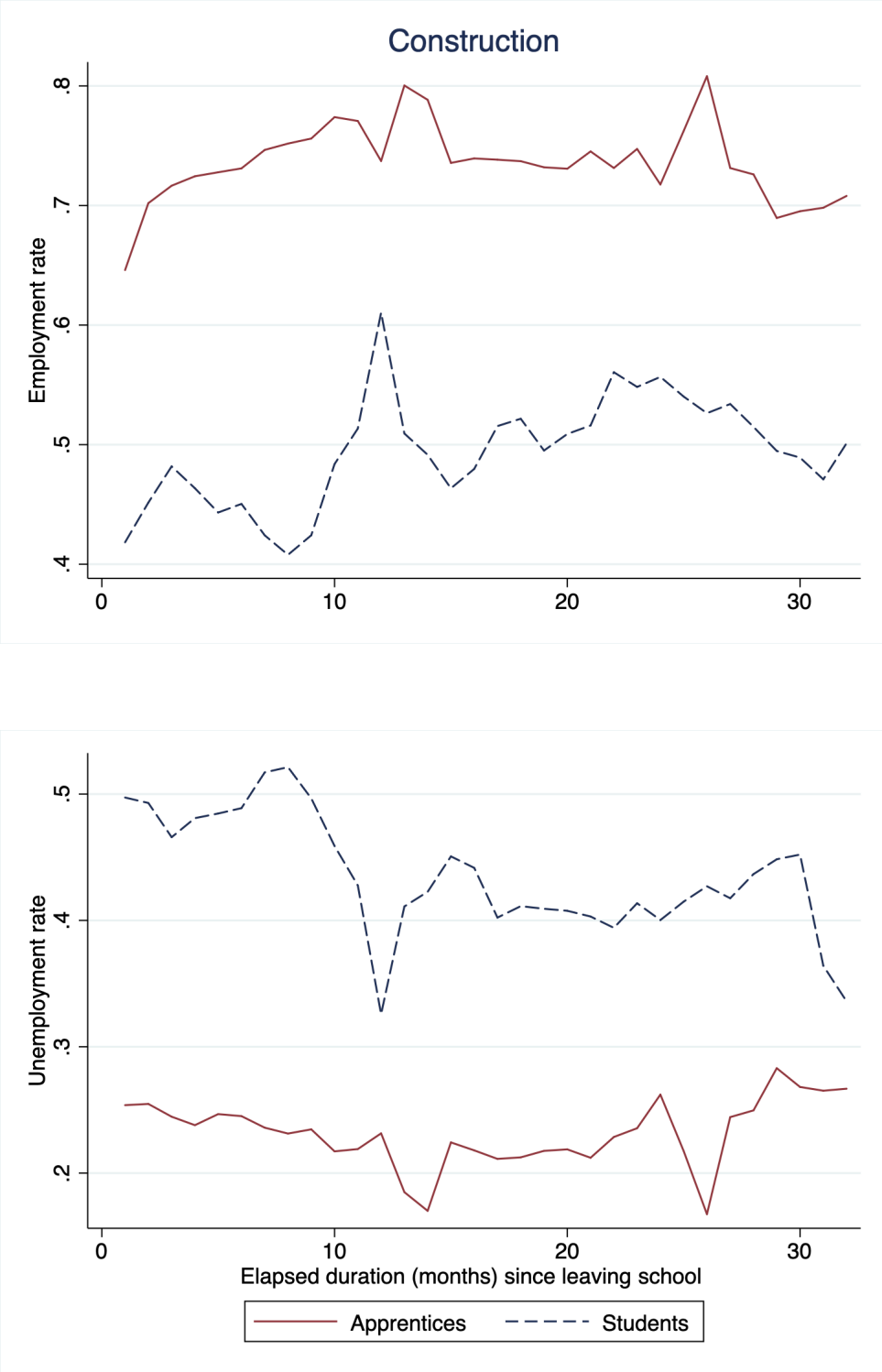


Figure A.4.2.1: Evolution of the share of students and apprentices in employment or unemployment after leaving school in construction.
Note: Students got their CAP diploma in June-July 2010. Month zero stands for September 2010.
Source: pooled *Génération 2001-2007-2010-2013* surveys, CEREQ.

A.5 Callback probabilities

Let us first consider jobs for which employers screen résumés. An apprentice who applies to a job with m_a and n_s other applicants is called back with probability $1/(1+m_a)$. A student applying in a firm with m_s other student applicants is called back with probability $[1-\mathbf{1}(n_a>0)]/(1+m_s)$ where $\mathbf{1}$ is the indicator function.

On jobs which do not screen résumés, the hiring probability of apprentices and students is identical. It is equal to $1/(n_a+n_s)$

Therefore, the callback probability of an apprentice, who competes with $(1-\rho)N_a-1$ other apprentices on all vacancies, is equal to

$$\sum_{n_a=0}^{(1-\rho)N_a-1}\sum_{n_s=0}^{N_s} b(m_a,(1-\rho)N_a-1,1/v)b(n_s,N_s,1/v)\left(\frac{\eta}{(1+m_a+n_s)}+\frac{(1-\eta)}{1+m_a}\right)$$

The callback probability of a vocational student can be computed in the same way:

$$\sum_{n_a=0}^{(1-\rho)N_a}\sum_{m_s=0}^{N_s-1} b(n_a,(1-\rho)N_a,1/v)b(m_s,N_s-1,1/v)\left(\frac{\eta}{(1+m_a+n_s)}+\frac{(1-\eta)\left[1-\mathbf{1}(n_a>0)\right]}{(1+m_s)}\right)$$

A.6 Wage and productivity of apprentices and students

This appendix presents the estimation of the distributions of productivity of apprentices and vocational students, conditional on experience, region of residence, family situation and work environment. As explained in the main text, the productivity distributions of apprentices and vocational students, $G^j(y),\ j = a, s$, are estimated assuming that wages are determined by the wage bargaining solution, so that we start by estimating the wage distributions to retrieve the productivity distributions relying on equation (9).

In line with our correspondence study, the analysis is restricted to young males who enrolled in a CAP-equivalent program after middle school and are working in the construction industry, hotel and restaurants, and related sectors such as transport and retail in order to get a sufficient number of observations. The analysis is focused on the monthly wage of full-time workers to avoid important measurement errors. To compare entry wages conditional on individual characteristics, we run standard Mincer-like earnings regressions, where the log-wage is the dependent variable and explanatory variables include the number of months of labor market experience after leaving school, dummies for gender, the type of labor market contract and fixed effects for the department of residency, the sector of activity and years.

Figure A.6.0.1 displays the histogram of wages. To account for the presence of the minimum wage, the wage distribution is left-truncated at the minimum wage level and log-wages are estimated with the maximum likelihood method. Another strategy could be to assume that wages are contaminated by measurement errors. However, the main source of measurement errors below the minimum wage is likely due to the fact that there are several subsidized jobs the status of which allows the employers to circumvent the minimum wage regulation, especially in the case of young workers. Insofar as the status of these jobs is not well reported in the *Génération* survey, there are some observations below the minimum wage. We hence discard these observations and truncate the wage distribution at the minimum wage to infer the productivity distributions from the wage distributions.

In order to estimate the wage distributions of ex-apprentice and ex-vocational student workers conditional on characteristics, we compute the residuals from the regression of log monthly starting wages for all workers. Once we have computed the residuals from the regression of log wages, we define the wage level of an apprentice worker as the mean wage of the whole sample times the exponential of his residual and the wage level of a student worker as the mean wage of the whole sample times the exponential of his residual. Then we compute the productivity y of each individual from equation (9). We assume that productivity is log-normally distributed, i.e. the distribution of y is $\log -\mathcal{N}(\mu_j, \sigma_j),\ j = a, s$. The estimation of the productivity distribution of apprentice workers yields $\mu_a = 7.8555488$, $\sigma_a = 0.2257112$; and that of students $\mu_s = 7.8457506$, $\sigma_s = 0.21937228$. The productivity distributions of apprentices and students are displayed on Figure 2.

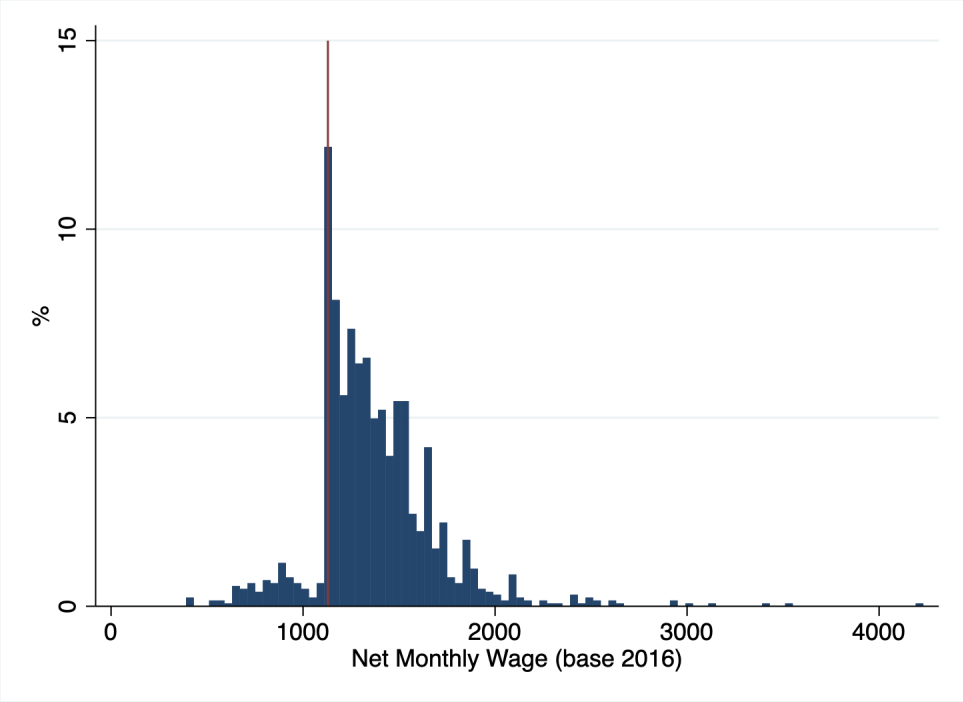


FIGURE A.6.0.1: Histogram of the Net Monthly Wages earned by Apprentices and Students. Source: pooled *Génération 2010-2013* surveys, CEREQ.

A.7 Robustness of the model

Table A.7.0.1
Robustness of the model simulations according to different values of β

Model	Estimates				
	(1)	(2)	(3)	(4)	(5)
β	0.3	0.4	0.5	0.6	0.7
μ_a	8.379575	8.0458825	7.8503906	7.7237941	7.6198244
σ_a	.21000747	.22228958	.22613206	.2215229	.22051209
μ_s	8.3548678	8.0349114	7.8407658	7.7126926	7.6159226
σ_s	.20924469	.21272207	.2181748	.2150759	.20936935
	Benchmark ($\alpha = 0.5$)				
η	0.90	0.90	0.90	0.90	0.89
h	€1232.58	€687.91	€433.48	€281.53	€176.82
u_a	.1972	.1972	.1972	.1972	.1972
u_s	.2894	.2894	.2894	.2894	.2894
u	.2433	.2433	.2433	.2433	.2433
$\tilde{u}$	.2781	.2781	.2781	.2781	.2781
θ	1.4304	1.4304	1.4309	1.4341	1.4448
	Counterfactual ($\alpha = 0.6$)				
u_a	.1986	.1989	.1989	.1989	.1992
u_s	.2906	.2910	.2909	.2910	.2914
u	.2354	.2358	.2357	.2357	.2360
$\tilde{u}$	.2769	.2774	.2773	.2773	.2777
θ	1.4371	1.4344	1.4355	1.4386	1.4473

Note: This table reports the indicators simulated by the model with different values of β both in the benchmark and one counterfactual situation. The estimates discussed in the core paper are presented in column (3) with $\beta = 0.5$.