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of Apprenticeship Training
in France and Germany

Une analyse comparative
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en France et en Allemagne

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192

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Comparative Analysis of Apprenticeship Training in France and Germany

Clément Brébion

Abstract

This paper is a comparative analysis of apprenticeship training in France and Germany. It relies on the German Socio-Economic Panel and the Enquêtes Génération. I find that apprenticeship training is associated with a stronger advantage over full-time students in France than in Germany at the secondary education level while no causal effect can be evidenced among students exiting higher education in both countries. I bring elements of proof suggesting that, at the secondary level, the average apprentices' advantage on the labour market follows a divergent pattern in the two countries. In Germany, it mostly stems from a high retention rate from the training firms' part whereas, in France, the advantage of apprentices is also rooted in their position on firms' external labour market. These results allow me to discuss the literature of the Aix School and of the Varieties of Capitalism.

Keywords: *apprenticeship training, youth unemployment, France, Germany, international comparison*

JEL Codes: *J24; I26; C36*

UNE ANALYSE COMPARATIVE DE L'EFFICACITÉ DE L'APPRENTISSAGE EN FRANCE ET EN ALLEMAGNE

RÉSUMÉ

Cet article est une analyse comparative de l'efficacité des études en apprentissage en France et en Allemagne. Les données utilisées sont celles du *German Socio-Economic Panel* pour l'Allemagne et des enquêtes *Génération* pour la France. On montre qu'avoir suivi un apprentissage est associé à un avantage plus fort sur les sortants d'études à temps plein en France qu'en Allemagne à la sortie du secondaire. À la sortie du supérieur, aucun effet causal n'est observé dans les deux pays. On apporte des éléments de preuve suggérant qu'en sortie de secondaire, l'avantage moyen des apprentis sur les étudiants à temps plein suit un schéma différent dans les deux pays. En Allemagne, il est principalement expliqué par des hauts niveaux de rétention des apprentis par les entreprises de formation, tandis qu'en France il est également issu de la position favorable des anciens apprentis sur le marché du travail externe. Ces résultats permettent une discussion de la littérature de l'école d'Aix et de celle des *Variétés du Capitalisme*.

Mots-clefs : études en apprentissage, chômage des jeunes, France, Allemagne, comparaison internationale.

SYNTHÈSE DES PRINCIPAUX RÉSULTATS

Face à un taux de chômage des jeunes élevé, bon nombre de pays européens, dont la France, tournent leur regard vers les pays germaniques (Allemagne, Autriche...) où la situation demeure plus favorable pour les jeunes. Un large consensus s'est installé dans le débat public présentant l'apprentissage comme un élément fondamental de la réussite de ces pays.

La littérature scientifique a effectivement démontré **qu'un système d'apprentissage développé est fortement corrélé à un faible niveau de chômage des jeunes**. C'est le cas en Allemagne où plus de la moitié des élèves passent par le système dual (*i.e.* l'apprentissage) et où le taux de chômage des 15-24 ans n'a pas dépassé 15,6 % depuis la réunification. En France, où le taux de chômage des jeunes n'est jamais descendu à ce niveau dans la même période et où la proportion de jeunes passant par l'apprentissage est deux fois moindre, une volonté politique a donc vu le jour pour accroître le nombre d'étudiants formés en apprentissage. L'objectif de 500 000 apprentis réaffirmé par différentes majorités gouvernementales depuis 1993 n'a cependant toujours pas pu être atteint. De fait, le discours s'est graduellement déplacé. **Plutôt qu'une simple augmentation du nombre d'apprentis, c'est dorénavant un transfert plus général de l'organisation du système de formation allemand qui est espéré** (moins de matières générales dans la partie scolaire de l'apprentissage, par exemple). Ceci, avec l'idée souvent implicite que l'apprentissage en Allemagne assurerait une meilleure transition sur le marché du travail qu'en France. Si des études ont démontré que l'apprentissage offrait de meilleures opportunités que la formation à temps plein dans ces deux pays, **à ma connaissance, aucune n'a porté un regard comparatif à ce sujet**.

Ce document de travail évalue donc l'effet de l'apprentissage sur la qualité de la transition école-emploi en France et en Allemagne. L'analyse est menée successivement sur deux populations distinctes : les sortants du secondaire et du supérieur. En France, cela est attendu, puisque l'apprentissage peut être suivi à tous les niveaux de diplôme. En Allemagne, le système dual se situe à la fin du collège (*Hauptschule, Realschule* ou *Gymnasium*). Dans le cas de l'Allemagne, l'étude sur le supérieur porte donc sur une population différente et compare la qualité de la transition école-emploi des ex-apprentis passés ensuite par le supérieur à celle des autres étudiants du supérieur. L'article s'appuie sur les *enquêtes Génération* pour la France (1998, 2001, 2004 et 2007) et le *Socio-Economic Panel* pour l'Allemagne (vagues 1992-2013). Au-delà de l'aspect comparatif, ces données récentes permettent d'actualiser les études réalisées jusque-là sur chaque pays et, pour l'Allemagne, d'intégrer l'Allemagne de l'Est dans l'analyse.

L'analyse de l'apprentissage se fait en deux temps. **Un premier temps descriptif** met en évidence les corrélations existantes entre le fait d'être passé par l'apprentissage et la situation sur le marché du travail. **Dans une seconde étape, l'effet causal de l'apprentissage est étudié** : l'analyse descriptive n'est pas causale si la population des apprentis diffère de celle des non-apprentis pour des raisons indépendantes au *cursus* suivi. Ce risque de biais est pris en compte ici par la **méthode des variables instrumentales**. Cette méthode contraint l'analyse causale à ne porter que sur une sous-population spécifique. Il s'agit ici des jeunes dont le choix de se tourner vers l'apprentissage ou vers les études à temps plein s'est fait en relation avec une variable « instrumentale » : pour nous, l'implication de la région d'origine dans le développement de l'apprentissage approchée par le taux d'apprentis dans la région (voir ci-dessous).

En termes descriptifs, les résultats obtenus montrent que **l'écart de niveau de chômage des jeunes entre la France et l'Allemagne résulte avant tout des vingt-quatre premiers mois suivant la sortie d'études**. On constate également que **l'avantage des apprentis sur les étudiants à plein temps est en moyenne plus fort en France** pour la plupart des indicateurs considérés. **Sur les douze premiers mois suivant la sortie du secondaire**, il est par exemple équivalent à une diminution du chômage de 11,6 points de pourcentage (p.p.) en France contre 5,5 p.p. en Allemagne. En sortie d'études supérieures, la réduction du taux de chômage est de 8,2 p.p. en France contre 1,7 p.p. en Allemagne. En France, les apprentis font également mieux que les étudiants à temps plein **sur le moyen terme**. Suivre un apprentissage est associé à une plus grande probabilité de connaître une période d'emploi continu de plus de dix-huit mois lors des trente-six mois suivant la sortie d'études. C'est également vrai en sortie de secondaire en Allemagne, même si l'écart entre apprentis et étudiants à plein temps est plus faible. Cet effet de moyen terme est doublé d'un temps d'attente plus faible avant l'expérience d'une telle période de stabilité.

La réussite des apprentis dans leur insertion sur le marché du travail relève de différents mécanismes suivant le pays. En Allemagne, elle provient surtout d'**un taux de rétention élevé** des entreprises de formation à la fin de l'apprentissage. Par contre, il semble que les employeurs ne privilégient pas les jeunes formés en apprentissage lorsqu'ils embauchent sur le marché externe. Au contraire, **en France**, si le taux de rétention des entreprises où a lieu la formation est faible, **les employeurs semblent privilégier les anciens apprentis aux autres étudiants sur le marché externe**.

Ces résultats interrogent la pertinence de **travaux institutionnalistes** traditionnels pour décrire la période actuelle. Tout d'abord, Maurice, Sellier et Silvestre (1979) ont décrit les employeurs français comme privilégiant les compétences générales aux compétences spécifiques, contrairement aux firmes allemandes. Le contraire apparaîtrait plutôt ici, puisque les formations professionnelles à temps plein fournissent plus de compétences générales. Ensuite, la littérature des *Variétés du Capitalisme* (Hall et Soskice, 2001) dépeint l'Allemagne comme un pays où une forte coordination entre les acteurs permet à l'apprentissage de fournir des compétences pertinentes pour l'ensemble du secteur d'activité. Ceci devrait préfigurer d'une situation privilégiée pour les apprentis sur le marché externe, ce qui n'est pas le cas dans nos données. En s'appuyant sur les travaux de Busemeyer (2009) et Busemeyer et Thelen (2011), que l'on étaye par des statistiques descriptives dans le papier, on peut considérer que **les mutations récentes du modèle de formation allemand** fournissent une bonne piste pour expliquer ce résultat. Ces auteurs décrivent une évolution depuis un modèle de formation collectif – où les associations d'employeurs contraignent les grandes entreprises à former au-delà de leurs besoins pour le bénéfice plus large de l'ensemble des entreprises et des PME en particulier – vers un modèle « segmentaire » – où les grandes entreprises quittent ces organisations patronales ou négocient des clauses afin d'orienter davantage la formation vers leur marché interne et de répondre à leurs besoins de compétences spécifiques.

En termes de qualité de l'emploi obtenu, les résultats montrent que **l'apprentissage est associé à une probabilité plus forte de travailler à temps plein en sortie de secondaire et de supérieur en France et en sortie de secondaire en Allemagne**. À genre donné, l'effet en sortie de secondaire est similaire dans les deux pays. Enfin, tandis que les ex-apprentis français gagnent plus que les étudiants à plein temps en sortie de secondaire et de supérieur à la fois sur le court terme et moyen terme (après trois ans), les ex-apprentis sortant du supérieur en Allemagne ne gagnent pas plus que les autres étudiants à caractéristiques observables données, et ceux sortant de secondaire gagnent moins. Ce dernier résultat est à

prendre avec précaution étant donné que la majorité de la littérature sur le sujet a trouvé un effet opposé. Les données utilisées ici sont cependant plus récentes et couvrent l'Allemagne de l'Est. Ce résultat pourrait donc mettre en évidence une tendance au déclin de la place relative des apprentis sortant d'école secondaire au sein de la concurrence sur le marché du travail allemand. Le nombre croissant d'apprentis passant par le supérieur avant d'arrêter les études pourrait fournir un élément d'explication.

Ces analyses descriptives permettent de caractériser les trajectoires des apprentis par rapport aux autres étudiants, mais elles ne mesurent pas l'impact propre de l'apprentissage : d'autres facteurs non observables peuvent aussi expliquer les différences de trajectoires. On utilise donc la méthode des variables instrumentales pour capter ce risque de biais. **L'instrument utilisé est le ratio régional du nombre d'apprentis sur le nombre d'étudiants à temps plein prévalant au moment du choix de se tourner ou non vers l'apprentissage.**

L'analyse causale apporte trois types de résultats principaux. Premièrement, les analyses suggèrent que, lorsque les régions développent l'apprentissage, elles attirent, d'une part, les jeunes réussissant moins bien sur le plan académique et peinant à trouver un contrat (cas du secondaire) et, d'autre part, de bons étudiants ne se décidant à suivre une telle filière que si un contrat de qualité leur est proposé (cas du supérieur). **Les effets sont donc différenciés suivant le niveau de sortie d'études.** Deuxièmement, pour les sortants du secondaire en France, les résultats montrent **un avantage comparatif en termes d'employabilité du fait de la possible embauche par la firme où a lieu la formation, mais une absence d'effet positif en cas de recherche d'emploi sur le marché « externe »**, suggérant une faible qualité de l'apprentissage suivi. Plus généralement, c'est la difficulté de la transition école professionnelle à temps plein-emploi et apprentissage-emploi, lorsque le jeune n'est pas embauché par son entreprise de formation, qui est mise en évidence ici. **En sortie de secondaire en Allemagne, l'apprentissage semble augmenter la durée du chômage l'année suivant la sortie d'études.** De nouveau, ce résultat est contraire à la mince littérature traitant de la question. L'instrument diffère cependant et, comme évoqué précédemment, les données utilisées ici sont plus récentes et incluent l'Allemagne de l'Est. La littérature a montré que les apprentis qui quittent l'école à la fin du secondaire ont suivi un apprentissage de moins bonne qualité que la moyenne. Or, ils entrent sur un marché du travail où plus de la moitié de la population détient un diplôme en apprentissage. Ceux qui, parmi ces jeunes, ne sont pas conservés par leur entreprise de formation se distingueraient donc pour les employeurs non par la nature de leur diplôme – comme ce pourrait être le cas en France où l'apprentissage est moins développé – mais par la faible qualité de l'apprentissage qu'ils ont suivi. Par ailleurs, et contrairement au cas français, le signe positif de l'effet mesuré rappelle les bons résultats des étudiants du secondaire dans les écoles professionnelles à temps plein. Troisièmement, les régressions mettent en évidence une **absence d'effet de l'apprentissage sur les trajectoires en sortie de supérieur à la fois en France et en Allemagne.** Ainsi, l'avantage moyen en sortie d'études à ce niveau s'explique avant tout par l'attractivité du système dual en Allemagne et par la sélectivité de l'apprentissage dans le supérieur en France.

Ces résultats apportent des **éléments de réflexion en matière de politiques publiques dans le cas français.** Tout d'abord, les résultats de l'analyse portant sur l'Allemagne montrent que, **lorsque l'apprentissage gagne en importance dans un pays, il peut atteindre un point où ses bénéfices décroissent pour les étudiants dont les résultats au collège sont les moins bons.** Ensuite, notre étude suggère que l'amélioration de la qualité des études professionnelles à temps plein est aussi importante que le développement de l'apprentissage. Enfin, dans le secondaire en France, les étudiants attirés par l'apprentissage grâce à

l'investissement des régions ne semblent bénéficier de leur formation que lorsqu'ils sont embauchés par leur entreprise de formation et non sur le marché externe en raison d'une formation de moindre qualité. Ceci souligne qu'un accroissement des subventions destinées à favoriser la participation des firmes dans le système peut être d'un effet limité puisqu'elles constituent un encouragement à utiliser les apprentis comme travail à bas coût. **Conditionner les subventions à un taux de rétention moyen de moyen terme et/ou à une certaine qualité de formation à ce niveau d'éducation pourrait donc être bienvenu.** Notons que ce dernier point nécessiterait une surveillance accrue de la part des Chambres de Commerce et d'Industrie et des Chambres de Métiers, comme c'est le cas en Allemagne. Concernant l'apprentissage dans le supérieur, les résultats encouragent à **renverser la tendance initiée au début des années 1990 qui a vu se développer l'apprentissage dans les études supérieures en France, tandis qu'il perdait en intensité dans le secondaire.** En particulier, les aides publiques semblent être plus efficaces à ce dernier niveau – conditionnellement au fait que le développement de l'apprentissage en résultant n'ait pas lieu par des contrats sans perspective d'embauche.

INTRODUCTION¹

Unemployment rates of the young people aged 15 to 24 years have remained under 15.6% in Germany since its reunification. During this period, it went below this threshold only two years in France (Eurostat, Labour Force Survey). The resulting gap averages 11% since 1992. Similarly, the activity rate of this age group has barely dropped under 50% in Germany since 1992 whereas it has not reached 40% in France in the same period. Yet, the gap does not stand when one considers the 25-74 year olds. The spread in unemployment rates for this population has not exceeded five percentage points and France did better than its neighbour between 2001 and 2008. Likewise, the activity rate of the 25-54 year olds has been exceeding the German one since 1992. The German labour market clearly stands out to the advantage of the youth. The unemployment ratio of the under 25 to the over 25 makes this particularly salient: since 1991 it has averaged 1.3 in Germany while it has not been better than 2 in France.

In the public debate, this German success is generally ascribed to the importance of its apprenticeship system. About 53% of each age cohort has indeed taken an apprenticeship at a point of its schooling (Hippach-Schneider, Krause, and Woll, 2007)². In 2013 this amounted to a stock of about 1,400,000 apprentices in training for a yearly inflow of 530,700. Apprenticeship – defined here as programs that include both work-based training on a firm’s site and in-school education leading to a diploma which curriculum is defined according to outlines decided externally to the sole employer – is indeed widely considered as providing a comparative advantage for the school-to-work transition. Marsden and Ryan (1991), for instance have showed that among the European Economic Community (EEC), the group of countries with a higher level of apprenticeship (including Germany) has a labour market more favourable to the youth than the rest of the EEC (including France). More specifically, Van der Velden and Wolbers (2003) demonstrate that the apprenticeship level is one of three factors³ explaining the almost whole variance of youth employment between countries.

Yet, France has been favouring school-based vocational training over apprenticeship. Whereas the vocational tracks at the secondary level include a proportion of students similar to Germany (respectively 44% and 48% in 2012, Martinot (2015)), only 32% of them follow an apprenticeship in France against 70% in Germany (Dayan and Delpech, 2013; Martinot 2015). Institutionalized in the early post-WWII era in France, this matter of fact has been severely questioned since low-skilled unemployment began rising in the 1970s. Since then, political actors have been holding a strong discourse in favour of an increase in the proportion of apprentices (Dayan and Delpech, 2013). Yet, despite a clear evolution between 1993 and 1998⁴, the undertaken reforms have had little effect. As of 2013, the stock of

¹ I thank P. Askenazy, C. Erhel, C. Perraudin and S. Briole for advice and suggestion. The first analyses on this paper have been led at the CEET in the context of a research internship.

² Importantly enough, the gap in unemployment and activity rates of the 15-24 holds when removing from the analysis the apprentices – considered as employed.

³ Alongside the employment protection level and the general situation of the labour force in the country

⁴ Stemming from the “loi quinquennale pour l’emploi”

apprentices reached 424,000 for a yearly inflow of 273,000 (Depp, 2013; Dares, 2015)⁵. As a result, the discourse has slowly evolved from a call to increase numbers per the German example to a drive to copy the organisation of the German apprenticeship model. This has been relying on an implicit that apprenticeship in Germany does better, not solely regarding its ability to involve a large number of firms and young people, but also in ensuring apprentices a good school-to-work transition.

Yet, to my knowledge, no comparative study has ever been made on the efficiency of the German and the French apprenticeship systems. This paper therefore follows both the aim of a comparative study and of a within country work with up-to-date datasets.

The remainder of the paper proceeds as follows. In Section 1 provide some elements of background on the organisation of apprenticeship in both countries, on the strategy of the training firms and on the institutional factors at stake in the relation between vocational training and education (VET hereafter) and the labour market. I present the data in Section 2 and show some descriptive statistics in Section 3. Section 4 describes the model and discusses the validity of the instrument used. I discuss the results and conclude in the last two Sections.

In brief, I separately lead the estimations on those exiting school after secondary education and higher education in each country. For France, this is straight-forward since apprenticeship is available at mostly all levels. For Germany, the treated group in higher education is composed of students who followed a higher education track after completing an apprenticeship in the secondary education. The instrument used in the IV setting is the ratio of apprentices over full-time students in studies at the corresponding level the year before the individual choice is to be made. The descriptive statistics emphasize that the overall difference in youth unemployment between the two countries is mostly driven by the 24 first post-exit months. I then show that apprenticeship training benefit more women than men on average. More generally, apprenticeship training is broadly associated with stronger positive outcomes in France than in Germany for students exiting both secondary and higher education. To a certain extent, this advantage follows a divergent pattern in France and Germany. In Germany, it mostly stems from a high retention rate from the training firms' part whereas, in France, the advantage of apprentices is also rooted in their position on the firms' external labour market. These results allow me to discuss the literature of the Aix School and of the Varieties of Capitalism. As for the causal study, I firstly discuss the nature of the compliers in each cell. I then evidence that compliers have negative employment prospects in Germany due to the low quality of their apprenticeship training, the large number of ex-apprentices on the labour market and the rather good outcomes of the full-time vocational students. In France, apprenticeship training has a positive effect on compliers' employability. This is only channelled by their likelihood to be retained in the training firm after their apprenticeship. The absence of causal effect on wages coupled with the fact that retention rates are low in France highlight the poor outcomes of the compliers when they follow full-time vocational training and when they are not hired by their training firm in the case of an apprenticeship. Finally, the IV led on the higher education cell of each country show that the average apprentices' advantage is rooted in the high quality of the students rather than in the very apprenticeship track.

⁵ Demographics and the length of the apprenticeship tracks (mostly two or three years in both countries) do not explain much of the variation in numbers between the two countries.

1. BACKGROUND

1.1 Apprenticeship tracks stand at a different position in the French and the German educational systems

In Germany, the apprenticeship system (*duale Ausbildung* or dual system) can be reached after the three tracks of lower secondary education – *Hauptschule*, *Realschule* and *Gymnasium*. Yet, they offer different chances of success. The strong link between the previous school results and the choice of lower secondary education results in a disadvantage for students exiting the *Hauptschule*. In a context of diploma inflation (see Table 1 in Appendix), firms are increasingly preferring pupils owing a diploma from the *Realschule* (Protsch and Dieckhoff, 2011). Nowadays, 40% of the former finds an apprenticeship against 60% of the latter, despite both tracks firstly targeting the dual system. Inequality in access among students stretches out to the quality of apprenticeship when accepted in the program. Students exiting the *Hauptschule* are more often accepted in 2-year long contracts in the craft industry. Those with a diploma from the *Realschule* or the *Gymnasium* are more likely to find a 3-year or 3.5-year long contract in large industrial firms (Granato and Kroll, 2013). Importantly enough, the dual system is not a dead-end in terms of education since it is a gateway towards higher education. On-the-job training also provides good opportunities for postapprentices, especially through the Maister qualification which is needed to train apprentices (see Appendix 1). As a result, according to Möbus and Sevestre (1991, 88), “one should not view the dual system as a standardized training. The only common feature of all apprenticeships is the diploma and the national educational outlines”.

There is an even stronger hierarchy among apprentices in France since most diplomas can be reached through both an apprenticeship and a full-time track. In particular, the *baccalauréat* divides two rather different populations among apprentices. Apprentices from secondary education are more often members of disadvantaged social classes and are more likely to have faced difficulties at school than the rest of their cohort. Conversely, apprentices in higher education are close to higher education full-time students in terms of both their family backgrounds and their school results (Moreau, 2008). The training firms also differ between the two groups: more craftwork for the secondary education apprentices, larger industrial firms for those in higher education (Fougère and Schwerdt, 2001). There is a “‘glass ceiling’ at the *baccalauréat* level” (Moreau, 2008, 126): only 28% of the apprentices in secondary education go on in the higher education; conversely, only 12% of the apprentices in higher education have followed an apprenticeship in secondary education (Moreau, 2003). Importantly enough, apprenticeship does not have the same function on either side of the *baccalauréat*. While it lasts for at least two years in secondary education, 35% of apprenticeships in higher education lasts less than a year, thereby being more of a “super internship” than anything else (Martinot, 2015: 21). Triggered with the ‘Séguin’ (1987) and ‘Cresson’ (1992) laws which enacted higher education apprenticeships, the heterogeneity of apprentices has been accelerating since then. The nearly whole increase in the number of apprentices since 1996 has happened in higher education which now accounts for 30% of the total (see Appendix 1).

1.2 The apprentices' advantage explained through firms' strategies

The smoother school-to-work transition of apprentices compared with students from full-time vocational education has been largely documented in the literature. As for France, Sollogoub and Ulrich (1999) and Simonnet and Ulrich (2000) use the several-step method from Barnow, Cain and Goldberger (1980) to clear the selection bias into apprenticeship. They show that among students leaving school at the end of secondary education, apprentices are advantaged in terms of rapidity of access to the first job and of employment duration during the first four years following the school exit. This latter effect decreases with the diploma level (Simonnet and Ulrich 2000; Arrighi and Brochier 2005). Using a bivariate probit, Issehnane (2011) also finds that apprentices are advantaged in terms of probability of employment one year after the school exit⁶. Regarding the post-studies earnings, the two groups receive an equivalent wage right after the school exit (Issehnane, 2011; Simonnet and Ulrich, 2000). Yet, the result is less clear-cut on the longer run. Sollogoub and Ulrich's study (1999) grants students leaving full-time secondary vocational training a small surplus 4 years after the school exit whereas Abriac et al. (2009) found an opposite result three years after the school exit (bivariate probit). As for higher education, Isshenane (2011) finds an advantage for apprentices in terms of wage but no significant difference in employment probability when correcting for the selection bias.

On the German side, most of the previous literature has shown that apprentices enjoy a stronger probability of employment after leaving education both on average (Franz et al., 2000; Winkelmann, 1996; Parey, 2012) and after taking into account the selection bias (Parey 2012). Interestingly the latter has a negative sign in Parey's study on Western German men. This suggests that those whose decision to enter apprenticeship is related to an increase in the vacancy rate of training spots (his instrument) have unobservable characteristics negatively valued on the labour market. Contrarily to these results, Riphahn and Zibrowius (2015) find no difference between the two groups. As for wages, apprentices are generally found to earn amounts similar to full time vocational students (Winkelmann, 1994; Witte and Kalleberg, 1995). Parey finds a positive effect on average but none in his IV analysis. Finally, unemployed full time students find a job quicker than apprentices in unemployment (Winkelmann, 1996) which suggests that apprentices' early advantage is much conditional on employment in the training firm. Importantly, most of these studies have worked on Western Germany before 2000. Only Riphahn and Zibrowius (2015) work on a more recent period on the whole youth population. They mostly use the margin vocational training v.s. non vocational education. Yet, interestingly, they only find minor differences in outcomes between women and men or West Germany and East Germany.

These studies draw an advantage for apprentices over full-time vocational education students. Yet, they do not provide a comparative look and are not sufficient to state which of the French or the German system provides the best relative outcome to the apprentices, although this is a prerequisite for any institutional transfer. Moreover, for the German side, an analysis on a more recent period is necessary due to the numerous changes the German labour market has experienced. Before quantitatively tackling the issue, I consider the theoretical rationales for the apprenticeship advantage.

⁶ These two methods are discussed in Section 4 and Appendix 4.

Apprentices' advantages over full time students firstly stem from an educational ground. The literature in education research has argued that apprenticeship increases the motivation of those less inclined towards academically oriented tracks by making concrete the theory learnt at school (Unwin and Wellington, 1995; Lerman and Pouncy, 1990). Being surrounded by expert workers would also extract one from the peer pressure opposing hard work which can occur in some deprived neighbourhoods (Lerman and Pouncy, 1990). On the cognitive side, the combination of theoretical and applied learning may generate positive spillovers on each other (Parey, 2012). Through work experience, apprenticeship may finally provide a young person work-related skills such as self-discipline or team-work abilities, thereby easing the often sharp transition between full time studies and work (Brzinsky-Fay, 2007; Parey, 2012).

The relative position of apprentices also stems from the training firms' strategy. The literature generally retains two ideal-typical strategies for taking on an apprentice. The first one is cost-based and turned towards present benefits. In this case, the "training" firm ensures that the apprentice is contributing more to its output than she is costing through her wage, the training facilities and the non-productive time of the "maister"⁷. This "current production" strategy (Lindley, 1975) is mostly taking place when a firm substitutes the apprentice for regular workers to take advantage of the cheap labour costs of the former. West Germany for instance was plagued with this type of firms' behaviour before the 1969 vocational law (Taylor, 1981). The "current production" strategy can also be attractive in the case of a shortage of unskilled labour or against an unstable business cycle since apprentices constitute a flexible workforce with low firing costs (Wolter and Ryan, 2011). When "trained" with such a strategy, an apprentice is therefore expected to be in a worse position than the rest of her cohort as she is unlikely to receive a job offer by the training firm and a priori has little credentials to sell on the market.

The second strategy is to invest in human capital with future expected profits. In this future production strategy, the firm is looking for a new skilled employee and provides the apprentice an actual training likely to generate positive net training costs. An apprentice trained with such a strategy will therefore be likely to enjoy a good position on the labour market, due to both the high probability of being hired by the training firm and the skills she can value on the external market. One can state several reasons why an employer would invest in apprenticeship training rather than hiring an external jobseeker (and, in particular, one from a full time vocational school). First, such an investment is especially likely to happen when firms face (or expect) a shortage of the external supply of skilled labour (Fougère and Schwerdt, 2002) Second, apprenticeship provides employers with a good screening device: it is a cheap fixed-term contract with no firing costs at its end. It therefore allows hiring workers who have already proven themselves to the contrary of external jobseekers, thereby decreasing the costs rising from adverse selection. Third, employers' associations have a role to play on the design of both the school-based and the in-house parts of the apprenticeship curricula. On the one hand, this decreases the asymmetry of information over the trainees' abilities and, on the other hand, it is likely to better shape the curriculum towards the actual production needs in comparison with the curricula in full time education. This latter point is reinforced by the fact that firms are more likely to share private information such as their skills requirements to business associations than to the public actors in charge of designing courses for full-time vocational education (Culpepper, 2003; Wolter

⁷ N.B. such profits during the training period are impossible in a competitive set up with "free entry at the start of [the] period" (Leuven, 2005:89) since firms enter the market until the surplus drops to zero (Ryan and Wolter, 2011:537). The actual happening of negative net training costs highlights the existence of monopsony power, see Appendix A.2.

and Ryan, 2011). Four, even though regulatory rules on apprenticeship limit employers' discretionary power regarding the on-site training, there is still some room to partially adapt it to the firm-specific tasks the future employee will be required to lead (Barone and van de Werfhorst 2011)⁸. Last, apprenticeship can create some asymmetry of information between firms thereby generating incentives to train – especially in a context of wage compression – (see Appendix A.2).

It therefore seems that one should compare the relative importance of each of the two strategies in France and Germany to postulate in which of the two countries apprentices enjoy the best situation relatively to full-time students. This boils down to studying the sign of the net training costs in each country: the literature generally considers that the larger they are, the more likely a firm would be to provide a good training. I show here why this reasoning could be misleading and is anyway difficult to apply here. Net training costs are roughly equal to the cost of training facilities + the maister's training time + the apprentice's wage – the apprentice's output – the public subsidies received. The two former cannot be used here as they are not evaluated in France (Martinot 2015, 71). Regarding the wage, it seems that no comparative hypothesis can be sketched due to the large and overcrossing range of apprentice's earnings in the two countries. Apprentices' wage depends on the school year and the age in both countries. In France, it varies between 25% and 78% of the national minimum wage (i.e. between 366€ and 1,144€) or of the sectoral minimum wage if higher. In Germany, apprentices do not benefit from the national minimum wage. Their wage is sectoral and varies between lander, thereby resulting in an even larger spread (for instance, 214€ for a hair-dresser to be in Eastern Germany, 1,374€ for an apprentice working with reinforced concrete in Western Germany). The difference in apprentice's output does not provide better room for any hypothesis. Fougère and Schwerdt (2002) indeed show that the net effect of apprentices on the expected output for training firms is similar in both countries: positive in medium firms (between 20 and 200 employees) and negative in the others. Finally, public subsidies are much higher in France than in Germany. Martinot (2015, 71) quantify them to 5,644€ per apprentice in the former and 455 € in the latter. Accordingly, the costs for the training facilities and the maister's time aside, net training costs seems to be lower in France due to more generous public subsidies.

One would therefore expect current production strategies to be more widespread in France. Yet, Fougère and Schwerdt (2002, 13) show that firms train apprentices in relation to their need in skilled workers in both countries – and, in medium firms, despite the involvement of apprentices in the production (Fougère and Schwerdt 2002, 14-16). They also fail to evidence a strategy of substitution between apprentices and unskilled workers in France or in Germany. A more recent literature has led more precise case studies and showed that some sectors do have a strategy of substitution in Germany (see for instance Mohrenweiser and Zwick, 2009; Dionisius et al., 2009)⁹. Yet, I could not find such results for the French case and am therefore limited to using the older comparative study from Fougère and Schwerdt.

⁸ Importantly enough, in his 1994 article on the German apprenticeship, Soskice leads a back of the envelop calculation suggesting that the on-the-job training costs necessary to adapt an externally hired worker to the tasks ascribed to her is “of the same order of magnitude as the net costs of an apprenticeship” (Soskice, 1994:37). This calculation questions the two latter arguments on the demand-side based advantages of apprentices.

⁹ Mohrenweiser and Zwick (2009) work on contemporary gross profits and find that “in trade, commercial, craft and construction occupations [...] apprentices are substitutes for unskilled or semi-skilled workers [...] the apprenticeship training rather is a human capital investment [in manufacturing industries]”. Dionisius and coauthors (2009:Table 2)

Two conclusions should therefore be drawn here. First, it has not been proved that French firms follow a current production strategy more often than their German counterparts, despite (a priori) cheaper training costs¹⁰. Second, it seems necessary to mitigate the reality of the two ideal-typical strategies. Fougère and Schwerdt's result suggests that a current production strategy is not necessarily antagonist to a proper training since medium companies do have a wish to retain post-apprentices despite their use in current production. Similarly, a comparative study on Germany and Switzerland (Dionisius et al., 2009) urges to discuss the relevance of the two ideal-typical strategies. The authors show that despite average negative net training costs (i.e. positive profits), 3-year long apprenticeship in Switzerland provides at least as good a training as in Germany where net costs are positive for 93% of the firms. The most important reason behind this is that unions and works councils constrain firms not to use apprentices for productive tasks in Germany. Thus, during on-site training, German apprentices do more practice and benefit from more instruction time thereby learning less through productive tasks (Dionisius et al., 2009; Ryan et al., 2013). Retention rates at the end of apprenticeship training are larger in Germany than in Switzerland since German firms need to ensure profits to cover their initial investment. Yet non-retained apprentices are likely to find a job quicker in Switzerland if we only consider the productivity ability. Hence, a seemingly current production strategy can lead to decent outcomes for apprentices on the labour market. In other words, a firm could substitute apprentices for workers while training them at the same time.

As a result, if one considers that the most important feature of youth unemployment relies in the very content of the training and the risk of mismatch with the demand, then approaching the question through training costs may not be the best way to deal with it. Conversely, if one considers that the major struggle for a first-time labour seeker is rooted in the difficulty to sell her credentials on the labour market for other reasons – for instance a firms' lack of trust in the educational system – then working on firms' training costs may be a good option since firms enduring net positive training costs will be willing to hire their ex-apprentices to ensure future sur-profits. In this regard, public subsidies could be harmful by their incentivizing effect for current production strategies.

1.3. Institutionalists' views on the French and German vocational training systems and the subsequent hypotheses stemming from these

I turn here to an institutional view of the role of apprenticeship training in France and Germany and show that the 'societal coherence' in each of the two countries provides interesting avenues of hypothesis. The previous part aimed at drawing hypothesis based on the expected strategies that similar rational driven agents would lead in the divergent environments of France and Germany. Typically, if training costs are lower, one would expect a stronger use of a current production strategy whichever the society; or other things equal, larger information asymmetries should lead to more training. The Aix-school of thoughts (see the seminal works of Maurice, Sellier, and Silvestre 1979, 1986) has criticized this method. In their words, "the universalism of these approaches assumes invariant across

found a net training cost 7,528 €per year (€of 2000) in Germany and state that 93% of German firms bear a positive net cost.

¹⁰ Note that in a first version of their paper, Fougère and Schwerdt (2001) had even found the reverse: "the small and medium firms [taken as a group], use apprenticeship to invest in human capital more often in France than in Germany" (Fougère and Schwerdt, 2001:691).

societies two elements of the basic model: the social nature of the actors [...] and the rationality directing these actors' actions. The strategies implemented and the constraints which constitute the environment solely vary" (Maurice, Sellier, and Silvestre, 1979: 333). Conversely, the authors regard social phenomena as coherently interacting and thereby explain differences in outcomes. As for vocational education, this leads Möbus and Verdier (2000, 272) to state: "the vocational diploma, as a result from social bargaining and as a basis of a labour market regulation, is of an extremely different nature on each side of the Rhine: fundamentally an organizing rule of the labour market in Germany (Reynaud, 1987), a mere signal to value on this market in France (Gamel, 2000)". The difference in outcomes would stem from this difference in nature.

According to Maurice, Sellier and Silvestre (1979) (MSS hereafter), one can draw two ideal-types for the conception of a firm's working system. Either it chooses its own criteria to define the work stations and it expects the workers to adapt to them ("the organisation dominates qualifications"), or it firstly takes into account the workers' qualification to delineate the job tasks according to them ("qualifications dominate the organisation"). The authors state that the first case is more likely to occur when professional training is relatively rare and not thorough. They regard France as close to it. In this ideal-type, jobseekers' adaptability is their most valued skill and is assumed to be best proxied by their level of diploma. Jobseekers are therefore ranked according to their highest level of diploma from the general education and, as a result, the jobs requiring only a short on-the-job training end up undervalued in comparison with managing or designing tasks. This reinforces the social appeal for long and general education against vocational training. Since firms do not recognize school diploma as qualifications leading to professional jobs but decide of their own organisation, skills are rather firm-specific and are slowly acquired within the company (Eyraud, Marsden, and Silvestre, 1990). MSS name these setups "Internal Labour Markets" (ILM) and see France as a good example.

The spine of the second ideal-type – to which MSS associate Western Germany – is vocational education and training. It is more likely to develop where "the generalisation of vocational education and its social legitimation urge the firm to define work organisation in function of the professional norms stemming from it, and that the company legitimizes in its turn" (Maurice, Sellier, and Silvestre, 1979: 347). Here, firms enjoy a strong traditional role in the design and organization of the VET. As a result (or as a "compensation" in MSS' words), they acknowledge the referential stemming from the educative system. MSS name this case an "Occupational Labour Market" (OLM). Importantly enough, as for the ILM, the several characteristics of the OLM are self-reinforcing.

This framework provides several conclusions. First, as an example of OLM, Germany displays a coherent linkage between the initial and further vocational education systems. Once acquired the diploma from apprenticeship or full time vocational education, a student hired in a company is later able to gain more qualifications specific to his branch of trade, transferable to the whole sector and necessary to reach a better position in her stream. This is in particular the case of the diploma of Maister which gives the right to supervise an apprentice. The German societal convention of professional training therefore generates cores of professional identity within in each branch (Silvestre 1990). Vocational training, and specifically apprenticeship, is therefore attractive. Such a professional identity per sector does not exist in France and VET is depreciated. In particular, French vocational diplomas are targeted towards the continuity of initial education tracks rather than aiming at a direct entrance on the labour market (Möbus and Verdier, 2000). Thus, exiting school after a

vocational diploma of the secondary education offers better outcomes on the German labour market than in France (Möbus and Sevestre, 1991, 77) (see Section 2).

Conclusions regarding the relative advantage of apprentices over full time students are less straight-forward. First, in Germany, the inherited role of firms in the design of apprenticeship training has gained a social legitimation through its founding role in the societal coherence of the industrial system (see for instance MSS 1979, 346 and Appendix A.3). Conversely, the inherited role of the French State over VET (see Appendix A.3) has gained some force through both the increasing integration of vocational training in the general educative system and the stronger autonomy of French firms to design and organise work stations. The positive outcomes ascribed to the firms' and business associations' role in the design of apprenticeship should therefore be larger in Germany. Second, on the first hand, the German OLM better values specific skills than general training and apprenticeship is the school track where qualifications delivered are the most specific (Brauns et al., 1997). Conversely to the French ILM, apprentices should therefore be preferred to full time vocational students on the external market. Yet, on the second hand, apprentices are part of the training firm's internal labour markets. As such, they gain knowledge of the specific organisation designed by the firm and the specific set of skills relevant to it. According to the previous discussion, this should be more valued in France. Everything else equal, it should offer a stronger relative advantage to the French apprentices¹¹. This latter hypothesis gains in power by considering the fact that French firms have more discretionary power on the contents of on-site training than their German counterparts.

The theories of the Aix School of Thoughts are mostly framed in terms of 'socialisation of the agents' and mostly pertain to a path dependency explanation. Outcomes are rooted in the fact that social actors act according to integrated norms on the industrial sphere and in function of the pre-existing recognition of professional training in their own society (this is particularly salient in MSS, 1979; see also MSS, 1982:313-314). Instead, the *Varieties of Capitalism* literature (Hall and Soskice, 2001) is framed in a framework of game theory. It reintroduces rational and investment-thinking actors¹² in the analysis. In their words, "workers face the problem of deciding how much to invest in what skills, [...] firms face the problem of securing a workforce with suitable skills" (*ibid*, 7). The determinant of an educative system relies in the "strategic interactions central to the behaviour of economic actors" (*ibid*, 5). Hall and Soskice root these in 5 interacting spheres: industrial relations institutions, vocational training and education, corporate governance, inter-firm relations and the internal structure of the firms.

In Germany, access to finance does not traditionally rely on balance-sheet criteria or current benefits. Instead, investors have access to private information through cross-shareholding (supplier and customer firms are often seating in the supervisory boards), joint-membership

¹¹ The retention rate of apprentices is lower in France than in Germany. After graduating from a CAP, BEP, Bac pro or BP, 42% of the French apprentices stay in their training firm. The figure is of 44% after graduating from a BTS, DUT, université, or grande école (author's calculation using the Céreq's representative sample of apprentices leaving school in 2004). In Germany, in 2000, more than 50% of those graduating from the dual system go on working for their training firm (respectively 60% and 46% in Western and Eastern Germany) (Berufsbildungsbericht, 2002 : 462). This difference does not go against the above-mentioned hypothesis since full-time vocational students also have better outcomes on the German Labour market than in France.

¹² They do refer to informal rules (Hall and Soskice, 2001:13) but this is secondary in their analysis.

in business associations and joint-research. Here, reputation expectedly plays an important role since exchanges in this sphere consist in a repeated game – notably channelled through business associations which thereby are able to monitor and sanction firms if they hide information. Hence the efficiency of business associations in understanding sectoral needs in skills – important for apprenticeship courses to be well designed (see above) – and their ability to pressurize members to take on apprentices. The long-run expectations of the financial system allows firm to offer their employees long-term contracts not likely to be broken in time of recession. Works councils also play a major role in this regard. As members of the supervisory boards, they have some power over lay-offs and working conditions. The resulting little flexibility over the workforce urges workers to invest in firm-specific skills and therefore to engage in an apprenticeship. Finally, business associations ensure that poaching happens as little as possible thanks to industrial-level wage bargaining.

These main lines of coordination in Germany explain the development of apprenticeship in the country in a different way than MSS. More importantly for our case, on the first hand apprenticeship is likely to be efficient since long-job tenure and the lemon-market resulting from the no poaching condition (see Appendix A.2) are incentives for firms to invest in training with a future production view. On the second hand, the German ‘Coordinated Market Economy’ largely relies on “employer associations [which] are encompassing organizations that provide many benefits to their members and to which most firms in a sector belong” (Hall and Soskice, 2001, 25–26). Yet, we know that business associations’ membership has strongly declined since the 1980s. According to Streeck (2010, Table 3.1), the membership density of the employers’ association of the metal industry (*Gesamtmetall*) declined from 54.6% in 1985 to 22.5% in 2003 (last year available, 25.5% in the West, 7.6% in the East). Moreover, the benefits provided by business associations should be taken into consideration when assessing the net training costs. Indeed, while rules on training may require a training firm to bear a positive net training cost, the loss it would endure if non-training meant leaving the sectoral business association could be higher, thereby urging a rational-counting firm to take on apprentices. In other words, some firms could train apprentices up to the requirements of a business association in order to keep on benefiting from the association’s membership. In that case, positive net training costs would be compatible with a current production strategy. Next, the sanctioning power of business association should be put into question. Firms voluntarily enter these associations and exclusion may lead to a rise in poaching undesired by business associations (Culpepper, 2001: 292). This is especially true in Eastern Germany where apprenticeship has developed from the 1990s onwards and in a context of decreasing business associations’ memberships: “[t]hese associations, concerned with the stagnation of membership numbers in eastern Germany, admit that they have no credible sanctioning mechanism against free-riding companies [on bargaining wage rates], and the companies know it” (*ibid*:293).

The case of Eastern Germany largely falls out of Hall and Soskice’s analysis. The strong development of the market in a state-organized economy with bankrupted large state-owned firms resulted in an increasing heterogeneity among Eastern German firms, thereby limiting their capacity to organize despite the historical footprint of apprenticeship (Piotti, 2011: 400). Western German firms have largely taken over these big firms and stretched out Western business associations ties to the Easter part (Culpepper, 2001). Yet, small and medium firms were largely left aside in this process and collective agreements have been covering respectively about 10 and 20 percentage points less Eastern employees and employers in comparison with their Western German counterparts (Marius R. Busemeyer and Thelen, 2015; Culpepper, 2001). The results established by the VoC literature therefore mostly stand

for Western Germany and one should be cautious regarding the Eastern part. The lesser level of coordination drives the hypothesis of a lesser efficiency of apprenticeship in this part of Germany.

France is an outlier in the VoC literature: it fits neither in the German like category of the Coordinated Market Economies nor in the Anglo-Saxon like one of the Liberal Market Economies. Instead, some have defined it as a Mixed-Market Economy (or State-Led Economy). The State has traditionally had a predominant role in organising the economy both directly through legislation and public-owned firms and indirectly through the elite civil servants taking position in major private firms (Thatcher, 2007: 155). The country indeed displays a “mode of coordination [...] [which] entails a system whereby the state, banks and large firms are intertwined through a complex elite network” (Hancké, 2001: 313): the organising role of both elected and unelected civil servants has not favoured the development of stakeholders’ organisations in the country (Hancké, 2001; Culpepper, 2001; Goyer, 2007). Thus, despite important cross-shareholding across large firms, business associations are weak. They lack “the capacities of information circulation and deliberation” (Culpepper, 2001: 298) and are generally seen as some State’s co-opted bodies (*ibid*). Moreover, there are little cooperative links between suppliers and large firms: until recently, the former “had traditionally been treated as simple executors from large firm orders” (Hancké, 2001: 319). As for VET, the lack of coordination between private actors increases poaching risks. It also limits the sector-specific skills to the profit of firm-specific ones. The State has tried to take over but with no private actors with whom to coordinate its action and from whom it would obtain necessary information such as sectoral needs in skills, it largely failed to foster apprenticeship (Culpepper, 2001). As for internal industrial relations, the coordinating role of the elite results in the concentration of power in the CEO and in top managers within firms. Conversely, employees have little power to block managerial decisions. In particular, “firm-level works councils possess limited information rights on the hiring of new staff – not a full veto power that could prevent employers from replacing current workers with new employees” (Goyer, 2007: 210). The lack of coordination at the firm-level therefore results in little incentive to invest in apprenticeships for students: they have less guarantees to keep their job in case of firm reorganization than their German counterparts and have less skills to sell on the external market since the low level of sectoral coordination leaves firms enough room to mostly provide firm-specific skills.

As a result, here again, two competitive forces seems to play. On the first hand, the skills provided in the school part should be less properly targeted at current industrial needs due to the lack of private actors’ coordination. Moreover, the lack of portability of the skills provided during the in-house training part should depreciate apprentices’ outcomes on the external market. Yet, on the second hand, the firm-specificity of these skills may be much valued by the training firm in its hiring process. The lack of coordination would result in a low number of apprenticeship contracts but good outcomes for the young people taken on.

2. DATA

2.1 The surveys

For the French case, I use the Céreq’s surveys “*Génération*”. They provide a representative sample of the students – including apprentices – leaving education for the first time for at least a year. Produced every three years since 1998, the surveys are labeled after the exit year (“*Génération 1998*” for instance). Each respondent is surveyed 3 years after her school exit

and again 2 years, 5 years and 7 years later for the 1998 and 2004 generations. I focus on the early school-work transition and therefore use the 3-year post-exit surveys of the 1998, 2001, 2004 and 2007 generations.

As for Germany, I use the German Socio-Economic Panel (SOEP). This is a general survey, representative of the German population at the household and the individual levels (Haisken-DeNew and Frick, 2005). I only use the answers from students leaving school between 1992 and 2013 as some of the key variables I use are absent or are differently worded before 1992 and because I need to know the outcomes of the post-exit years to carry my analysis (hence preventing the use of later waves).

2.2 The last observable school-to work transition and the construction of key variables

To have some comparative value, the French and German analyses should be carried out on similar underlying populations. Yet, it is not straight forward to identify the first school exit in the German panel due to the attrition and the age of entrance in the panel: the first school-to-work transition observed is not necessarily the first one. This is reinforced by the fact that school breaks are common in Germany. There is therefore a strong risk to mistake school resumptions for first exits. Importantly enough, one can show that the probability to be in employment the years following the first school exit significantly differ from subsequent ones. I therefore work on the last observable school-to-work transition in this paper for both countries¹³. The selection over the SOEP sample boils down to retaining a sample of 3,489 individuals. As for France, I use 99,861 observations spread between the five surveys (respectively 40,648, 11,320, 27,707 and 20,186 for the 1998, 2001, 2004 and 2007 cohorts).

I first study short run outcomes by focusing on the first 12 months following the school exit. I use three criteria of analysis: the number of months in unemployment among these first 12 post-exit months, the proportion of months spent in full time employment with respect to the total number of months spent in employment and the first wage declared. I then turn to the 3-year post-exit range to work on the medium run employment situation. Here, I first follow Lopez (2004) and study the probability to experience more than 18 months in employment (either full time or part time) with no break. Among those who experience such an employment spell, I study the number of months spent before the beginning of the period as well as the first wage declared after the 18th month of the period.

I have to mention three points here. First, Respondents to the SOEP only declare a yearly wage. I therefore use for the short-run analysis the wage stated the year of the school exit if available, and the one of the post-exit year if not¹⁴. Regarding the middle-run analysis, I use the first wage and contract type declared after the 18th month of the period. In both cases I control for the time between the school exit and the relevant interview. In the French case, short run wage levels are those of the longest work spell of the post-exit year and middle-run wages are those declared at the end of the first job ending after the 18th month of the period or in the last observed month if no job ending is observed. Here also, I control for the time spent since the school exit. The number of months in part-time employment and in

¹³ I do not take into consideration transitions from further education towards employment since these are occurring in the course of a job. Likewise, training delivered by the public employment service (Pôle emploi and the Bundesagentur für Arbeit) are not taken into consideration here.

¹⁴ Winkelmann (1996) states that the inaccuracy stemming from the fact that wages are declared once a year rather than monthly only marginally affects his results.

unemployment is based on calendar spelled variables for both countries. In the SOEP, each month, surveyed people have to choose between full-time employment, part-time employment, first-time company training/apprenticeship, further training, unemployment, retirement, parental leave, studies, military service, housework and other¹⁵. As for France, respondents can choose between: temporary work, self-employed, housework, employed, holidays, job search, inactivity, training, school resumption, military or civil service. When employed, respondents can then state if this is a full-time or a part-time job.

Second, I separately lead the estimations on secondary education exits and higher education exits in each country. I aim at comparing the outcomes of apprentices and full-time students at a given diploma level. For France, this is straight-forward since apprenticeship is available at mostly all levels. For Germany, the treated group in higher education is composed of students who followed a higher education track after completing an apprenticeship in the secondary education.

Third, the apprenticeship dummy is 0 if an apprentice fails her exams or breaks her contract before its end¹⁶. If it is harder to obtain an apprenticeship diploma in comparison with a full-time diploma in Germany than it is in France, I am likely to overestimate the German relative advantage of apprentices over full-time students; especially if this leads to some auto-selection anterior to the choice of a vocational track. Yet, I have no possibility to avoid this pitfall here if I want to obtain the differentiated value of vocational diplomas on the labour market.

3. DESCRIPTIVE STATISTICS

3.1 Unemployment and NEET rates

Figures 3 to 10 display the unemployment rate and the rate of youth neither in employment, nor in education and training (NEET). Both are the average ratio of unemployed or NEET months over the first (“t+1” hereafter), second (“t+2”) and third (“t+3”) years following the school exit. Graphs are separately drawn for students exiting secondary or higher education. In the German case, the mean over all cohorts is used due to the small size of the dataset. As for France, each cohort is separately displayed. Importantly, the unemployment cell in Germany is built on declarations of being registered as unemployed whereas in France, it is based on declarations of job-search. The inaccuracy in definition disappears with the analysis of NEET rates.

At first sight, it first appears that exiting higher education provides much better outcomes. Second, the overall difference in youth unemployment between the two countries is mostly driven by the 24 first post-exit months. If one calculates similar unemployment and NEET rates over the whole 36 first post-exit months, the group-to-group difference in unemployment and in the NEET rates are of less than 6.5ppt in either the “secondary” group or the “higher education” one¹⁷. Third, if one compares the average cohort outcomes for France and Germany over the period, it appears that the French apprentices and full-time

¹⁵ I also use partly use these variables to identify school exits. As Winkelmann (1996), I rely on the question “Did you end school, vocational training, or university education after December 31, [of the previous year]” to find the exit year. I then use the calendar to find the exit month.

¹⁶ According to Martinot (2015), 24.4% of the apprentices in the dual system break their contract against 28.1% in France. Yet, among these, 45.5% begin a new contract in Germany against 22.1% in France.

¹⁷ The average difference in the seasonally adjusted monthly unemployment rates between 1992 and 2013 is of 10.8 pp.

students exiting higher education do worse than their German counterparts in the three post-exit years to one exception: apprentices who left higher education have a similar NEET rates in t+3 as their German counterparts. As for secondary education, both French full-time students and ex-apprentices do similarly or better than their German counterparts in t+3 as for the NEET and the unemployment rates. French apprentices catch quicker their German counterparts since as soon as t+2, they exhibit an unemployment rate similar to these ones.

Interestingly, the rise in the third post-exit year NEET rate of apprentices who left secondary education in Germany does not fully explain the closing gap with their French counterparts. The latter is indeed mostly rooted in the strong rise in maternity leave (similarly to non-apprentices) which explains the pretty strong advantage French ex-apprentice women have on their German counterparts. Yet, the NEET rate for the German ex-apprentice males is very steady between t+2 and t+3 and French ex-apprentice males also do as well as the German ones in t+3.

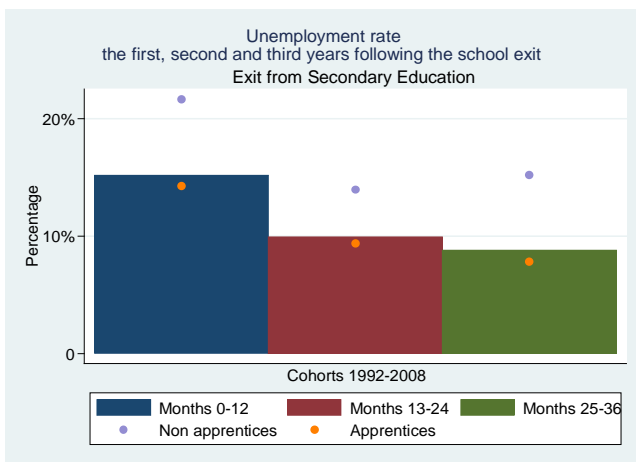


Figure 3. Unemployment rate on leaving the German secondary education

Source : German Socio-Economic, own calculations

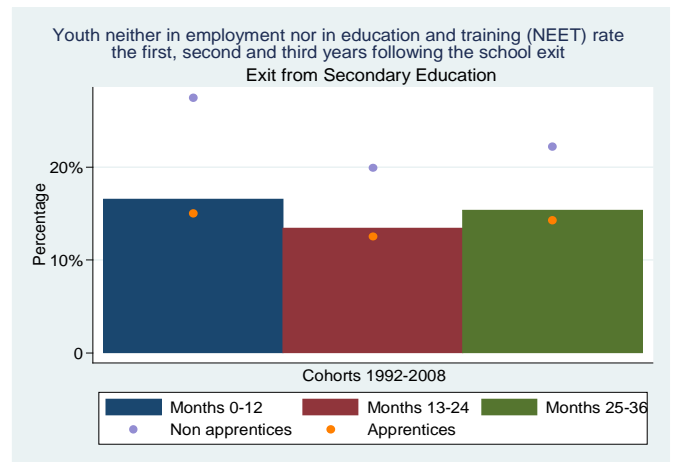


Figure 4. NEET rate on leaving the German secondary education

Source : German Socio-Economic, own calculations

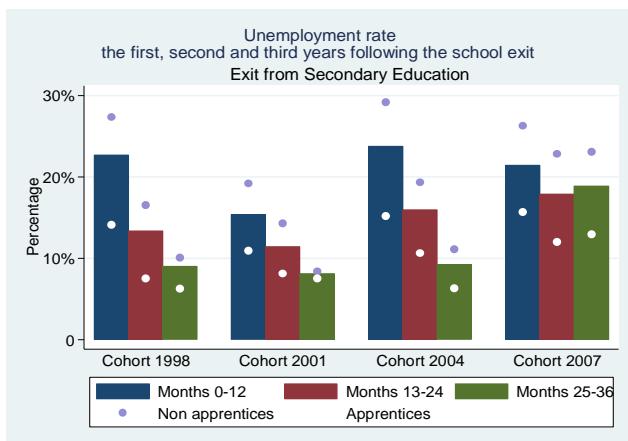


Figure 5. Unemployment rate on leaving the French secondary education

Source : Enquêtes Génération, own calculations

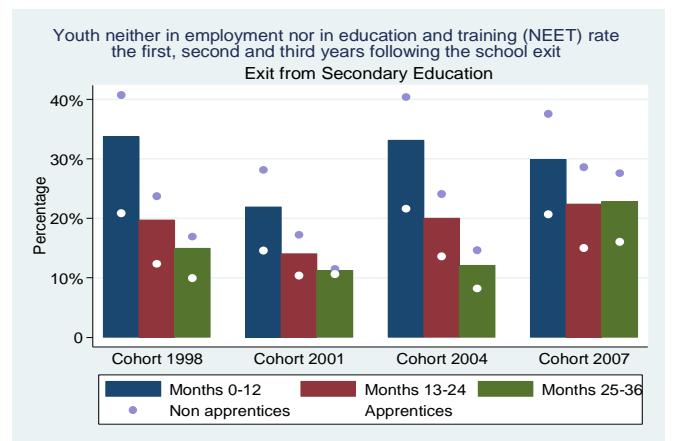


Figure 6. NEET rate on leaving the French secondary education

Source : Enquêtes Génération, own calculations

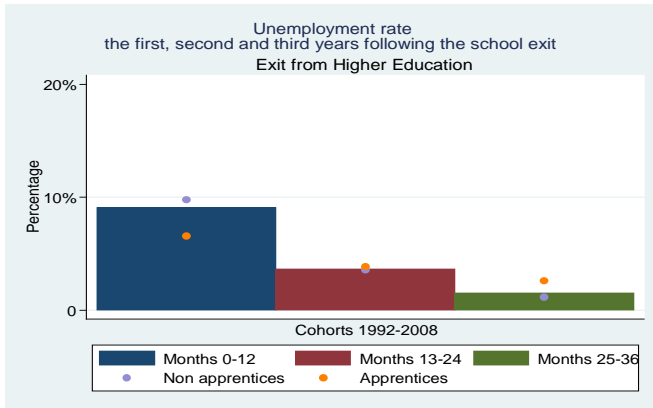


Figure 7. Unemployment rate on leaving the German higher education
Source : German Socio-Economic, own calculations

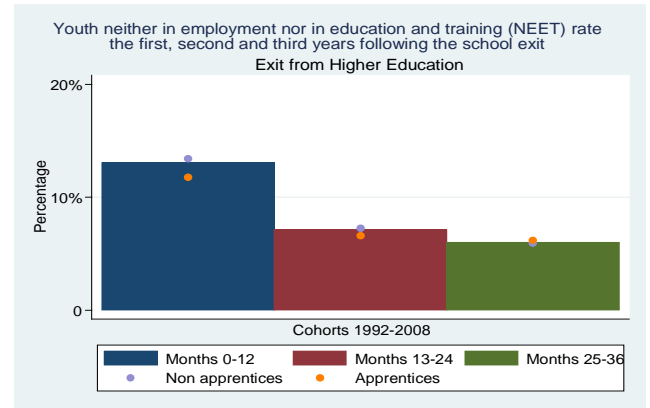


Figure 8. NEET rate on leaving the German higher education
Source : German Socio-Economic, own calculations

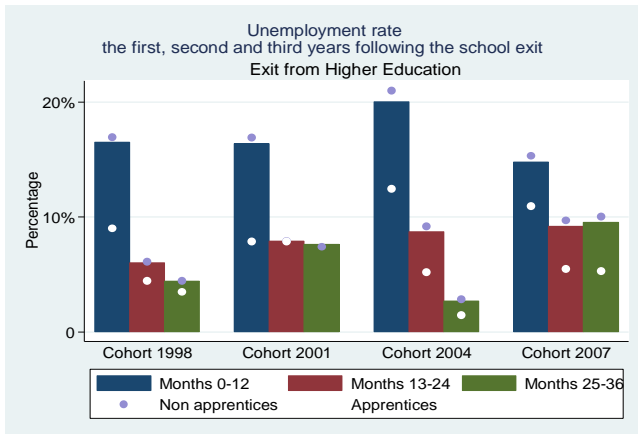


Figure 9. Unemployment rate on leaving the French higher education
Source : Enquêtes Génération, own calculations

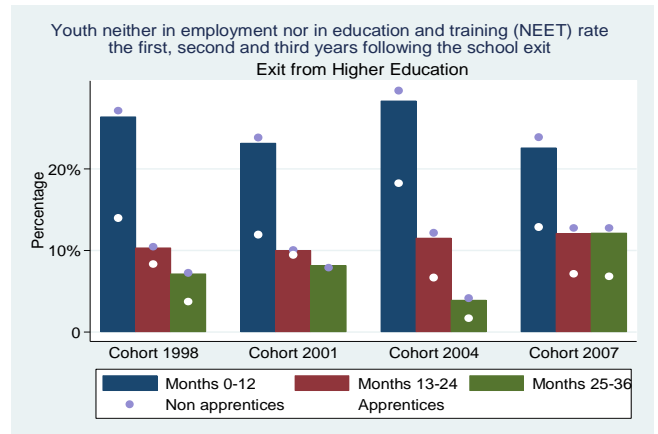


Figure 10. NEET rate on leaving the French higher education
Source : Enquêtes Génération, own calculations

As for the apprentices v.s. non-apprentices gap, it is – always but in two cases – larger in France than in Germany in each post-exit years for the two indexes and for either those exiting secondary or higher education when pooling the cohorts.

Finally, note that the 2007 cohort in France endures a revival in unemployment as an effect of the crisis. It also induces a weaker reduction between apprentices’ and non-apprentices’ outcomes. If they also suffer from the economic downturn, apprentices could resist better relatively to full-time students¹⁸.

3.2 Retention of apprentices per firm type

Table 2 in Appendix 4 displays the retention rates of apprentices per firm type per the Arrighi and Brochier (2005) typology. In France, the categorization is based on the field of the

¹⁸ The data for France does not offer more details on the content of inactivity when NEET.

apprenticeship track (the '*Nomenclature des spécialités de formation*') whereas for Germany, I use the NACE ('*Nomenclature Statistique des Activités économiques*') code of the training firms. I only use the Western German observations from the secondary education cell due to a lack of accuracy of the Eastern German data on this matter and some limitations in the dataset.

As now known in the literature, on average, Germany does better than France on this matter. The German outcomes are mostly driven by heavy industrial sectors but also by the fact that very few sectors exhibit a release rate lower than 50%. Strikingly, the retention rates in the French post-secondary education and post-higher education are close in average. This result suggests a more salient resort to current production strategies from French firms' part in comparison with their German counterparts. Noteworthy, the German rate tends to strongly increase with the exit year¹⁹. Table 3 in Appendix 4 stresses the fact that this matter of fact is mostly driven by a recent increase in large firms' retention of apprentices. This fact goes in line with Busemeyer's (2009) and Busemeyer and Thelen's (2011) description of the evolution of the German apprenticeship system. They describe a move from a collective training system where business organisations compel large firms to train over their need for the benefit of smaller companies to a segmentalist one where large firms either opt-out from these organisations or obtain lighter deals. In this segmentalist model, large firms would increasingly train for their own internal labour market and therefore provide apprentices an increasing part of firm-specific skills. This recent line of analysis urges to question whether the conclusions of the VoC literature on the level of coordination in Germany are still relevant after the recent institutional evolutions of the country. In particular, this is likely to negatively affect the "employability" of ex-apprentices on the external labour market.

4. THE MODEL

4.1 A risk of selection bias

It is likely that apprentices have some common unobserved features since entering an apprenticeship track may not be randomly decided given the usual control variables. The literature has largely mentioned such a risk (Ryan, 1998; Sollogoub and Ulrich, 1999; Simonnet and Ulrich, 2000; Issehnane, 2011; Alet and Bonnal, 2011; Parey, 2012). Three methods are generally used to deal with it. The first one jointly estimates the equation of interest and the probability of following an apprenticeship through maximum likelihood technics (Issehnane, 2011). It requires strong assumptions on the joint-distribution of the residuals from the two equations. Due to a high lack of accuracy of this method when those assumptions do not stand (Chiburis, Das, and Lokshin, 2012), I do not use it. The second technique relies on a several-step estimation based on the maximum likelihood technic of the Barnow, Cain, Goldberger paper (1980) (Simonnet and Ulrich, 2000). Yet, as shown in Appendix A.5, this method does not fit with discrete second-step dependent variables and requires manipulation of the data with a risk of error in any case. As a result, the usual IV procedure is preferred despite the fact that the first stage dependent variable – and some second stage ones – is discrete (Parey, 2012).

¹⁹ 2007-2013 is one example, the trend is valid for smaller and larger windows.

4.2 The instrument

As common in the literature, the instrument I use is the regional rate of apprenticeship which applies the year preceding the choice to enter an apprenticeship track or a full-time vocational one. For the French case, it accounts for the ratio of the number of apprentices in secondary (resp. higher) education relatively to the number of full time vocational students at the same level three years before the school exit. For Germany, the ratio I used is the one from secondary education tracks for both the analyses in the “secondary cell” and in the “higher education cell” since the dual system I study here takes place in secondary education. The ratio considered is the one applying at age 15 for those exiting school after secondary education and the one applying at age 16 for those exiting school after higher education²⁰.

In France, the 1983 law transferred the State prerogatives on apprenticeship training to the regions. The 1993 five-year law deepened the decentralization process. It transfers the whole jurisdiction on vocational training matters for the youth aged up to 26. The law also requires regions to decide of a regional plan on vocational training development for the youth. Alongside the transfer of prerogatives, State spending on the matter decreases. Regions are now responsible for about 23% of total spending on apprenticeship (two third of which are aimed at the ‘*Centre de Formation d’Apprentis*’). Reciprocally, this spending accounts for half of regions expenditures (Mainaud, 2007). Beginning in 1983, but mostly after 1993, local orientation of vocational training has therefore largely depended on each regional council’s ability and will to coordinate the numerous local stake holders in apprenticeship training as well as on their relationship with local businesses. One would therefore expect apprenticeship rates to explain individual decision to turn either to full time vocational training or to apprenticeship training. Regarding the exclusion restriction, these rates have no expected clear channel of effect on the outcome variables which therefore make them good instrument candidates.

As for Germany, the major role of the *lander* is well-known. In particular, local and regional authorities are in charge of the spending on the school part of the dual system. They also essentially develop the curricula for general education at vocation schools (Hippach-Schneider, Krause, and Woll, 2007). Moreover, firms can request assistance from their local employment office for the vacancies they could not manage to fill (Parey, 2012). Finally, on top of the *lander*’s prerogatives, the various Chambers are in charge of “advising companies, registering trainees, certifying trainers’ specialist aptitude, accepting examinations and conducting social dialogue at regional level” (Hippach-Schneider, Krause, and Woll, 2007). As such, it is both the role of the regional authorities and of the ‘competent bodies’ which are playing a role here.

To this instrument, some authors have added the crossed effect of apprenticeship rates with a proxy for the level in the first year of secondary education (Alet and Bonnal, 2011) or the size of the city in where one lived at 11 (Simonnet and Ulrich, 2000). Yet, these variables seem to have an effect on the second stage dependent variables. For these reasons, I stick to using the apprenticeship rates as a singular instrument.

²⁰ Students leave the *Hauptschule* (resp. *Realschule*, *Gymnasium*) at age 15-16 (resp. 16-17, 16-18).

5. RESULTS

The presentation of the results proceeds as follows. First, I work on short term outcomes which are built on the 12 first months following the school exit. I successively assess the effect of apprenticeship on the number of months in unemployment, the ratio of full-time employment over part time work and the first wage declared in this period. I then turn to medium-run outcomes built on the first 36 months following the school exit. As in Lopez (2004), I first consider the probability of experiencing a continuous period of employment (either part time or full time) of more than 18 months among these 36 months; next, I study the waiting time in months before this period begins; finally, I study the first wage declared after the 18th month of this working period. In a third step I break down each group by gender.

In each case, regressions are separately led on students exiting secondary education and higher education. As previously stated, the treated group in the German higher education includes those who turned to university after passing an apprenticeship exam. The control group gathers all other students successfully leaving full time higher education. As for regressions on leavers from the German secondary education, apprentices are those who exited school after passing their exams of the dual-system track. The control group includes the school-leavers from full-time *Berufsfachschule* and *Fachoberschule*. In France, the treated groups are composed of those who exited school after successfully taking apprenticeship exams. In the secondary education cell, these are either a *CAP*, *BEP*, *Bac Pro* or *Brevet professionnel*. The control group therefore includes the students who passed these exams after a full-time vocational track. As for higher education, I focus on students leaving either a BTS or a DUT track (pooled), university or an engineering or business '*grande école*' for both treated and control groups.

The naïve regressions are either OLS, probit or poisson ones, depending on the type of the dependent variable (respectively the ratio full-time *v.s.* part-time employment and the wages; the probability to experience a stable period of employment; count variables including the number of months in unemployment and before the beginning of the period of stability). For France, I pool the 4 cohorts (1998, 2001, 2004 and 2007) in the tables displayed in the text. As for Germany, the lack of data prevents the gender analysis for those exiting higher education. It also urges to take cautiously the results from the IV analysis.

5.1 First Stage

The instrument has a strong influence on the probability of following an apprenticeship (see Table in Appendix A.6) in the two French cells. A 1 percentage point increase in the apprenticeship ratio inflates the likelihood to follow an apprenticeship by 0.57 p.p. in secondary education and by 0.83 p.p. in higher education. Two main explanations could be given here. First, apprenticeship is a rare good in France and students can struggle finding a firm where to be trained. The more numerous apprenticeship matches are a given year thanks to the regional council's stand, the more numerous offers are likely to be the following year, first through the usual turnover of apprentices and second by a mimetic appeal for non-training firms. In this case, compliers are likely to be those at the end of the waiting queue who are considered as the least able by the firms. Second, it is possible that the more the region develops apprenticeship, the more willing good students will be to enter an

apprenticeship track. Here, relatively to the average apprentice, the compliers are more likely to be successful students who have *positively* chosen to enter an apprenticeship track. In this view, the regional action on apprenticeship increases its appeal and compliers would rather be at the top of the waiting queue. As stated by Bordigoni (1995), apprenticeship at the secondary education level in France is “reserved to the young people in situation of school failure”. Apprentices often declare choosing these tracks as a last-resort option because they are not confident in their chances to access full-time professional or general high-schools. As a result, it is unlikely that a localized regional stand for apprenticeship training is sufficient to attract the best students. It is therefore likely that the first explanation applies to this cell. Conversely, apprenticeship in higher education is known for being more attractive and selective (Issehnane, 2011; Sanchez, 2004; Kergoat, 2010). As such, the second line of explanation would apply to it.

As for Germany, the effect of the apprenticeship ratio is less straightforward. An 1 p.p. increase results in a 0.43 p.p. decrease in the likelihood to have gone through the dual system before exiting secondary education and in a 0.77 p.p. increase in the likelihood to have passed an apprenticeship diploma before exiting higher education. The most likely path of explanation here is one based on the competitive access to the dual system. Before developing it, I first assess the motive behind the strategy consisting in taking an apprenticeship before turning to higher education²¹. This is a two-step process which can be described in two different ways. The first one proceeds as follow: 1) the choice to take or not an apprenticeship track, 2) after the dual-system, the choice to go forward to higher education or to exit school. This view follows Herget (1997) and suggests that the strategy apprenticeship-higher education is not formalized at the time of exiting lower secondary education. Conversely, it implies that students ending up in higher education after an apprenticeship turned first to the dual system for similar reasons as those which drove the apprentices from the secondary cell towards an apprenticeship track²². Yet, the opposite sign of the coefficient in the secondary and higher cells questions this reasoning. Therefore, the following two-step process seems to better fit the results displayed here: 1) a student aims at entering higher education or not 2) she decides to enter the dual system (before higher education if (1) leads to it). This view follows Lewin et al (1996). It implies that students from the higher education cell who have taken the apprenticeship track beforehand are not the least able or/and the most risk-adverse ones in their cell as the first view suggested it, but, instead, are individuals active in their choice of study options. They expect a lack of practical training in higher education and are willing to compensate it (*ibid*). While the first view insists on the dividing line between apprentices and non-apprentices and describes the former as rather homogenous, the second view insists on the divide between the higher and the secondary cells and highlights the heterogeneity among apprentices. With this second view in mind, the signs of the coefficient are more straightforward to explain. When the region develops apprenticeship training, a larger number of offers are available on the market. As a result, the students who are aiming at entering higher education but consider going through the apprenticeship track are more likely to find offers of interest and therefore to enter the dual system. Those students are not struggling to access the dual system. On the contrary, they are rather at the top of the queue to find a training firm. This process results in a lower number of offers available for those at the end of the queue, namely the compliers of the

²¹ Once again, the ex-apprentices in the higher education cell have passed a diploma from the dual system.

²² Relatively low school results and risk aversion according to Büchel and Helbreger (1995).

secondary cell. For them, the more the region develops apprenticeship training, the more attractive it is for the rest of their cohort and the least chances they have to access it. In this regard, the compliers of the secondary cell would therefore be the least able students from the firms' point of view.

Regarding the observable characteristics, men have a stronger likelihood to enter apprenticeship with the exception of the German higher education cell. Moreover, despite the bad reputation generally ascribed to apprenticeship in French secondary education, students who repeated class(es) (proxied here by the fact of being older in 6^e than normally expected) are less likely to enter an apprenticeship class. Table 4 in Appendix A.6 also highlights the role played by the parental origin. Having a father of a French nationality or born on the national soil increases the probability of following an apprenticeship in France. The equivalent does not apply in Germany. As for socio-professional groups, the workers are the most likely to have their children follow an apprenticeship in Germany whereas farmers, craftsmen, shopkeepers and business owners have so more often in France.

5.2 Short-run effects of apprenticeship on employment and wages

Results on the first 12 months following the school exit are displayed in Tables 5, 6 and 7 (marginal effects are given). In both level groups in France and Germany, ex-apprentices experience better outcomes than full-time students regarding the unemployment rate. Interestingly, on average, French apprentices enjoy a better relative situation. The difference-in-difference of non-unemployment gains between French and German apprentices with their respective control groups reaches 6 (resp. 6.5) percentage points after secondary (resp. higher) education in favour of French apprentices. In the two countries, the apprentices' advantage could stem from two channels. The first one relates to the likelihood of being hired by the training firm, the second one is the relative position on the external labour market. It can be shown that, in France, the average advantage of apprentices in terms of unemployment stays positive when comparing apprentices non-hired by their training firm with the control group. In other words, on average in each level group, French apprentices are preferred to full-time students on the external labour market²³.

This is not true in Germany. There, the apprentices' advantage stems firstly from the likelihood to be hired by the training firm. In other words, and relying on the previous descriptive statistics, French apprentices stay less often in their training firms but, once unemployed, find a job more easily than their German counterparts relatively to their respective control group. This could suggest that the content of training is less firm-specific in France than in Germany. The recent evolution of the German collective organizations would back this point. Against the VoC literature which states that a high level of coordination in Germany ensures that apprenticeship training involves sector- rather than firm-specific skills, Busemeyer (2009) and Busemeyer and Thelen (2011) describe German firms as increasingly training for their internal labour market and as such as providing more and more firm-specific skills. According to Dustmann and Schönberg (2007, 6), only 5% of the skills provided in apprenticeship training are firm-specific. Yet, they base their analysis on apprenticeship contracts taking place between 1980 and 1992. The extent to which this matter of facts has evolved is not clear and more research is needed on the topic. Note that the above mentioned result could also suggest that employers' preferences for specific skills

²³ The result – available on demand – is a lower bound since apprentices hired by their training firms are likely to be the most employable ones.

– here understood as sector-specific since we consider the external labour market rather than the training firm’s internal one – in Germany have evolved towards more general skills since MSS’ work.

As for the average treatment effect (ATE hereafter) effect on wages, it is positive in both French cells whereas it is negative after secondary education and null after higher education in Germany. The negative correlation after the German secondary education applies to both the apprentices hired by their training firm and those who look for a job on the external market. It must be discussed here, especially as it goes against the previous literature (Winkelmann, 1996; Büchel and Helberger, 1995; Riphahn and Zibrowius, 2015; Parey, 2012). Note first that this literature mostly focuses on Western Germany before the 2000s. More generally, two different lines of explanation can be provided. First, the German labour market is filled with a very large stock of apprenticeship graduates. Apprentices exiting school after secondary education therefore have a larger number of competitors on the labour market than full-time students do. As such, while they benefit from a larger probability to find a job thanks to the opportunity of being hired in their former training firm, the relative stronger competition they experience on the labour market could result in lower wages. The second line of explanation boils down to the fact that students exiting school right after their apprenticeship have often not benefited from a good training (see Section 1.1). As a result, their productivity is likely to be lower than the one of the control group, thereby resulting in lower wages. Note that the competition to find an apprenticeship position has been increasing which could be another reason explaining why the previous literature – which uses older data–mostly finds no effect.

Finally, regarding the probability to work full time *v.s.* part time, here again on average, apprentices experience an advantage over full-time students after secondary education in the two countries and after higher education in France only. For the former, the advantage is similar in the two countries when gender is given. Yet, women are relatively more likely to take a full-time track in Germany than in France, thereby biasing the overall difference to the advantage of Germany.

The local average treatment effect (LATE hereafter²⁴) in the French secondary education is larger than the ATE one in terms of the unemployment rate and of the type of contract. Yet, the positive ATE effect for the wage dies out when selection is addressed. As discussed above, compliers here seem to be students who struggled to find a training firm and would have been constrained to enter full-time training would there not be a regional policy able to have firms enroll in this type of training. With this in mind, the LATE results can be explained as follows. I focus first on the ATE and LATE on wages. The educational literature has evidenced that apprenticeship training is best suited for the least academically inclined students (Unwin and Wellington, 1995; Lerman and Pouncy, 1990). The compliers such as described above should therefore be among those gaining the most skills out of *a given* apprenticeship training relatively to full-time vocational training. As a result, their lesser advantage in terms of wage is likely to stem from heterogeneity in apprenticeship contracts²⁵. It is indeed likely that the compliers have access to a training of a lesser quality

²⁴ The LATE effect is the causal effect of apprenticeship training on compliers. The ATE effect does not address selection and therefore is only a correlation when observable characteristic are given.

²⁵ This LATE on wage contributes to the literature which is unclear on this point for school leavers from secondary education (negative effect in Sollogoub and Ulrich, 1999; no effect in Simonnet and Ulrich, 2000 and Isshenane, 2011 and positive effect in Abriac, 2009).

providing them a lower amount of skills than the rest of their cohort (see Section 1.1). An element backing this idea is the fact that, contrarily to the ATE on the unemployment outcome, the LATE fades away when considering only the apprentices who were not kept by their training firm²⁶. As a result, as exhibited by the non-significant LATE on wages, when employed, ex-apprentices seem to have a productivity level similar to the one they would exhibit would they have followed a full-time track. Therefore, for these students, the main advantage provided by apprenticeship training is the higher probability of avoiding unemployment thanks to the possible retention by the training firm²⁷. This result therefore emphasizes the very poor outcomes in terms of unemployment compliers would suffer had they followed a full-time vocational track. This reasoning finally highlights the fact that an increase in apprenticeship rate is welcome if it is not to the detriment of firms' retention rate. In this regard, the effect of subsidies in particular is not straight forward. They are likely to increase the apprenticeship rate but also to foster current production strategies, see Section 2.

As for the LATE in the secondary education cell in Germany, the ATE seems to fade away in the case of the full-time *v.s.* part-time ratio and of the wage when selection is taken into account – though discussion on these two outcomes should be cautiously taken considering the low F-test statistics. More conclusive is the LATE on the number of unemployed months among the 12 first post-exit months. Rather than the value of the point estimate which is very high due to large standard errors, its sign is more interesting to discuss. As stated in Section 5.1, compliers here are the students likely to be situated at the end of the waiting queue for apprenticeship contracts. As such, and since the German labour market is characterized with a large stock of ex-apprentices, it is straight-forward to understand that they are likely to experience difficulties to find a job after their apprenticeship. More specifically, this result highlights the fact that the compliers are likely to end up in a low quality apprenticeship where a relatively²⁸ low likelihood to be hired by the training firm makes the full-time track a better alternative for them.

As for higher education in the two countries, the LATE are all but in one exception non-significant²⁹. This result is in line with the literature on this issue for France (Issehnane, 2011; Sanchez, 2004) and highlights the selectivity at stake in apprenticeship tracks of higher education. The compliers are good students in the two countries (see Section 5.1) who would have managed as well through full-time training. The high level of subsidies used on apprenticeship training in the French higher education seems therefore hard to justify.

²⁶ Hence emphasizing the lack of strength of the French collective organizations willing to limit current production strategies.

²⁷ Importantly, this does not mean that retention rates are higher for the compliers than for non-compliers. On the contrary, the opposite is likely (see Section 1.1 and 1.2).

²⁸ Once again, the likelihood to be hired in the training firm must be considered in relation to the average retention rate as well as to the full-time students' outcomes

²⁹ This case is hard to explain and would need more research. It is a possibility that ex-apprentices favour more part time when having kids than full-time students. In any case, it seems hard to link with the type of jobs occupied.

Table 5. Marginal effect of apprenticeship training on unemployment

	Exit from Secondary Education								Exit from Higher Education					
	Germany	France	Ger. Males	Ger. Females	Fr. Males	Fr. Females	Ger. IV	Fr. IV	Germany	France	Fr. Males	Fr. Females	Fr. IV	Ger. IV
	Poisson	Poisson	Poisson	Poisson	Poisson	Poisson	IV	IV	Poisson	Poisson	Poisson	Poisson	IV	IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Apprenticeship	-0.66*** (0.11)	-1.39*** (0.03)	-1.25*** (0.19)	-0.52*** (0.13)	-1.11*** (0.03)	-1.87*** (0.07)	6.34* (3.86)	-2.340* (1.354)	-0.21** (0.10)	-0.98*** (0.04)	-0.99*** (0.05)	-0.90*** (0.06)	1.093 (2.790)	0.76 (1.93)
Personal characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm characteristics														
Cohort fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region fixed effect ⁽¹⁾	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,446	18,217	646	800	11,601	6,616	1,005	18,217	885	25,673	12,043	13,630	25,673	478
First stage F-statistic							9.592	184.6					17.92	11.63

Note: Standard errors in parentheses, clustered by region. *** p<0.01, ** p<0.05, * p<0.1

(1) 'Super-region' fixed effect for the IV regressions.

Source: German Socio-Economic Panel and *Enquêtes Génération*, own calculations.

Table 6. Marginal effect of apprenticeship training on the ratio full-time v.s. part time work over the first post-exit year

	Exit from Secondary Education								Exit from Higher Education					
	Germany	France	Ger. Males	Ger. Females	Fr. Males	Fr. Females	Ger. IV	Fr. IV	Germany	France	Fr. Males	Fr. Females	Fr. IV	Ger. IV
	OLS	OLS	OLS	OLS	OLS	OLS	IV	IV	OLS	OLS	OLS	OLS	IV	IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Apprenticeship	0.11*** (0.02)	0.06*** (0.01)	0.06** (0.03)	0.12*** (0.03)	0.04*** (0.01)	0.11*** (0.02)	-0.01 (0.22)	0.130* (0.0729)	0.01 (0.03)	0.08*** (0.01)	0.04*** (0.01)	0.13*** (0.01)	-0.137 (0.266)	-0.29* (0.17)
Personal characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm characteristics														
Cohort fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region fixed effect ⁽¹⁾	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,293	15,365	589	704	10,335	5,030	901	15,365	803	23,321	11,024	12,297	23,321	427
First stage F-statistic							7.868	148.4					17.21	14.26

Note: Standard errors in parentheses, clustered by region. *** p<0.01, ** p<0.05, * p<0.1

(1) 'Super-region' fixed effect for the IV regressions

Source: German Socio-Economic Panel and *Enquêtes Génération*, own calculations.

Table 7. Marginal effect of apprenticeship training on the first declared log-wage of a full-time job in the first post-exit year

	Exit from Secondary Education								Exit from Higher Education					
	Germany	France	Ger. Males	Ger. Females	Fr. Males	Fr. Females	Ger. IV	Fr. IV	Germany	France	Fr. Males	Fr. Females	Fr. IV	Ger. IV
	OLS	OLS	OLS	OLS	OLS	OLS	IV	IV	OLS	OLS	OLS	OLS	IV	IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Apprenticeship	-0.10** (0.04)	0.01*** (0.00)	-0.08 (0.08)	-0.09* (0.05)	0.01** (0.01)	0.02** (0.01)	0.78 (0.53)	-0.0221 (0.0549)	0.00 (0.05)	0.05*** (0.01)	0.05*** (0.01)	0.05*** (0.01)	0.152 (0.143)	0.23 (0.22)
Personal characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cohort fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region fixed effect ⁽¹⁾	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	621	12,617	297	324	9,373	3,244	442	12,617	423	19,645	9,847	9,798	19,645	233
First stage F-statistic							4.599	103.7					14.62	12.20

Note: Standard errors in parentheses, clustered by region. *** p<0.01, ** p<0.05, * p<0.1

(1) 'Super-region' fixed effect for the IV regressions.

Source: German Socio-Economic Panel and *Enquêtes Génération*, own calculations.

5.3 Medium-run effects of apprenticeship training on stability in employment and on medium-run wages

Table 8 provides information on the probability to experience a period of continuing employment longer than 18 months over the 36 first months after the school exit. Table 9 deals with the waiting time in months before such a period and Table 10 displays the effect of apprenticeship training on the first wage declared after the 18th month of this period.

Medium run effects of apprenticeship on stability in employment follow the same pattern as the short run ones previously described. Thus, on average, apprentices benefit from a stronger likelihood to experience a period of stable work. The effect is of 14 p.p. (resp. 8 p.p.) after exiting the French (resp. German) secondary education and it is of 9 p.p. (resp. 4 p.p. but not significant) when leaving higher education. The advantage of apprentices is also more important in France than in Germany with respect to the waiting time before experiencing such a period. The IV estimates confirm the existence in France of a negative selection bias for apprentices in secondary education and of a positive selection bias for apprentices in higher education. The German dataset does not provide enough power for an IV estimate in these cases.

As for wages, the average advantage benefitting to French apprentices similarly lasts more than a year and a half in both secondary and higher education. More precisely, it is still salient in the 36th month after school³⁰. Yet, as for the short-run wage, the IV estimates fail to ascribe these advantages to the very apprenticeship tracks in the case of the compliers. As for Germany, the disadvantage for apprentices exiting school after secondary education is similarly persistent.

5.4 Discussion of the gender bias

Finally, I discuss the previous outcomes with respect to gender. On a general rule, men do better than women in France with respect to all the outcomes considered. In Germany, results are a bit more mitigated but the pattern is similar. It is interesting to note that, both after secondary and higher education, the wage difference between men and women is similar in the two countries at the school-exit time but is much more important in Germany in the medium-run (tables not displayed here).

If one separately runs the naïve regressions on men and women, it appears that, in France, the correlation exhibited is stronger for women to the only exception of the time spent in unemployment after higher education. In Germany, the effect is less clear-cut for students leaving secondary education. The relative average advantage of men and women is stronger for the latter in terms of the ratio full-time *v.s.* part-time work and the likelihood to experience a stable period of employment, while it is to the advantage of the former in terms of short-run unemployment and of short- and medium-run wage levels. Developing apprenticeship tracks seems therefore to be a reasonable policy in favour of the quality of women's work-to-school transition. The main point of interest is the strong advantage of ex-apprentices with respect to the likelihood of full-time work in both countries and, more clearly for France than for Germany, the shortening effect of apprenticeship on unemployment spells.

³⁰ Result not displayed here, available on demand

Table 8. Probability to experience an employment spell of 18 months over the first 36 post-exit months

	Exit from Secondary Education							Exit from Higher Education				
	Germany	France	Ger. Males	Ger. Females	Fr. Males	Fr. Females	Fr. IV	Germany	France	Fr. Males	Fr. Females	Fr. IV
	Probit (1)	Probit (2)	Probit (3)	Probit (4)	Probit (5)	Probit (6)	IV (7)	Probit (8)	Probit (9)	Probit (10)	Probit (11)	IV (12)
Apprenticeship	0.08** (0.04)	0.14*** (0.01)	0.00 (0.07)	0.11** (0.05)	0.12*** (0.01)	0.18*** (0.01)	0.388*** (0.115)	0.04 (0.03)	0.09*** (0.01)	0.08*** (0.01)	0.11*** (0.02)	0.247 (0.382)
Personal characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm characteristics												
Cohort fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region fixed effect ⁽¹⁾	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	987	18,217	426	538	11,601	6,616	18,217	602	25,673	12,043	13,630	25,673
First stage F-statistic							184.6					17.92

Note: Standard errors in parentheses, clustered by region. *** p<0.01, ** p<0.05, * p<0.1

(1) 'Super-region' fixed effect for the IV regressions.

Source: German Socio-Economic Panel and *Enquêtes Génération*, own calculations.

Table 9. Waiting time before the beginning of the period described in Table 7

	Exit from Secondary Education							Exit from Higher Education				
	Germany	France	Ger. Males	Ger. Females	Fr. Males	Fr. Females	Fr. IV	Germany	France	Fr. Males	Fr. Females	Fr. IV
	Poisson (1)	Poisson (2)	Poisson (3)	Poisson (4)	Poisson (5)	Poisson (6)	IV (7)	Poisson (8)	Poisson (9)	Poisson (10)	Poisson (11)	IV (12)
Apprenticeship	-0.38** (0.20)	-1.54*** (0.04)	0.67* (0.37)	-0.41 (0.26)	-1.20*** (0.04)	-2.45*** (0.09)	-2.167** (0.917)	-0.31 (0.21)	-1.84*** (0.05)	-1.57*** (0.06)	-2.10*** (0.09)	6.422 (5.363)
Personal characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm characteristics												
Cohort fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region fixed effect ⁽¹⁾	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	727	12,935	322	405	9,001	3,934	12,935	559	19,995	9,712	10,283	19,995
First stage F-statistic							133.1					13.07

Note: Standard errors in parentheses, clustered by region. *** p<0.01, ** p<0.05, * p<0.1

(1) 'Super-region' fixed effect for the IV regressions.

Source: German Socio-Economic Panel and *Enquêtes Génération*, own calculations.

Table 10. Marginal effect of apprenticeship on the first log-wage declared for a full time job after the 18th of the period of stability

	Exit from Secondary Education						Exit from Higher Education					
	Germany	France	Ger. Males	Ger. Females	Fr. Males	Fr. Females	Fr. IV	Germany	France	Fr. Males	Fr. Females	Fr. IV
	OLS (1)	OLS (2)	OLS (3)	OLS (4)	OLS (5)	OLS (6)	IV (7)	OLS (8)	OLS (9)	OLS (10)	OLS (11)	IV (12)
Apprenticeship	-0.09*** (0.03)	0.02*** (0.01)	-0.09 (0.07)	-0.10*** (0.04)	0.02*** (0.01)	0.04*** (0.01)	-0.000631 (0.0654)	0.04 (0.04)	0.09*** (0.01)	0.08*** (0.01)	0.11*** (0.02)	0.247 (0.382)
Personal characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cohort fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region fixed effect (1)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	458	9,867	208	250	7,488	2,379	9,867	361	25,673	12,043	13,630	25,673
First stage F-statistic							82.73					17.92

Note: Standard errors in parentheses, clustered by region. *** p<0.01, ** p<0.05, * p<0.1

(1) 'Super-region' fixed effect for the IV regressions.

Source: German Socio-Economic Panel and *Enquêtes Génération*, own calculations.

CONCLUSION

In this paper, I compare the effect of apprenticeship training in France and Germany on the short-run and medium-run. I separately lead the estimations on students exiting school after secondary education and higher education in each country. For France, this is straightforward since apprenticeship is available at mostly all levels. For Germany, the treated group in higher education is composed of students who followed a higher education track after completing an apprenticeship in the secondary education. The causal effect of apprenticeship training is studied in an IV setting where the instrument is the ratio of apprentices over full-time students in studies at the corresponding level the year before the individual choice is to be made.

The descriptive statistics show that the overall difference in youth unemployment between the two countries is mostly driven by the 24 first post-exit months. I then highlight that apprenticeship training is on average broadly associated with stronger positive outcomes in France than in Germany for students exiting both secondary and higher education. This is first the case of the short-run effect on employability. The relative advantage when exiting the French secondary education is equivalent to a differential of 11.6 percentage points while it is of 5.5 p.p. in Germany at the same level during the first post-exit year. After higher education, it drops to an equivalent of 8.2 p.p. in France against 1.7 p.p. in Germany. The apprentices' advantage persists on the medium run in France since apprenticeship is associated with a larger probability of experiencing a stable period of more than 18 months in both the secondary education cell and the higher education one during the first 36 post-exit months. To a lesser extent, this is true as well among the German students exiting school after secondary education. Conversely, in the German higher education cell, apprenticeship training is only associated with positive outcomes on the short-run. Note that, in the cells where it is significant, this medium-run effect comes with a shorter waiting time before the period of employment stability.

The channel explaining the relative advantage of ex-apprentices seems to differ between the two countries. I provide pieces of proof evidencing that the short-run advantage of German apprentices is mostly rooted in the high retention rate of the training firms, which suggests that German employers are not privileging apprentices when hiring on the external labour market. Conversely, the retention rate exhibited in France is low. Yet, on the external labour market, firms seem to privilege ex-apprentices (therefore trained elsewhere) to full-time students. These results put into question the relevance for the current period of the traditional institutionalist literature on the issue. First, Maurice, Sellier and Silvestre (1979) have described French employers as valuing more strongly general content in skill training than specific one to the contrary of German employers. This does not seem to hold here since full-time vocational training provides more general skills. Second, the literature of the Varieties of Capitalism (Hall and Soskice, 2001) has described Germany as a country where relations of coordination between private actors should ensure that apprentices are taught skills relevant for their sector, thereby implying an advantage on the external market. The results described here similarly mitigate this point. Relying on Bussemeyer (2009) and Bussemeyer and Thelen (2011), I consider the recent evolution of the German model of skill formation as a candidate for explaining this fact. These authors describe a move from a collective training system where business organisations compel large firms to train over their need to the benefit of smaller companies to a segmentalist one where large firms either opt-out from these

organisations or bargain lighter deals. In this segmentalist model, large firms would increasingly train for their own internal labour market and therefore provide apprentices an increasing part of firm-specific skills. The descriptive statistics I provide on the retention rates seem to back this point.

I then show that apprenticeship training is associated with a stronger likelihood to work full-time rather than part-time at all levels in France and after secondary education in Germany. The effect is close in the two countries in the secondary education cell when gender is given. Finally, regarding wages, while French apprentices earn more than full-time students after school both on the short and medium run when observable characteristics are given, there is no significant correlation in the higher education cell in Germany and apprenticeship is associated with a lower income in the secondary cell. This latter result has to be taken cautiously since it goes against most of the literature on the issue – which yet uses older-dated datasets. It could evidence a declining position of the apprentices exiting school after secondary education in the competition on the labour market. In particular, the rising number of apprentices exiting school after higher education could be an element of explanation.

The analysis of the LATE brings three main types of results. First, the instrument I use is the ratio of apprentices over full-time students prevailing at the time of the choice to enter or not an apprenticeship track. I provide some elements suggesting that the compliers in the secondary cell of both France and Germany are rather low school achievers who are at the bottom of the waiting line in the applications for apprenticeship training and would struggle to find a firm would there not be a regional stand in favour of apprenticeship training. In the higher education cells, compliers would rather be good students whose choice to enter an apprenticeship track depends on the availability of good apprenticeship positions. Second is the causal effect in terms of employability. In the French secondary education, the causal local average treatment effect (LATE) is stronger than the average treatment effect (ATE). The former is mostly driven by the retention rate of the compliers: contrarily to the ATE, the LATE effect fades out when restricting the treated group to those who have not been hired in their training firm. Yet, it is first known that the compliers such as described above are not benefiting from high retention rates in France. Second, the null LATE on wages implies that the training compliers receive is of a very poor quality, especially since the education literature suggests they should be among those benefitting the most from practical training. Therefore, more than anything else, this result highlights the very poor outcomes of these students first when they are not hired by their training firm and second when they do not follow a full-time vocational track. As for the German secondary education, the IV study shows a significant causal effect of apprenticeship training only on the number of months spent unemployed in the first post-year exit. Interestingly, and contrary to the previous literature (Parey, 2012), it is positive. Note however that I use more recent data, include Eastern Germany in the study, and work on a slightly different instrumental channel. Given the previous discussion, compliers are likely to benefit from a training of a lesser quality than the average (see Section 1.1). This especially matters when the apprentice is not retained by the training firm. Non-retained compliers are entering an external labour market filled with ex-apprentices where their credentials stands out not thanks to the nature of their diploma – as it would be the case in France – but rather because of the low quality apprenticeship they followed. Moreover, contrarily to the French case, the positive LATE effect suggests as a mirror image pretty good outcomes of the compliers had they taken a full-time vocational course. Third, regressions highlight no effect of apprenticeship training in the French and German higher education cells with the exception of the ratio full-time *v.s.* part-time training

in Germany which seems difficult to account for. As a result, the average advantage experienced by apprentices in these cells for all outcomes in France and for the short-run employability in Germany at least partly stems from the high quality of the treated group.

These results provide some applications for public policies in the French context. First, the German case shows that, as apprenticeship training grows in importance in a country, there may be a limit in the benefits it can provide to the low school achievers. Second, in line with the discussion on the descriptive statistics, it seems that improving the quality of full-time vocational training in the French secondary education may be of an even importance as is the increase in the apprenticeship rate. Third, fostering apprenticeship training against full-time vocational training at the secondary education level seems to benefit compliers through an only one channel: the possible retention in the training firm. In terms of public policy, this suggests that an increase in apprenticeship rates obtained through a rise in subsidies is therefore not necessarily suited since they exert a positive incentive on using apprentices as cheap labour (see the “current production strategies” described in Section 1). Conditioning subsidies on both an average retention rate of apprentices per firm on a medium time span and on a better quality of training at this level would therefore be advisable. Note that the latter would necessitate a stronger monitoring of apprenticeship training either by the Trade and Craft Chambers as in the German model or by the State. Last, the absence of causal effect of apprenticeship training in higher education urges to inverse the trend initiated in the early 1990s which has seen a strong development of apprenticeship training at this level while it was decreasing in importance in secondary education. In particular, subsidies seem to be more efficient if targeted at the secondary level, once again conditional on the fact that the resulting increase in apprenticeship training is not taking place through contracts with no hiring expectation.

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APPENDIX

A.1 The French and German education systems

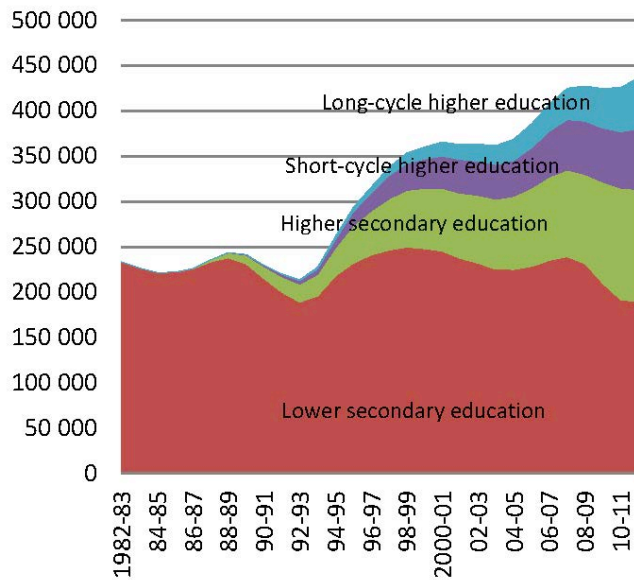


Figure 1. Numbers of apprentices in training per diploma and year in France

Source: Depp, enquêtes 51 and Sifa, as of December 31st, own calculations.

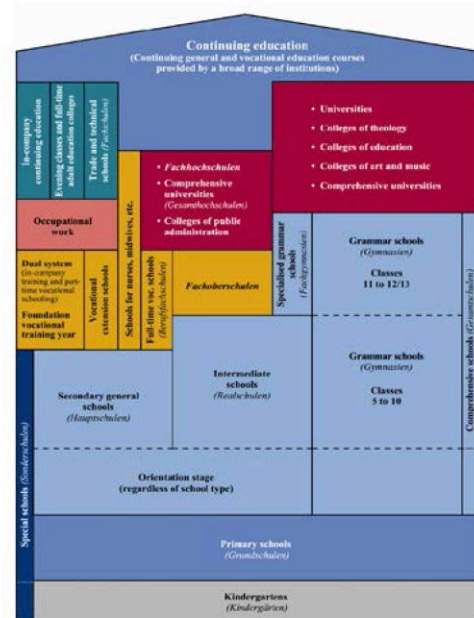


Figure 2. Education in Germany

Source: Cedefop (2008)

Table 1. Distribution of students leaving lower secondary education and of the whole population

	Population in 1990	Cohort graduating in 1990	Population in 2012	Cohort graduating in 2012
Hauptschule	61.6 %	24.6 %	35.6 %	18.1 %
Realschule and Oberschule	19.3 %	35.0 %	29.0 %	39.7 %
Hochschulreife and Fachhochschulreife	14.7 %	33.8 %	27.3 %	35.1 %
Drop out or other	4.4 %	2.6 %	8.1 %	7.1 %

Source: Winkelmann (1996) and Destatis, own calculations.

A.2 The hold-up puzzle

Despite the incentives previously stated, it is not straightforward why a firm would bear negative net training costs since, once trained, apprentices can be ‘poached’ by external firms (thus cancelling the future benefits expected by the training company). The literature has underlined several answers to this ‘hold-up’ puzzle. Becker (1962) forecasts that to avoid it, a

firm will only invest in (i.e. pay for) firm-specific human capital. The lack of portability of these skills indeed suppresses the poaching risk. In his theory students would be the ones paying for their training in general (i.e. portable and therefore ‘poachable’) skills. Yet, the literature has proven the theory to be insufficient (Ryan and Wolter, 2011). In Germany for instance, Dustmann and Schönberg (2007:6) show that firm-specific skills training account for only 5-percent of total apprenticeship training. The rest boils down to 35% of sector-specific skills, therefore leaving 60% of general skills. Becker’s model is framed in the framework of pure and perfect competition. But the ‘hold up’ situation strongly mitigates when rigidities apply.

Thus, the regulatory standards of training can only account for the minimum content of general training a firm has to provide. The rest of it is therefore left to its discretion and unknown from external firms which therefore have to bear an information-based cost to find the true productivity of an ex-apprentice (Katz and Tideman, 1990). This leaves a surplus that training firms can earn out of their investment in human capital. An asymmetry of information also occurs regarding the ability of post-apprentices. Assume a low-ability type and a high-ability type of apprentices. Assume external firms to be unable to fully observe the ability of a given apprentice – for instance if certification is not informative enough. In this case, for a given level of certification, the same wage will be offered to both types. By offering jobs only to high-ability apprentices and paying them a small bit above the market wage, the training firm manages to have them stay after their training period and ensures a benefit: the apprenticeship works here as a screening device. In the end, this theoretical case provides incentive to increase general training for apprentices. First, since general training is generally considered as a complement to ability (Acemoglu and Pischke, 1998), the training firm has the incentive to invest in it in order to increase the difference between the high ability type’s productivity and the market price. Second, in this setup, the market for post-apprentices free to be hired is fully composed of low-ability individuals, therefore leading external firms to train their own apprentices.

On top of the role of asymmetry of information, two major arguments can justify the training in portable skills. First, in a situation where external firms have a limited ability to ‘poach’ due to information asymmetry, the more compressed the market wages are, the higher the firms’ incentive to train is since the productivity/wage ratio increases with the skills and ability in this case (Stevens, 1994b; Acemoglu and Pishcke, 1999a). Second, given that sets of general and specific skills are not valued to the same extent by all firms, a company may invest in a set of general and specific training which is less valued by external competitors (Ryan and Wolter, 2011). In this case, the trainee is less likely to be poached than in the pure and perfect competition framework: the firms’ monopsony power explains part of the above-mentioned poor fit of Becker’s predictions with reality.

Regarding my empirical case, it is not clear which of the two countries has the higher level of rigidities. Wage compression is equivalent between the two countries in the lower half of the distribution but stronger in Germany in the upper part (Verdugo, 2014: Table 3). The level of asymmetry of information is likely to be higher in France due to the lesser importance of business Chambers there. They indeed enjoy a lesser institutionalized power and are less able to aggregate firms’ private information: whereas they are “considered trustworthy” in Germany, in France “businesses are suspicious of chambers for fear they are more creatures of the state than representatives of industry” (Soskice, 1994:42).

A.3 Historical explanation of the difference in the ratio apprenticeship/full time vocational training in France and Germany

In France, students can access vocational education mostly through full time tracks. Conversely, Germany favours apprenticeship. 4.7% of all German employees were apprentices in 2007 against 1.7% of French ones in 2008 (Steedman, 2010). Moreover, the State has a major role in managing the apprenticeship system in France whereas, in Germany, firms are known as the “natural and main operator of initial vocational education” (Lasserre, 2011:14).

These discrepancies stem from the unequal fate of collective organisations in the 18th and 19th centuries. In France, the Allarde decree and the Le Chapelier law abolished corporations in 1791 and outlawed any training for the youth if collectively set up. Rooted in a liberal political philosophy, this legislation clamps down on the main producers of norms in VET matters (Lemerrier, 2007). It leads to the growth of on-the-job training with no regulation, diploma nor contract (Lequin, 1989; Troger, 1993). Conversely, in Germany, the mid-19th century laws hostile to corporations had little effect and are short-lasting. In a context where the working class' social democratic claims grow and where the elite's liberal ideology stay strong, the Conservatives and Centre parties see in the independent craft sector a political ally in favour of the establishment (Thelen, 2004). As a result, craft chambers are institutionalized: handcraft firms are required to register to them in 1897 and they are granted a monopoly for apprenticeship training in 1908 (*ibid*).

Facing a common need in skilled workers generated by the industrial revolutions but a different institutional context, strategic firms (engineering industries in particular) therefore exert a differentiated lobby pressure on their respective State from the early 20th century to the 1960s. In France, in the absence of branch agreement, skills learnt in factory schools are barely transferable and are of a disparate quality. Moreover, investment costs that firms endure for these schools are not always bringing the expected returns since numerous smaller firms not engaged in training are able to offer higher wages thereby ‘poaching’ the postapprentices (Rojot, 2014). Despite its liberal aspirations, the ‘*Association Française pour le Développement de l'Enseignement Technique*’ (AFDET) – which was set up in 1902 and is mostly funded by the metal industry – therefore calls for a stronger State intervention to ensure a diploma standardization and to limit ‘poaching’ behaviors. The lobbying pressure is successful since the national CAP diploma, the requirement to train apprentices out of the workplace and the ‘apprenticeship tax’ are set up in the inter-war period (Brucy and Troger, 2000; Dayan, 2013).

In Germany at the same time, the main difficulty experienced by modern firms is to attract the brightest students in their in-house schools (Thelen, 2004). The main incentive of students and their parents to follow a training course is the insurance of diploma sanctioning their success at the end of the track (Webb and Webb, 1897). Yet, as said above, firms from craft chambers then have a monopoly to offer such apprenticeship diplomas. As a result, the lobbying group DATSCH – set up in 1908 by the *Verein Deutscher Ingenieure* (VDI) and the *Verband Deutscher Maschinen und Anlagenbau* (VDMA) – pressures the State to recognize the right of business and trade chambers to collectively organize and sanction apprenticeship training (Thelen, 2004). The claim will turn into law in 1935. The 1969 law on apprenticeship only changed at the margin the pre-existing system by incorporating unions in the co-management of apprenticeship. As a result the choice of imperial Germany to grant craft chambers a monopoly in apprenticeship training conditioned the agents' strategic

behavior and initiated the path which led the country to a strong level of subsidiarity in VET matters.

In France, triggered by a low level of business collective organization in the early 20th century, State intervention in vocational training increased after WWII. Against the French Communist Party, the anti-communists unions F.O. and F.E.N turn to be natural allies to the Socialists who are at the head of the *Direction Générale de l'Enseignement Technique* (DGET) between 1948 and 1951 (Troger, 1989, 1993). These unions are opposing the working-class ethos of the PCF. They therefore urge the DGET to privilege full time vocational tracks to apprenticeship training in the *Centres d'Apprentissage* (CAs) (*ibid*). This process results in the integration of the *collèges d'enseignement technique* (CETs – new name of the CAs) under the management of the lycées and colleges in the early 1960s. Large industrial firms do not oppose the rapprochement between apprenticeship training and full time public vocational training (Charlot and Figeat, 1985). Net training costs are indeed growing due to the costs resulting from technological innovation and the low returns on investments stemming from 'poaching' behaviors that a persisting low level of collective organization cannot prevent (Niell, 1954). Moreover, factory schools are increasingly struggling to attract good students and prove not to be as flexible as expected relatively to public schools (Hatzfeld, 1996; Quenson, 1996; Gallet, 1996). The major role of the State in vocational training and the predominance of full time vocational training over apprenticeship training are therefore rooted in that period in France with the tacit agreement of strategic firms who have been facing a lack of employers' collective organization since the 1791 anti-corporatist laws.

A.4 Retention of apprentices by the training firms

Table 2. Retention of apprentices per sector

	Western Germany Sec.		France Sec.			France Sup			
	Mean	2007-2013	Mean	1998	2001	2004	Mean	1998	2004
Agriculture, Environment	48%	68%	39%	32%	42%	43%	47%	21%	57%
Building, Civil engineering, Working of wood, glass or other building materials	47%	44%	48%	39%	52%	50%	42%	23%	63%
Metalworking	55%	55%	45%	38%	49%	47%	32%	52%	20%
Motor vehicle mechanics	58%	62%	31%	25%	32%	35%	46%		47%
Food industry, Cooking	70%	65%	27%	25%	27%	29%	46%	77%	43%
Other type of mechanics, Electricity	55%	81%	43%	36%	46%	45%	40%	41%	40%
Chemical, nuclear, rubber or plastic industrial technologies	64%	54%	42%	47%	31%	61%	37%	27%	42%
Business	39%	27%	28%	26%	21%	37%	43%	65%	36%
Transport, Logistics	80%	80%	53%	55%	52%	51%	61%	70%	57%
Management, Finance or Real estate	61%	83%	20%	15%	15%	44%	40%	49%	37%
Hair Care and Aesthetic services			34%	22%	37%	39%		34%	
Health, Social Work	42%	57%	47%	44%	48%	48%	58%	23%	67%
Hotel Sector, Tourism or Leisure activities	46%	45%	36%	26%	37%	46%	52%	52%	53%
Information and communication	63%	70%	39%	33%	38%	64%	33%	9%	39%
Other community services			80%	38%			83%	29%	83%
Other	35%	71%	60%	31%	79%	38%	42%	22%	50%
Mean	56%	61%	38%	32%	40%	42%	42%	38%	43%

Source: German Socio-Economic Panel and Enquêtes Génération, own calculations.

Table 3. Retention of apprentices per firm size in Western Germany

	1992-2013	2007-2013
Less than 20 employees	36%	37%
Between 20 and 200 employees	62%	65%
More than 200 employees	64%	76%

Source: German Socio-Economic Panel, own calculations.

A.5 Two possible estimation technics to take into account the selection bias

Formally, the estimation writes as

$$\begin{cases} y_1^* = \alpha A + X_1 \beta_1 + u_1 & (1) \\ y_2^* = X_2 \beta_2 + u_2 & (2) \end{cases}$$

with A a dummy variable which equals one if the individual ended school after an apprenticeship diploma, X_1 and X_2 two sets of covariables, y_2^* the latent variable such as $A = 1$ is equivalent to $y_2^* \geq 0$ and y_1^* the main dependent variable which can be either observed or not.

If u_1 and u_2 are further assumed to be linearly related through the expression $u_1 = \rho \frac{\sigma_1}{\sigma_2} u_2 + v$ with σ_i the standard error of residual u_i and v some noise independent from u_1 and u_2 , the problem can be re-shaped as

$$y_1^* = \alpha A + X_1 \beta_1 + \rho \frac{\sigma_1}{\sigma_2} (y_2^* - X_2 \beta_2) + v$$

.Which therefore leads to :

$$E(y_1^* / X_1, X_2, y_2^*) = \alpha A + X_1 \beta_1 + \rho \frac{\sigma_1}{\sigma_2} (y_2^* - X_2 \beta_2) \quad (3)$$

Thus, a selection bias in the estimation of α appears when ρ is non-null. Contrarily, if ρ is zero, equation (1) can be estimated on its own.

The joint estimation of the equations by maximum likelihood requires to assume that u_1 and u_2 follow a binormal law: $\begin{pmatrix} u_1 \\ u_2 \end{pmatrix} \rightarrow N\left[\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma_1^2 & \rho \sigma_1 \sigma_2 \\ \rho \sigma_1 \sigma_2 & \sigma_2^2 \end{pmatrix}\right]$ (Lollivier 2001 et 2002 ; Robin 2000). Yet, this assumption is strong and it has been proven that when it does not stand, the joint estimation leads to poorer results than a usual IV estimate (Chiburis et al, 2011)

A two-step method could therefore be preferred to decrease the strength of the assumptions necessary to the estimation. Without assuming the normality of v , one can show that $E(u_2 / X_1, X_2, A = 1)$

et $E(u_2 / X_1, X_2, A = 0)$ are two Mills' ratios (Arendt et Holm, 2006). Hence, if one sets

$$\begin{aligned} \lambda_1 &= \frac{\phi(X_2 \beta_2)}{\Phi(X_2 \beta_2)} \\ \lambda_2 &= \frac{-\phi(X_2 \beta_2)}{1 - \Phi(X_2 \beta_2)} \\ \mu &= \lambda_1 A + \lambda_2 (1 - A) \end{aligned}$$

and calls η a residual, one can write:

$$y_1^* = \alpha A + X_1 \beta_1 + \rho \sigma_1 \mu + \eta \quad (4)$$

The two-step method defined in Barnow, Cain et Goldberger (1981) boils down to first estimating $\widehat{\beta}_2$ in (2), so that $\hat{\mu} = \frac{\phi(x_2 \widehat{\beta}_2)}{\Phi(x_2 \widehat{\beta}_2)} A + \frac{-\phi(x_2 \widehat{\beta}_2)}{1 - \Phi(x_2 \widehat{\beta}_2)} (1 - A)$ can be used as an estimate for μ in (4) to obtain an unbiased OLS estimation of α . Note that standard errors have to be bootstrapped (Lee, Maddala and Trost, 1980). Bayart (2009 :chap7) further explains the difference with a usual IV procedure.

Importantly enough, a limit to this later method appears when y_1^* is unobserved. Indeed, in this case, the assumption that η is normal is necessary for the estimation whereas this is not *necessarily* the case in (4) (Lollivier, 20012). The second stage has to be estimated by “linear least squares regression” (Barnow, Cain and Goldberger, 1981:25, sic.) which prevents the use of a probit or logit model.

A.6 First Stage

Table 4. First stage of the regression on unemployment length in the first post-exit year

	France		Germany	
	Sec. Educ.	Higher Educ.	Sec. Educ.	Higher Educ.
Apprenticeship rate	0.57*** (0.07)	0.83* (0.43)	-0.43*** (0.14)	0.77*** (0.23)
Gender	0.16*** (0.01)	0.03*** (0.00)	0.04* (0.02)	0.02 (0.04)
Age	-0.07 (0.06)	0.10*** (0.01)		
Age2	0.00** (0.00)	-0.00*** (0.00)		
Father is French or born in France/German or born in Germany	0.11*** (0.01)	0.01* (0.01)	0.03 (0.03)	0.04 (0.06)
Father worker - REF. = o,	-	-		
Farmer	0.06*** (0.02)	0.02 (0.01)	-0.19* (0.10)	-
Craftsman, Shopkeeper or Business Owner	0.06*** (0.01)	0.02** (0.01)	-0.03 (0.03)	-0.11** (0.05)
Manager, Engineer, Profession or Professor	0.01 (0.01)	-0.00 (0.01)	-0.04 (0.06)	-0.07 (0.06)
Technician, Supervisor, Sales Rep, Intermediate Professions	0.00 (0.01)	0.01 (0.01)	-0.06* (0.04)	-0.06 (0.08)
Employee	0.00 (0.01)	0.00 (0.01)	0.01 (0.05)	-0.08 (0.11)
Retired	-0.03** (0.01)	-0.01 (0.01)	0.00 (0.03)	-0.16* (0.08)
N/A			-0.06 (0.05)	-0.05 (0.07)
Exit after a CAP - REF.				
Exit after a BEP	-0.50*** (0.02)			
Exit after a Bac. Pro. or a Brevet Pro.	-0.52*** (0.02)			
Exit after a BTS or DUT - REF.				
Exit after university		-0.10***		

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		(0.02)		
Exit after a 'grande école'		-0.07***		
		(0.02)		
Exit after university - REF				
Exit after a Fachhochschule			0.05	
			(0.04)	
Younger than 11 in 6ème	-0.01	-0.00		
	(0.02)	(0.01)		
Older than 11 in 6ème	-0.06***	-0.01*		
	(0.01)	(0.01)		
Gymnasium - REF				
Realschule			0.09***	0.35***
			(0.03)	(0.05)
Hauptschule			0.12***	-
			(0.03)	
N/A or drop-out			0.11	-
			(0.09)	
Small Town - REF. = o,	-	-		
Medium city	-0.00	-0.01*	-0.07**	-0.01
	(0.01)	(0.01)	(0.03)	(0.05)
Large city	-0.04***	-0.02**	0.01	0.01
	(0.01)	(0.01)	(0.03)	(0.05)
N/A			-0.01	0.06
			(0.05)	(0.07)
Children	0.05**	0.03**	0.03	0.00
	(0.02)	(0.01)	(0.04)	(0.05)
Women with children	0.03	-0.02	-0.08	0.06
	(0.03)	(0.02)	(0.05)	(0.07)
Unemployment rate	-1.04**	0.28	0.00	-0.01
	(0.47)	(0.39)	(0.01)	(0.01)
Constant	0.65	-1.18***	1.07***	-0.47**
	(0.64)	(0.18)	(0.13)	(0.19)
Observations	18,217	25,673	1,005	478
First stage F-statistic	184.6	17.92	9.592	11.63

Robust standard errors in parentheses, clustered by region *** p<0.01, ** p<0.05, * p<0.1
 Source: German Socio-Economic Panel and *Enquêtes Génération*, own calculations.

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