Are Apprenticeship Contracts a Remedy for Hiring Difficulties?

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GitHub Repository: kilianguillon/Apprenticeship_Hiring_Difficulty

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Abstract

This paper investigates whether apprenticeship contracts can alleviate hiring difficulties in French firms, in the context of the 2018 Loi Avenir Professionnel reform. Using detailed firm-level panel data from 2018 to 2020, I estimate the impact of the reform on the share of apprentices in total hirings, with a focus on heterogeneity by hiring difficulty. The results show that the reform increased apprenticeship hiring overall, but not in firms facing the most severe hiring challenges. In particular, high-turnover firms and those with structural geographic mismatches hired fewer apprentices after the reform, suggesting that apprenticeship is not a perfect remedy for hiring difficulty. This highlights the need to consider causes beyond skill shortages or mismatches when addressing hiring difficulties. Factors such as working conditions, wage offers, and firms' organizational capacity to attract and retain workers also play a crucial role.

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Introduction

While unemployment in France is at historically low levels, hiring difficulties remain a major concern for firms. Although these challenges slightly declined in 2024, they are still widespread: according to the BMO survey, 57.4% of firms report recruitment problems. This situation constrains production capacity and reduces economic adaptability.

The dominant explanation, such as McGuinness et al. (2018) and Brunello and Wruuck (2021), points to labor supply issues, particularly skill shortages; many argue that the workforce lacks the training and experience needed to meet employers' expectations. While this view is widely accepted, it faces some contradictions. Labor supply has never been higher, with employment and participation rates reaching record levels since the pandemic.

This study aims to shed light on the root causes of hiring difficulties by analyzing how firms responded to the 2018 Avenir Professionnel law, which simplified and subsidized apprenticeship contracts. If skill shortages are the main issue, we would expect firms facing the most acute hiring problems to make greater use of apprenticeships, which provide tailored training and reduce skill-related uncertainty, as shown by Muehlemann and Wolter (2014).

I use French administrative microdata from 2018 to 2020 to assess the impact of hiring difficulties and the apprenticeship reform on the structure of firms' hiring practices. I show that the apprenticeship reform did not particularly benefit firms facing hiring difficulties. While the reform led to an overall increase in apprenticeship hires, this effect was significantly weaker, or even negative, for firms experiencing the most severe recruitment challenges. Several mechanisms could explain this result. First, although apprenticeships can help address skill shortages, firms with acute hiring needs may require immediate labor and cannot afford the time needed to train apprentices. Second, their hiring difficulties may not stem from skill mismatches at all, jobs may simply be unattractive due to low pay, harsh working conditions, or poor career prospects. Finally, geographical factors may also play a role, as some firms are located in areas with limited labor supply.

To address this question, the paper begins with a theoretical discussion outlining the potential mechanisms through which apprenticeship contracts could not alleviate hiring difficulties. The second part introduces the data, drawn from matched employer-employee administrative records. The third section presents the empirical strategy, relying on fixed effects regression models to estimate the heterogeneous effects of the 2019 apprenticeship reform depending on the degree and nature of hiring difficulties. Finally, the last section discusses the results, highlighting both the limits and potential of apprenticeship as a tool for addressing hiring challenges in the French labor market.

1 Theoretical Framework

I propose a simplified model to illustrate the trade-off between apprenticeship contracts and other hiring strategies faced by firms experiencing recruitment difficulties. Firms are characterized by a parameter $\theta \in [0, 1]$, which reflects the intensity of their labor needs (θ near 1, the firm is facing strong hiring difficulties). A firm can either hire an experienced worker at a total cost c_d (wage and recruitment costs) for a productivity level y. Assuming a competitive or tight labor market, the entire surplus is captured by the worker. As a result, the firm's profit from hiring directly is:

$$\pi_d = y - c_d = 0$$

Alternatively, the firm can train an apprentice. This option is subsidized, so the cost is $c_d - s$. However, the apprentice's contribution to production is delayed and uncertain. Specifically, their future productivity is reduced by a random variable τ with zero expectation, reflecting the firm's uncertainty about post-training productivity. In addition, the apprentice remains with the firm with probability $p \in [0, 1]$, and the firm discounts the future with a factor $\delta = 1 - \theta \in [0, 1]$.

The expected profit from training an apprentice is then:

$$E[\pi_a] = -(c_d - s) + \delta p E[y - \tau] = s - c_d + \delta p y$$

The firm will choose to train an apprentice if:

$$E[\pi_a] > 0 \quad \iff \quad s > (1 - \delta p)y$$

This expression shows that the more severe the hiring difficulties (low δp), the larger the subsidy required to make apprenticeship profitable. Thus, while apprenticeship subsidies may help many firms, they are less likely to benefit those most affected by hiring difficulties, unless the policy is precisely targeted. In general equilibrium, this may lead to worse consequences: these policies make companies without hiring difficulties more competitive, increasing the vicious circle.

2 Data

The analysis focuses on a short time span from 2018 to 2020, during which France experienced a sharp increase in the number of apprentices. Table 1 highlights the significant rise of new apprentices, particularly in 2020. This comes from a reform implemented on January 1, 2019. The Avenir Professionnel law introduced major changes to the vocational training and apprenticeship system in France, with the aim of making apprenticeships more attractive and accessible to both firms and young people. Key features included a simplification of the legal framework, the unification of funding mechanisms under a single national operator (France Compétences), and above all, a substantial increase in financial support for firms hiring apprentices. The reform extended subsidies, reduced administrative burdens, and allowed apprentices to enroll throughout the year. These measures significantly reduced the effective cost of hiring apprentices and made

apprenticeship contracts a more viable option for many firms. 2020 is affected by th COVID pandemic and the lockdowns; however, it has only slowed down the hiring of all types of workers only during some parts of the year and on a limited scale. And it is possible to compare the situation between 2019 and 2020 or to add year fixed effects, to show or neutralize the effect of the pandemic on the hiring of apprentices.

Year	**Total Apprentices**	**New Apprentices**	**Completed Apprenticeships**
2018	487,015	179,415	153,318
2019	547,207	210,237	170,246
2020	651,368	256,473	188,359

Table 1: Number of apprentices per year in the Base Tous Salariés

The data used in this study come from the Base Tous Salariés, an administrative dataset derived from the Déclaration Sociale Nominative (DSN). The DSN is a mandatory reporting system for all French employers (in the private and the public sector) with salaried workers. This rich administrative source provides detailed information on the employee-employer relationship, including the type of contract (permanent, fixed-term, apprenticeship), gross and net wages, contract duration, and additional characteristics of both the employee and the firm. It allows us to observe firms' recruitment strategies, whether they rely more on permanent contracts, short-term hires, or apprenticeships, and to construct proxies for hiring difficulties. The goal is to evaluate how firms adjust their use of apprenticeship contracts in response to labor shortages or shifts in hiring incentives.

The Base Tous Salariés focuses solely on each individual's main employment contract, as long as the person worked at least five days during the year. This dataset was more appropriate for our study than the Postes database, which records all employment contracts held by workers throughout the year. Since apprenticeship contracts are typically the main job of apprentices, and our comparison is primarily with permanent contracts (CDI), which are also usually the main job. In contrast, while the Postes database is more exhaustive, it tends to overrepresent workers who string together multiple short-term contracts, a group that is particularly large in the French labor market. This could have biased the analysis toward firms and sectors with high contract churn, which is not the primary focus of our investigation.

Each observation in Base Tous Salariés represents a unique employee-employer relationship. We aggregate these contracts at the firm level using the SIRET identifier, which allows us to construct a firm-level panel dataset. This provides richer and more targeted information for our research than the standard Entreprises dataset from the DSN, which contains fewer variables relevant to recruitment behavior and labor composition. In this panel, there are a total of 6,407,735 observations, or 2,346,047 unique firms that have been observed for at least two years between 2018 and 2020. We need to have at least two observations per firm to have firm fixed effects.

3 Empirical Strategy

The objective is to assess the impact of the 2019 apprenticeship reform on firms' use of apprenticeship contracts, while also considering how this effect may vary with the degree of recruitment difficulties faced by firms. I estimate the following equation with firm and year fixed effects:

$$y_{i,t} = \beta_1 Reform_t + \beta_2 Z_i + \beta_3 (Reform_t \times Z_i) + X'_{i,t}\gamma + \alpha_i + \lambda_t + \epsilon_{i,t}$$

The dependent variable ($y_{i,t}$) captures apprenticeship hiring behavior, such as the proportion of apprentices in the year's hires or the number of new apprentices. Two main explanatory variables are considered. First, a dummy variable ($Reform_t$) indicating the post-reform period (2019 and 2020), which captures the average effect of the reform across all firms. Second, a measure of hiring difficulties at the firm level (Z_i), proxied by variables such as the turnover rate, the share of non-permanent contracts or a synthetic index. This index uses two sources of heterogeneity : the region and the sector of activity of the firm. Using France Travail's Besoin en Main-d'Oeuvre 2019 survey, I obtain information on recruitment difficulties using these two parameters. As shown in figure 1, the index exhibits a smooth distribution and reveals substantial heterogeneity that can be exploited in the analysis.

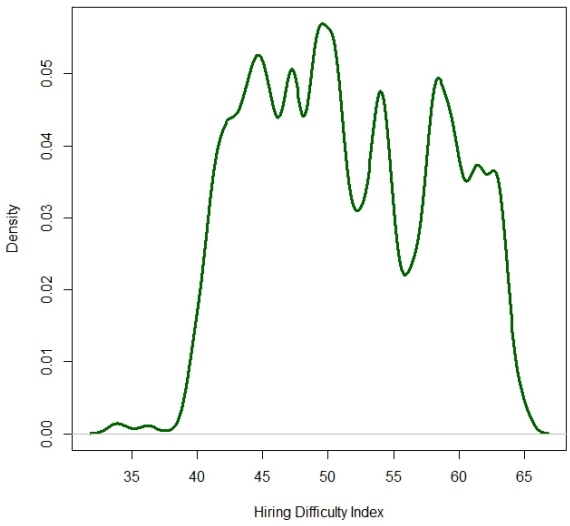

Figure 1: Density of hiring difficulty index

To test whether the effect of the reform differs according to firms' hiring difficulties, an interaction term between the post-reform dummy and the hiring difficulties measure is then introduced. While this setting does not strictly follow a difference-in-differences design, since all firms are exposed to the reform, I exploit the variation in hiring difficulties across firms to estimate heterogeneous treatment effects. The interaction between the post-reform dummy and the hiring difficulty variable allows us to assess whether the reform had a larger effect on firms facing greater recruitment challenges. All regressions include firm fixed effects to control for unobserved time-invariant characteristics, and year fixed effects to absorb aggregate temporal shocks. However, for econometric validity, the $Reform_t$ variable must be excluded when year

fixed effects are introduced, as it would otherwise be perfectly collinear. Additional controls include firm size, average wage and average age of the workforce.

To mitigate potential endogeneity issues between hiring difficulty measures and apprenticeship hiring outcomes, we excluded apprentices from the construction of our hiring difficulty indicators. Specifically, apprenticeship contracts are not included in the calculation of firms' turnover rates or the share of non-permanent contracts. This ensures that the explanatory variables are not mechanically influenced by the outcome variable.

Importantly, there was no other major reform in France between 2018 and 2020 that would have significantly affected other forms of hiring in a way comparable to the apprenticeship reform. This reduces the risk that our estimates are confounded by concurrent policy changes targeting employment more broadly. However, a limitation of our empirical strategy lies in the fact that we cannot fully ensure conditional parallel trends across firms with different levels of hiring difficulties. Since recruitment challenges may fluctuate from year to year depending on firm-specific conditions, the group of firms experiencing high hiring difficulties in one year may differ from that in the following year.

4 Results

After estimating the models using various measures of apprenticeship hiring and recruitment difficulties, we find consistent evidence that the Loi Avenir Professionnel was not effective in addressing hiring difficulties. Regardless of the model specification, the reform leads to both an absolute and relative increase in apprenticeship hires, as shown for instance in Model (1) of table 2. The effect of recruitment difficulties on apprenticeship hires varies across measures. As seen in Models (1) and (2) of table 2, both turnover and the share of short-term contracts (excluding apprentices) are associated with a decrease in apprenticeship hiring, all else equal. However, when we use the hiring difficulty index based on data from France Travail, as in Model (3) of table 2, the estimated effect is not statistically significant. This does not contradict our previous results, but rather highlights the complexity of measuring hiring difficulties, a multi-faceted phenomenon, as illustrated in table 5 in the Appendix.

The core focus of this paper is to assess the impact of the apprenticeship reform in light of hiring difficulties. In the first two models of table 2, we find that the higher the turnover, the weaker, or even negative, the effect of the reform on apprenticeship hiring. Similar results are obtained when using the share of non-permanent contracts as a proxy for hiring difficulties. However, when employing the index derived from France Travail data, we observe a positive and statistically significant interaction effect. According to this measure, the reform appears to have a stronger positive impact for firms experiencing greater hiring challenges.

Table 2: Effect of hiring difficulties and the Loi Avenir Professionnel on apprenticeship hiring

	(1)	(2)	(3)
2019 reform	0.668***		
	(0.016)		
Hiring difficulty	-5.316***	-4.410***	0.234
	(0.038)	(0.058)	(0.153)
Reform*Hiring difficulty	-0.134***	-0.042*	0.178***
	(0.024)	(0.025)	(0.012)
Log mean wage	-6.319***	-3.216***	-2.85***
	(0.037)	(0.022)	(0.021)
Mean age	-0.013***	0.065***	0.087***
	(0.002)	(0.002)	(0.002)
Total workforce	-0.256***	0.012**	0.011**
	(0.024)	(0.003)	(0.004)
Firm fixed effects	Yes	Yes	Yes
Year fixed effects	No	Yes	Yes
Observations	6,330,293	6,319,694	6,308,513
R-squared	0.22	0.22	0.21

Each model estimates the effect on the share of new apprentices in total firm hiring.
Model (1) includes only a dummy variable for the year 2019 and firm fixed effects; the hiring difficulty proxy is the turnover rate. **Model (2)** replaces the 2019 dummy with full year fixed effects, proportion of non-permanent workers is used for hiring difficulty. **Model (3)** builds on Model (2) but uses the index made with the France Travail data for hiring difficulty.
All models control for firm size, average age of non-apprentice employees, and the logarithm of the average wage.
Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

To better understand these results, which contrast with the previous findings, we re-estimate the empirical model without combining the regional and sectoral hiring difficulty scores into a single index. This disaggregated approach helps identify under which specific conditions the reform is more or less effective for firms facing hiring difficulties. As shown in table 3, neither the regional nor the sectoral indices individually have a significant effect, unlike the composite index. However, when interacted with the reform, they show opposite patterns: the reform appears to reduce apprenticeship hiring, everything else equal, for firms facing geographically driven hiring difficulties. In contrast, for firms affected by sector-specific hiring constraints, the reform significantly increases the hiring of apprentices.

Table 3: Effect of hiring difficulties and the Loi Avenir Professionnel on apprenticeship hiring (sector versus region)

	Share of new apprentices
Index region	-0.042
	(0.060)
Index sector	0.156
	(0.011)
Reform*region	-0.010***
	(0.003)
Reform*sector	0.016***
	(0.001)
Firm fixed effects	Yes
Year fixed effects	Yes
Observations	6,308,513
R-squared	0.21

The index region and the index sector are the percentage of hiring difficulties evaluate by France Travail.
This model controls for firm size, average age of non-apprentice employees, and the logarithm of the average wage.
Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

An important step toward understanding the effects of the reform and hiring difficulties on apprenticeship is to analyze their impact on alternative hiring forms, such as permanent (CDI) or fixed-term (CDD) contracts. Table 4 shows that an increase in apprenticeship hiring is associated with a decrease in the share of new CDI or CDD contracts, which is intuitively consistent with a substitution effect. Conversely, hiring difficulties are positively associated with overall hiring, as they signal unfilled vacancies, firms experiencing such difficulties are, by definition, attempting to recruit. However, this relationship also highlights the segmentation of the labor market: hiring difficulties do not positively affect apprenticeship hiring, suggesting a limited substitution between apprenticeships and standard contracts. Moreover, the reform appears to have further increased the hiring of permanent workers (CDI) in firms most affected by hiring difficulties, while reducing the use of fixed-term contracts (CDD) in the same context.

Table 4: Effect of hiring difficulties and the Loi Avenir Professionnel on CDI and CDD hiring

	Share of new CDI	Share of new CDD
Number of new apprentices	-5.391***	-3.130***
	(0.502)	(0.244)
Hiring Difficulty Index	1.439***	1.254***
	(0.388)	(0.288)
Reform*Hiring Difficulty	0.712***	-0.417***
	(0.713)	(0.213)
Firm fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Observations	6,308,513	6,308,513
R-squared	0.34	0.43

The hiring difficulty index is coming from France Travail data.
These models control for firm size, average age of non-apprentice employees, and the logarithm of the average wage.
Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

All these results help shed light on the central question of this paper: apprenticeship is not a remedy for hiring difficulties. Indeed, firms facing such difficulties are not only constrained by a lack of labor supply or inadequate skills, factors that apprenticeships are supposed to address. Their difficulties also stem from their limited ability to offer attractive positions: providing adequate working conditions to reduce turnover, offering wages that reflect the required effort, or ensuring schedules that meet workers' availability. Besides, firms experiencing hiring difficulties often need labor immediately, which is not compatible with training-based hiring strategies.

Hiring difficulties are associated with a decrease in apprenticeship hiring, while they are positively correlated with CDI and CDD hiring. The reform seems to have amplified this pattern. There are a few cases where it increased the use of apprentices, but the effect remained modest, even when statistically significant, and was confined to sectors facing specific recruitment challenges.

Overall, the main benefit of the apprenticeship reform for firms facing hiring difficulties may have been to reduce competition over permanent contracts (CDI), thereby facilitating their recruitment of standard employees. However, this raises longer-term concerns: such firms risk remaining in a persistent state of hiring difficulties, particularly if they fail to invest in training and developing their own workforce.

Conclusion and limits

This paper has investigated whether apprenticeship contracts can alleviate firms' hiring difficulties, using recent French data and the context of the 2018 Loi Avenir Professionnel reform. Our

empirical results show that, while the reform significantly increased the overall number of apprentices hired, its effects were uneven across firms. In particular, those most affected by hiring difficulties decreased their use of apprenticeships. I show that hiring difficulties are associated with higher recruitment of standard contracts (CDI and CDD), but not of apprentices. The reform appears to have amplified this segmentation, benefiting firms by easing the competition over permanent hires rather than directly supporting apprenticeship as a solution to recruitment problems. While some positive effects of the reform were found in sectors with structural skill shortages, they remain limited in scope. These findings suggest that apprenticeships are not a one-size-fits-all remedy for recruitment difficulties. This also implies that hiring difficulties do not only come from the supply of work and skills. Thus, addressing such challenges likely requires broader improvements in job quality, wages, working conditions, and internal training capacities. Without such changes, firms in persistent hiring difficulty may continue to struggle, even as policies seek to promote alternative hiring pathways.

This study opens several avenues for future research. A first improvement would be to extend the time period of analysis up to 2024, as hiring difficulties sharply increased in the aftermath of the COVID-19 pandemic. Investigating whether apprenticeships have become a more effective response to such difficulties in recent years would be highly relevant. Another key point is the measurement of hiring difficulties itself. This is a complex concept that can be defined in multiple ways. To ensure robustness, this paper relied on multiple proxies. However, using data from the ACEMO survey, it might be possible to build a more refined and convincing indicator. One promising approach could involve applying machine learning methods to predict hiring difficulties from firm characteristics and recruitment patterns, thus creating a high-dimensional, data-driven index. Finally, the analysis in this paper was conducted at the firm level, thanks to the SIRET identifier available in the Base Tous Salariés. However, a finer analysis at the establishment level might provide more localized and representative insights. While this approach may suffer from smaller recruitment volumes per unit, it would allow for better regional assignment and a clearer understanding of local labor market frictions. A robustness check at the establishment level would therefore be a valuable extension.

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Appendix

	Turnover	Difficulty Index	Regional Score	Sector Score	Non-permanent
Turnover	1.00	0.05	-0.04	0.07	0.33
Difficulty Index	0.05	1.00	0.32	0.95	-0.06
Regional Score	-0.04	0.32	1.00	-0.01	0
Sector Score	0.07	0.95	-0.01	1.00	-0.06
Non-permanent	0.33	-0.06	0	-0.06	1.00

Table 5: Correlation matrix between indicators of hiring difficulties