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Stay a Little Longer? Teacher Turnover, Retention and Quality in Disadvantaged Schools

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Highlights

- There is a significant gap in teacher quality between advantaged and disadvantaged schools. But evidence on policies aiming at reducing this gap is scarce. Existing research has mainly focused on financial bonus schemes to encourage teachers to stay in disadvantaged schools, but the literature remains inconclusive on their efficiency.
- This paper analyzes an incentive scheme offering non-financial benefits to teachers in order to reduce the teacher quality gap between disadvantaged and non-disadvantaged public middle schools in France. This scheme gives teachers who have spent more time teaching in disadvantaged schools a greater chance of choosing the school they go to next.
- We find this incentive scheme has a statistically significant positive effect on the number of consecutive years teachers stay in disadvantaged schools. It also decreases the probability of inexperienced teachers in disadvantaged schools leaving the profession.
- However we find no statistically significant effect on the teacher experience gap nor the student achievement gap between disadvantaged and non-disadvantaged schools

Why does this matter?

- **This study suggests that incentive schemes that offer non-financial benefits can successfully reduce teacher turnover in disadvantaged schools, and can keep inexperienced teachers from quitting the profession**
- **However, it also suggests that such policies alone might not be enough to reduce the student achievement gap between advantaged and disadvantaged schools**

Stay a Little Longer ?
Teacher Turnover, Retention and Quality in Disadvantaged Schools

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Abstract

Using French administrative data on secondary school teachers, we analyze a non-pecuniary, "career-path oriented" centralized incentive scheme designed to attract and retain teachers in French disadvantaged schools. We rely on a major reform of the structure of this incentive scheme to identify its effect on teacher turnover, retention, and quality in disadvantaged schools. We find this incentive scheme has a statistically significant positive effect on the number of consecutive years teachers stay in disadvantaged schools and decreases the probability of inexperienced teachers in disadvantaged schools to leave the profession. However, we find no statistically significant effect on the teacher experience gap nor the student achievement gap between disadvantaged and non disadvantaged schools.
Keywords: teachers, teacher mobility, teacher retention, educational inequalities, education prioritaire. JEL: I21, I22, J20.

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1 Introduction

In many countries, disadvantaged students are more likely to be assigned to lower quality teachers (OECD, 2005). In the United States for example, disadvantaged students are 10 percent more likely to be taught by teachers in the bottom 10 percent of the teacher quality distribution than non disadvantaged students (Goldhaber et al., 2015). The magnitude of this teacher quality gap in the US is equivalent to 20 percent of the student achievement gap (Darling-Hammond, 2015). There is a large literature showing that teacher quality matters for student outcomes (Rockoff, 2004; Chetty et al., 2014). Reducing the teacher quality gap is therefore a major policy issue in order to provide more equal educational opportunity.

There are very few papers analysing policies aiming at reducing the teacher quality gap. The main type of policies studied are financial bonus schemes for teachers working in disadvantaged schools. This literature remains inconclusive (Clotfelter et al., 2008; Prost, 2013). Furthermore, there is strong evidence showing that teachers do care about non-pecuniary factors (Hanushek et al., 2004).

This paper analyzes a "career-path oriented" centralized incentive scheme designed to reduce the teacher quality gap between disadvantaged and non-disadvanged public middle schools in France. To our best knowledge, there is no existing empirical evidence on the impact of teachers' non-pecuniary incentives on the teacher quality gap.

In France, teachers are assigned according to a centralized point-based assignment system. Teachers submit a ranked-ordered list of choices and are assigned according to a modified version of the deferred acceptance mechanism. The main assignment criteria are i) experience, defined as the number of years since entering the teaching profession; ii) seniority, defined as the number of consecutive years spent in the current school; iii) seniority in the same disadvantaged school.

This paper evaluates the last criteria: how effective is the disadvantaged school seniority bonus at attracting and retaining quality teachers in disadvantaged schools ? What is its effect on the student achievement gap in middle school ? In order to assess this scheme, we exploit a major reform in 2005 which changed i) the set of disadvantaged schools benefiting from this extra seniority bonus; ii) the structure of this bonus. This change in structure aims at giving teachers the incentives to stay at least five consecutive years in the same disadvantaged school, instead of three consecutive years before the reform. This paper relies on comprehensive administrative data on middle school teachers and students from 2002 to 2014 to perform a difference-in-difference comparing the evolution of the disadvantaged schools receiving the bonus to

the other schools before/after the 2005 reform. Disadvantaged schools benefitting from extra seniority points before the reform are part of the Zone d'Education Prioritaire, violent schools or sensitive schools programs (19 % of middle schools), hereafter called ZEP schools for simplicity. Disadvantaged schools benefiting from extra seniority points (13 % of middle schools) after the reform are called Affectation prioritaire a valoriser, hereafter APV. We analyze the impact of the 2005 reform on several outcomes at the school level: teacher turnover, measured by teacher mobility rate and seniority; teacher quality, measured by teacher experience; student achievement, measured by their test scores at the national standardized exam Diplome national du brevet (DNB) taken in 9th grade.

We find that the reform has a positive impact on teacher seniority in APV schools. The reform provokes a progressive decrease in the seniority gap between APV and non-APV schools reaching 20 % (0.3 years) at the end of the period. We also find that the reform decreases the probability of inexperienced teachers (i.e. with less than 10 years of teaching experience) in APV school to leave the teaching profession. Finally, we find that the reform has no statistically significant impact on the quality of teachers moving to APV schools, as measured by their number of years of experience, nor on the student achievement gap between APV and non-APV schools.

2 Institutional Setting

We present the main features of the French educational system as well as the 2005 reform of the disadvantaged school mobility bonus.

2.1 Overview of the French Educational System

The public French educational system is highly centralized. Contrary to the United States for example, schools have little autonomy and school principals cannot hire nor fire their teachers. The French territory is composed of 25 large administrative school districts, called academies (hereafter regions). Secondary school teachers are selected through a subject-specific national competitive examination, which is demanding academically and has low passing rates (between 15 and 30 %). There are two main certification levels: basic, called CAPES (Certificat d'aptitude au professorat de l'enseignement du second degre) and advanced, called Agregation. Conditional on passing this examination, teachers become civil servants managed by their region.

Teachers's salary is set through a national wage scale based on teachers' number

of years of experience and certification level (none, basic and advanced). For example, the gross wage of a teacher with the basic certification level and a year of experience is approximately 2,000 euros per month. Contrary to other countries such as the United States for example, wages do not vary across schools.

Teachers can however receive a small financial compensation for teaching in the disadvantaged schools that are part of the Zone d'education prioritaire (ZEP) program (Prost, 2013). The ZEP program, established in 1982, is a compensatory education policy giving additional resources (smaller class size, etc.) to a selected set of disadvantaged schools. ZEP schools are selected by the central government according to the socioeconomic background of their students. The ZEP financial compensation was introduced in 1990 at 300 euros per year, and was continuously increased to reach 1,156 euros per year in 2010.

Secondary school teachers are subject-specific: each subject is taught by a different teacher. In middle school (from grade 6 to grade 9), students are not tracked by major nor ability. Contrary to many countries such as the United States where students' peers depend on the teaching subject, in France, students stay in the same class, with the same peers throughout the school year and in every subject. At the end of 9th grade, students take a national and externally graded examination called Diplome national du Brevet in three topics: French, Math and History.

2.2 Certified Teacher Assignment and the 2005 Reform

Certified Secondary School Teacher Assignment. In many countries such as the United States for example, teachers are hired directly by schools. In France, secondary school certified teachers are assigned via a centralized point-based system (called SIAM, Systeme d'information et d'aide aux mutations) with two rounds: the inter-regional round and the regional round. Candidates submit a rank-ordered list of choices and are assigned according to a modified version of the school-proposing Deferred Acceptance mechanism (Combes, Tercieux and Terrier, 2017). Every year, i) new teachers and tenured teachers who want to change region apply to the inter-regional mobility round; ii) participants of the inter-regional mobility round, and tenured teachers who want to change school within their region, apply to the intra-regional mobility round.

Both at the inter and intra regional level, the main assignment criterias are teacher experience (defined as the number of years since entering the teaching profession), seniority (defined as the number of consecutive years spent teaching in the same school) and seniority in a disadvantaged school.

The 2005 Reform. This reform changed the set of schools benefitting from the extra seniority bonus. Before 2005, all the schools labelled ZEP benefitted from the additional seniority bonus. After 2005, a new list of schools, labelled APV (Affectation Prioritaire justifiant une Valorisation schools) was established. APV schools were selected based on their lack of attractivity as measured by their teacher turnover rate . The set of APV schools did not change after 2005. As shown in Table 1, most of ZEP schools became APV schools. However, many ZEP schools did not become APV schools. Therefore, we create four distinct groups of schools:

- non ZEP and non APV schools (3,920 schools): the status of these schools did not change throughout the period
- ZEP and non APV schools (392 schools): these schools benefitted from the disadvantaged school seniority bonus before the reform but not after the reform
- non ZEP an APV schools (140 schools): these schools did not benefit from the disadvantanged school seniority bonus before the reform but benefitted from it after the reform
- ZEP and APV schools (572 schools): the status of these schools did not change throughout the period

The 2005 reform also changed the structure of the seniority bonus. Before the 2005 reform, certified teachers got 10 points per year of seniority and 25 additional points every five years (table 3). This seniority bonus does not depend on the status of the school (ZEP school or not). Teachers assigned to ZEP schools got additional seniority points depending on their number of years of seniority: 50 additional points for 3 years of seniority; 65 points for four years; 85 points for five years or more.

After the 2005 reform, the structure of the standard seniority bonus changed. Teachers still get 10 points every year but now they get the additional 25 points every four years instead of every five years. The structure of the disadvantaged school seniority bonus also changed. The seniority bonuses at three and four years of seniority were suppressed. Teachers in APV schools get 300 additional points if they have five to seven years of seniority, and 400 points if they have 8 years or more of seniority.

Figure 1 plots the value of the seniority bonus by number of years of seniority, depending on the status of the school and the period (before or after the 2005 reform). The reform has a major impact on the disadvantaged school seniority bonus. For example, before the reform, a certified teacher with five years of seniority in a ZEP school got $4 \times 10 + 85 + 25 = 160$ points. After the reform, a similar teacher with

five years of seniority in an APV school gets $4 \times 10 + 25 + 300 = 375$ points.

The population affected by the reform is composed of teachers assigned to APV schools from the 2005 onwards but also of teachers who were assigned to ZEP schools before the reform. A transitory bonus scale was implemented after the reform for teachers who were assigned to ZEP schools. Table 2 shows the transitory scale for the disadvantaged school seniority bonus. It distinguishes between two types of ZEP schools: ZEP schools which did not become APV, i.e. schools which stopped benefitting from the extra seniority bonus after 2005, and ZEP schools that became APV, i.e. schools which continued to benefit from the bonus after 2005. In both type of schools, the population benefitting from the transitory scale are teachers assigned to ZEP schools before the 2005 reform. In ZEP & APV schools, the transitory scale was implemented only in 2005 whereas in ZEP non APV schools, it was implemented in 2005, 2006 and 2007.

The main motivation of this reform, as stated by the Ministry of Education, is to make APV schools more attractive for teachers and to reduce teacher turnover. More specifically, the objective is "to give teachers the incentive to be commited to their assigned APV schools for at least five years ".

3 Data and Descriptive Evidence

In this section, we briefly present the main characteristics of the data as well descriptive evidence on the impact of the reform on teacher mobility, seniority and experience in disadvantaged schools.

3.1 Data

This paper relies on comprehensive administrative panel data on teachers, middle schools and students from the French Ministry of Education :

- Data on teachers and their assignments (2001 - 2014): this datasets provide individual information on teacher such as their national identifier, their year of assignment, their type of assignment (permanent vs. temporary), school identifier, classroom identifier, number of years of experience, teaching subject
- Data on public secondary schools (2001 - 2014): national identifier, classification (ZEP, violent, sensitive), type (middle vs. high schools)

- Secondary school students (2004 - 2014): encrypted identifier, socio-demographic characteristics (financial aid status, profession of both parents), classroom identifier, test scores at the national and externally graded examination taken in 9th grade (Diplome national du Brevet)

We did not have access to the dataset from the Ministry of Education listing APV schools. Thus, we constructed the list of APV schools from the publicly available administrative documents on the regions' official websites.

We are able to match each individual teacher to all her students thanks to the school and classroom identifiers. Our sample focuses on teachers with a permanent assignment (78 % of observations) because temporary teachers are reassigned every year and do not benefit from the APV bonus. We also focus on public middle schools because there are almost no APV high schools.

We define the following outcome variables:

- teacher number of years of seniority: number of consecutive years a teacher teaches in the same school;
- teacher mobility rate: proportion of teachers leaving their current school for another schools. This mobility rate does not include teachers who are leaving the teaching profession
- teacher exit rate: proportion of teachers who interrupt their teacher career, temporarily (being on a long sabbatical) or permanently (quitting or retiring) . We use the share of teachers who leave the teacher database as a proxy [1]. Each year, between three and six percent of teachers leave the teaching profession (Figure A3). This exit rate can have many causes that we do not observe directly in the data. We have however access to individual teacher retirement data, from 2007 to 2013. We observe that over this period, teachers in non disasvantaged schools are more likely to retire than other teachers, which is consistent with the difference in the teacher experience structure between these two types of schools (Figure A1). In 2007 for example, almost 5% of teachers in non APV and non ZEP schools retired, against around 2% in APV and ZEP schools. This numbers are consistent with the descriptive statistics from the Ministry of Education (DEPP, 2014). This suggests that, in non APV – non ZEP schools, over the 2007-2013, more than 85 % of exits are due to retirement against less than 50 % in APV and ZEP schools.

[1] As we are using comprehensive administrative datasets, the probability of data collection related attrition is negligible

Given the objectives of the APV program, we would like to know whether it provides big enough incentives to deter teachers from quitting the teaching profession. An established result in the literature in that inexperienced teachers in disadvantaged schools are the population the most at risk of quitting (Boyd et al., 2008; Allen et al. 2015). This is why we focus the exit rate analysis to inexperienced teachers, for which the main cause of the exit rate is most likely to be quitting rather than retiring. To find the specific experience threshold, we plot the retirement rate by number of years of experience (Figure A2) and we observe than teachers with less than 10 years of experience have a probability close to zero. In the remaining of the paper, we therefore define inexperienced teachers as having less than ten years of teaching experience.

- teacher experience: number of years since the teacher entered the teaching profession

3.2 Descriptive Evidence

We provide descriptive evidence on the evolution of teacher mobility, seniority and experience in the different groups of schools from 2002 to 2015.

Evolution of the Outcome Variables per Year. We first analyse the evolution of the average teacher mobility rate by school year from 2002 to 2014 (Figure 2). The mobility rate is much lower in non disadvantaged schools (non ZEP - non APV schools) than in disadvantaged schools throught the period. The teacher mobility rate in non disadvantaged schools is around 5 % throughout the period against around 10 % in APV and ZEP schools. Yet, we do not observe any impact of the reform on the mobility rate of the different categories of schools.

We now turn to the evolution of the average exit rate of inexperienced teachers (Figure 3). Overall, the exit rate is slightly lower for inexperienced teachers in non disadvantaged schools (non ZEP - non APV schools) than in disadvantaged schools, especially APV-ZEP schools before the reform. This graph seems to suggest that the reform has a negative impact on the exit rate gap between APV and non APV schools, even though it does not provide clear causal evidence.

There are also major variations in teacher seniority and experience across the different groups of schools (Figure 4 and Figure 5). Teachers in schools both labelled APV and ZEP have on average, around 8 years of seniority. Teachers in non ZEP - APV schools have around 9 years of seniority in the begining of the period. However, starting from 2009, their average level of seniority decreases to 8 years, converging with

the level of seniority of teachers in ZEP-APV schools. Teachers in non- disadvantaged schools (non ZEP - non APV) have on average around 2 more years of seniority, around 10 years of seniority. Regarding teaching experience, we observe a large gap between disadvantaged schools (APV- ZEP, or non ZEP - APV) and non disadvantaged schools (non ZEP - non APV schools).

Mobility Rate by Number of Years of Seniority. We analyse teacher mobility by number of years of seniority. We distinguish four periods : i) before the reform: 2002 - 2004 (Figure 6) ; ii) year of the reform: 2005 (Figure 7); iii) transition years: 2006-2007 (Figure 8); iv) after the reform: 2008-2014 (Figure 9). Vertical lines correspond to seniority bonuses: black lines indicate seniority bonuses that apply to all types of schools; red lines indicate bonuses that apply to ZEP schools before 2005, and to APV schools after 2005.

Before the reform (2002 - 2004), we observe a spike in the mobility rate at 5 years of seniority for all types of schools. This spike corresponds to the additional 25 seniority bonus when teachers reach five years of seniority. For non ZEP- APV schools, the mobility rate goes from 10 % at four years of seniority to 24 % at five years of seniority. Interestingly, this is larger than the spike for ZEP schools, which benefit from the extra bonus at 5 years of seniority (whereas non ZEP - APV schools do not).

In ZEP - APV schools, the mobility rate increases from 3 years of seniority, when teachers get the 50 points seniority bonus: the mobility rate goes from 8 % at 2 years of seniority to almost 16 % at 3 years of seniority. This mobility rate remains constant at 4 years of seniority, when teachers benefit from a 65 points seniority bonus. Finally, it increases slightly at 5 years of seniority to around 18 %.

The year of the reform (2005), both teachers already in ZEP - APV schools and teachers already in ZEP - non APV schools benefit from a transitory bonus scale (see table 2). Additionally, teachers moving to APV schools benefit from the new scale, i.e. from the 300 points bonus at 5 years of seniority. In ZEP- non APV schools, mobility rate levels at 3,4, and 5 years of seniority remain comparable to those before the reform, i.e. between 8 and 12 %. In ZEP - APV schools, the 5 years spike does not seem to be affected by the reform, and is constant around 16 %. However, mobility rate levels at 3 and 4 years of seniority have fallen sharply compared to before the reform: from around 16 % before to around 9 % after the reform.

During the transition years (2006-2007), ZEP - APV schools do not benefit from the transitory bonus scale anymore (see table 2). However, ZEP - non APV schools still benefit from the transitory bonus scale. In ZEP - non APV schools, there is no spike at 5 years of seniority anymore. From the second year of seniority to the fifth

year, the mobility rate is constant around 8 %. In ZEP and APV schools, the structure of the mobility rate by seniority is similar to the transition period.

After the end of the transition period (2008-2014), we observe that the structure of the mobility in ZEP - non APV schools and in non ZEP- non APV schools is now extremely similar. There is no spike at five years of seniority for both types of schools, but small spikes every four years, corresponding to the additional 25 points all schools get every four years. The structure of the mobility in non ZEP - APV schools and in ZEP- APV schools is also now very similar. In both types of schools, there is a big spike in mobility at five years, and a smaller spike at 8 years, corresponding to the extra seniority bonuses these schools get.

Overall, this descriptive analysis of the evolution of the mobility rate by seniority provides strong evidence of the impact of the 2005 reform on the structure of teacher mobility. Whatever the status of the school, we observe that the evolution of the structure of teacher mobility is closely correlated with the structure of the disadvantaged school seniority bonus.

Quality Gap between Previous School and New School for Movers. We then investigate the relationship between the 2005 reform and movers' new schools. The reform considerably increased the APV bonus at five years of seniority, going from 85 points to 300 points. This raises the question: does this 70 % increase in the APV bonus changed the type of schools teachers move to? After the reform, do teachers with five years of seniority move to considerably better schools? To answer these questions, I plot, for movers, the quality gap between their previous school and the school they move to, by movers' number of years of seniority when they move. I use the average standardised test scores of 9th grade students over the period as a proxy for school quality. Figure 12 plots the average 9th grade test scores gap for movers between the school they leave and the school they join (hereafter called the school quality gap), by number of years of seniority when they move. First, it shows that the school quality gap is much larger for APV schools than for non-APV schools. At one year of seniority for example, the school quality gap is close to zero in non-APV schools whereas it is equal to 0.8 SD in APV schools. Second, the reform does not seem to have a large impact on the school quality gap for APV movers. However, the reforms seems to have slightly changed the structure of the school quality gap in the first five years of seniority. Before the reform, for APV movers, the school quality gap starts to increase from the third year of seniority, whereas it starts to increase only from the fourth year after the reform. This suggests that before the reform, the 50 points APV bonus at three years of seniority is already enough to give APV teachers access to slightly better

schools. Surprisingly however, the big increase in the 5 years of seniority APV bonus does not seem to translate into a higher school quality gap, as this gap is very similar before and after the reform. This may be because the reform did not change the type of schools APV movers apply to. Lastly, we do not observe any impact of the reform on the school quality gap in non APV schools, suggesting that no negative spillovers are taking place.

Exit Rate of Inexperienced Teachers by Number of Years of Seniority. Finally, we turn to the analysis of the exit rate of inexperienced teachers (i.e. teachers with less than ten years of experience). We distinguish two periods: before and after the 2005 reform. We mainly observe that the exit rate decreases faster with seniority after the reform than before, especially in APV schools. For example, both before and after the reform, the exit rate of inexperienced teachers after one year of seniority in an APV-ZEP school is equal to 4 %. Before the reform, the exit rate at 4 years of seniority is also equal to 4 % in APV-ZEP schools, against 2.5 % in those schools. Furthermore, we also observe that the exit rate gap between APV and non APV schools is smaller after the reform than before, whatever the level of seniority. Overall, this descriptive analysis suggests that the reform is correlated with a decrease in the exit rate gap between APV and non-APV schools.

4 Empirical Strategy

Our aim is to assess the impact of the 2005 reform on teacher mobility, exit, seniority, experience, and student achievement. The first basic intuition of the empirical strategy is to implement a difference-in-differences and to compare the evolution of APV schools to the evolution of non APV schools before and after the 2005 reform.

A difficulty is that the 2005 reform is likely to have different short-run and long-run effects because of the stock-flow dynamics. For example, ex ante, the impact of the 2005 reform on teacher seniority is ambiguous. In the short run, the average seniority of teachers in APV schools is likely to decrease because of a transitory "opportunity effect" for teachers who were assigned to APV schools before 2005. These teachers have strong incentives to leave because they now benefit both from the new bonus scale and the transitory scale. In the long run, this "opportunity effect" fades out as teachers already in APV schools in 2005 leave and the transitory bonus scale expires. To benefit from the new bonus, teachers who entered APV in 2005 have to accumulate at least five years of seniority in the same APV school. Before the reform, they had to accumulate at three years of seniority. Thus, the reform will start to have an impact

the entering teachers three years after its implementation, i.e. in 2008. From 2008 onwards, the reform can have several potentially competing effects:

- it replaces the incentives to exit at 3 or 4 years of seniority by strong incentives to stay at least five years. Therefore, it can have a positive effect on the average number of years of seniority in APV schools
- the reform marginally increases the incentives to stay 5 to 8 years in the same APV school. Therefore, it can also have a positive impact on the average seniority in APV schools
- the reform decreases the incentives to stay more than 8 years. Thus, it can a negative impact on the average seniority in APV schools.

Because of these complex and competing dynamic effects of the reform, the standard difference-in-differences approach may yield misleading results: as shown by Wolfers (2006), the standard difference-in-differences estimates confound these complex dynamics with panel-specific trends. We follow Wolfers (2006) dynamic difference-in-differences specification which imposes very little structure on the response dynamics, including dummy variables for the first two years, for the next years, and so on. These dummy variables allow a time variable to identify preexisting trends. Thus, we estimate the following specification:

$$y_{j,apv,t} = \sum_t \alpha_t.1_t + \delta_{apv}.1_{apv} + \sum_{t \geq 2005} \beta_{apv,t}(1_{apv}.1_t) + \gamma 1_{apv}.year + \epsilon_{j,apv,t}$$

where:

- $y_{j,apv,t}$: average outcome variable in school j, school category apv and year t
- 1_t: year dummy
- 1_{apv}: APV dummy

We focus on the following outcomes at the school-year level: average number of years of seniority, exit rate, number of years of experience, and standardized student test scores. Standard errors are robust and clustered by school.

5 Results

Impact on Teacher Seniority. We start by analysing the impact of the reform in teacher seniority. Table 4 shows the impact of the 2005 reform on teachers' number of years of seniority in APV schools. Each column corresponds to a single regresssion. We also control for the ZEP status of the schools. The first column reports the impact of the reform on the average teacher seniority gap between APV and non-APV schools. To analyse more closely the dynamic impact of the reform, columns 2 to 5 show the impact of the reform on the share of teachers with i) less than three years of seniority (column 2) ; ii) between 4 and 5 years of seniority (column 3); iii) between 6 and 8 years of seniority (column 4); iv) 8 years of seniority or more (column 5). We observe that, on average, before the reform, the seniority gap between teachers in APV schools and others is equal to 1.42 year (column 1). In its first two years, the reform has a negative impact on the average teacher seniority in APV schools, which is consistent with an "opportunity effect" for teachers who were already in APV schools before the reform. The reform starts to have a positive impact from year 3. This positive impact becomes statistically significant from year 5. At the end of the period, the average seniority gap between APV and non APV schools is reduced by 0.26 year compared to before the reform. In other words, the pre-reform seniority gap between APV and non APV schools is reduced by 18 % at the end of the period. This decrease in the seniority gap is driven by an decrease in the share of teachers with less than three years of seniority (column 2) and an increase in the share of teachers with a number of years of seniority between 4 and 8 years. This positive impact of the reform on seniority is mitigated by its negative impact on the share of teachers with 8 years or more of seniority (column 5).

Impact on Teacher Mobility Rate. We turn to the impact of the reform of teacher mobility rate in APV schools. On average, before the reform, the mobility rate is 4 percentage points higher in APV schools than in other schools (Table 5). As expected, the reform increased the mobility rate of teachers with 5 years of seniority (column 3) and decreased the mobility rate of teachers with less than 5 years of seniority.

Impact on Teacher Exit Rate. We then focus on the impact on the reform on the exit rate of inexperienced teachers (i.e. with less than 10 years of experience). First, as suggested by the descriptive analysis, the baseline exit rate in APV schools is higher than in non APV schools: on average, before the reform, the exit rate of inexperienced teachers in APV schools is 0.8 percentage points higher than in other

schools (Table 8). The reform starts to have a statistically significant negative impact on the exit rate gap from years 5- 6, i.e. when the first cohort reaches five years of seniority. At the end of the period, it seems that the reform closed the exit rate gap as it has decreased by 0.8 percentage points.

Impact on Teacher Experience. On average, before the reform, the experience gap between APV and non APV schools is equal to 2.78 years (table 7). We observe a decrease in teacher experience in the first four years of the reform, which is likely due to the "opportunity effect" of experienced teachers taking advantage of the reform to leave disadvantaged schools. Overall, the reform does not have a statistically significant long term impact on the average teacher experience in APV schools (column 1). However, it seems to have a negative impact on the average experience of entering and exiting teachers at the end of the period. This suggests that the reform is likely to have attracted less experienced teachers, i.e. those who need the APV bonus the most, in APV schools.

Impact on Student Test scores. Finally, we analyse the impact of the reform on the student test score gap. On average, before the reform, the student test scores gap between APV and non APV schools is equal to 15 %. Overall, the reform does not have any statistically significant impact on the student test scores gap between APV and non APV schools.

This result has several possible interpretations. It may be because the positive impact of the reform on teacher seniority is too small to have any statistically significant consequence on student achievement. It may also be that the effect on seniority is mitigated by the negative impact of the reform on the quality of teachers entering APV schools. This mechanism would be consistent with a decrease in the experience of teachers entering APV schools at the end of the period.

6 Conclusion

Most of the literature on teacher retention policies focuses on financial incentive schemes and remains unconclusive. The present paper shifts the focus from financial to non-pecuniary, career-oriented incentives. We analyse the impact of the disadvantaged seniority bonus giving teachers in disadvantaged schools an extra mobility bonus once they reach a certain level of seniority. We exploit as a natural experiment the 2005 reform which both changed the set of disadvantaged schools benefitting from this extra seniority bonus and the structure of this bonus.

We find that the reform has a positive impact on teacher seniority in APV schools.

The reform provokes a progressive decrease in the seniority gap between APV and non-APV schools up to 20 % (0.44 years). We also find that the reform decreases the probability of inexperienced teachers (i.e. with less than 10 years of teaching experience) in APV school to leave the teaching profession. Finally, we find that the reform has no statistically significant impact on the quality of teachers moving to APV schools, as measured by their number of years of experience, nor on the student achievement gap between APV and non-APV schools.

Further research. Further research will explore the underlying mechanisms underpining these results. First, we will try to understand why the average increase in teacher seniority in APV schools does not have any statistical significant impact on the average student achievement gap between APV and non-APV schools. A possible interpretation is that the reform attracted lower quality teachers into APV schools. We will therefore measure the evolution over time of the fixed effect of teachers entering APV schools.

Second, we will analyse the impact of the reform on teacher mobility applications. Does the reform make APV schools more attractive ? We will therefore exploit data on teacher applications to analyse the impact of the reform on the number of applications to APV schools and on the characteristics of the applicants. This can also help us understand the impact of the reform on inexperienced teachers exits from the teaching profession as the reform may have given better school options to those vulnerable teachers.

7 References

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8 Tables and Figures

Figure 1 – Number of Seniority Points per Number of Years of Seniority

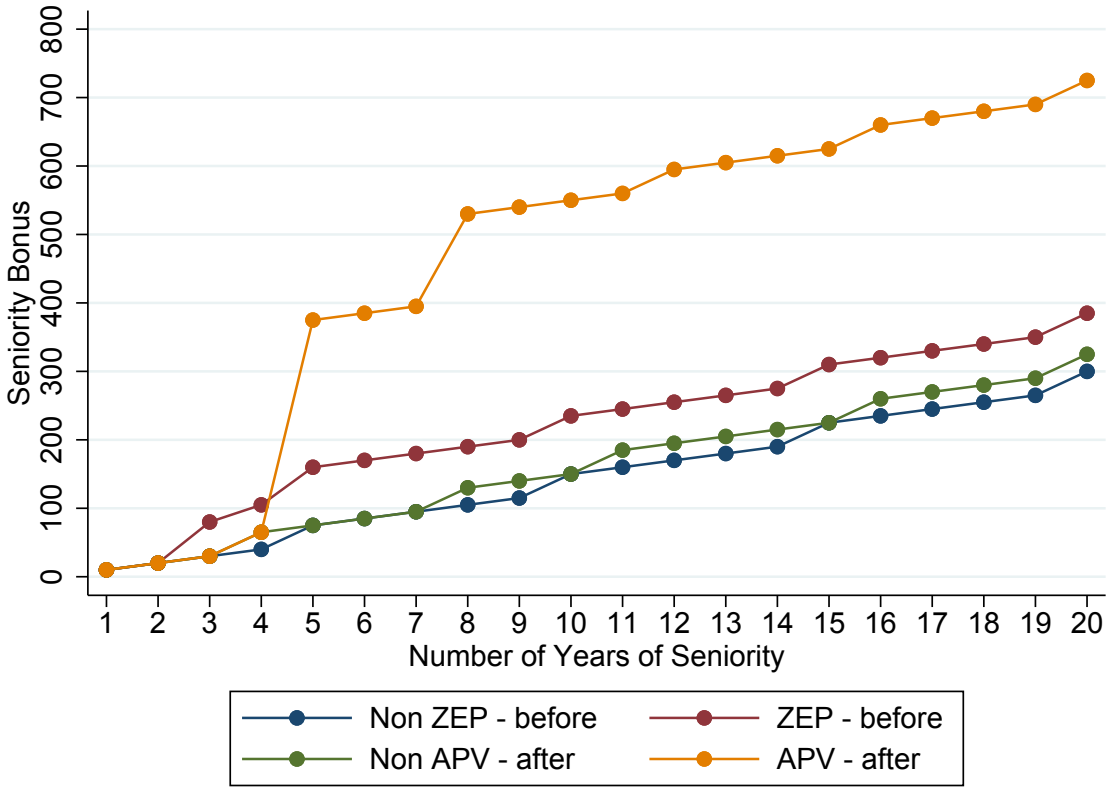


Table 1 – Correlation Table between ZEP schools and APV schools

	APV schools	**Non APV schools**	**Total**
ZEP schools	572	392	964
Non ZEP schools	140	3,920	4,060
Total	712	4,312	5,024

Table 2 – Transitory Bonus Scale

	ZEP & APV	**ZEP non APV**
Years of transition	2005	2005, 2006, 2007
Population	Teachers assigned before 2005	
Transitory scale	1 or 2 yrs: 30 pts 3 yrs: 65 pts 4 yrs: 80 pts 5 yrs or more: 100 pts	

Table 3 – Teacher Assignment Bonus Scale

	Before the 2005 Reform	**After the 2005 Reform**
Experience	First three years: 21 pts + 7 pts/year from the 4th year	
Seniority	10 pts/yrs + 25 pts/ five yrs	10 pts/yrs + 25 pts / four yrs
Seniority in disadvantaged schools	3 yrs: 50 pts 4 yrs: 65 pts 5 yrs or more : 85 pts	5 to 7 yrs: 300 pts 8 yrs or more: 400 pts

Table 4 – Impact of the 2005 Reform on Teachers Number of Years of Seniority in APV Schools (2002 - 2015)

	Average Seniority	Share with Seniority...			
		$\leq$ 3 yrs	4 - 5 yrs	6 - 8 yrs	8 yrs or +
	(1)	(2)	(3)	(4)	(5)
APV	-1.42***	0.07***	0.01**	0.00	-0.08***
	(0.15)	(0.00)	(0.00)	(0.00)	(0.00)
ZEP	-0.65***	0.04***	0.01**	-0.01*	-0.04***
	(0.13)	(0.00)	(0.00)	(0.00)	(0.00)
APV x Years 1 - 2	-0.21*	0.03***	0.02**	-0.04***	-0.00
	(0.12)	(0.01)	(0.00)	(0.01)	(0.00)
x Years 3 - 4	0.04	0.00	0.03***	-0.02**	-0.02***
	(0.14)	(0.01)	(0.00)	(0.00)	(0.00)
x Years 5 - 6	0.24*	-0.02*	0.05***	-0.00	-0.02**
	(0.14)	(0.00)	(0.00)	(0.00)	(0.00
x Years 7 - 8	0.31**	-0.02***	0.03***	0.01*	-0.02**
	(0.15)	(0.00)	(0.00)	(0.00)	(0.00)
x Years 9 - 10	0.26*	-0.02*	0.02***	0.01*	-0.02**
	(0.16)	(0.00)	(0.00)	(0.00)	(0.01)
ZEP x Years 1 - 2	-0.06	-0.00	0.00	0.00	-0.00
	(0.11)	(0.00)	(0.00)	(0.00)	(0.00)
x Years 3 - 4	-0.10	-0.00	0.01*	0.00	-0.00
	(0.12)	(0.00)	(0.00)	(0.00)	(0.00)
x Years 5 - 6	0.00	-0.01**	0.00	0.01**	-0.00
	(0.13)	(0.00)	(0.00)	(0.00)	(0.00)
x Years 7 - 8	0.19	-0.02**	-0.00	0.02***	0.01
	(0.14)	(0.00)	(0.00)	(0.00)	(0.01)
x Years 9 - 10	0.15	-0.01	-0.00	0.00	0.01
	(0.14)	(0.01)	(0.00)	(0.00)	(0.01)
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes
APV pre-trend	Yes	Yes	Yes	Yes	Yes
ZEP pre-trend	Yes	Yes	Yes	Yes	Yes
Nb of obs.	63,915	63.915	63,915	63,915	63,915

Note: Robust standard errors clustered by school. Each column corresponds to a single regression. ***: 1 % level; **: 5 % level; *: 10 % level.

Table 5 – Impact of the 2005 Reform on Teachers Mobility Rate in APV schools (2002-2015)

	Average mobility rate	Mobility Rate at...		
		$\leq$ 5 yrs	5 yrs	$\geq$ 5 yrs
	(1)	(2)	(3)	(4)
APV	0.04***	0.03***	0.01**	0.01***
	(0.00)	(0.00)	(0.00)	(0.00)
ZEP	0.03***	0.02***	0.01**	0.01***
	(0.00)	(0.00)	(0.00)	(0.00)
APV x Year 1	-0.00	-0.01*	0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)
x Years 2 - 3	-0.01***	-0.02***	0.01***	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)
x Years 4 - 5	-0.00	-0.01***	0.01***	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
x Years 6 - 7	-0.00	-0.02***	0.01***	0.01***
	(0.00)	(0.00)	(0.00)	(0.00)
x Years 8 - 10	-0.01*	-0.02***	0.01***	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
ZEP x Year 1	-0.00	-0.01**	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
x Years 2 - 3	0.00	-0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
x Years 4 - 5	0.00	-0.01**	0.00	0.01***
	(0.00)	(0.00)	(0.00)	(0.00)
x Years 6 - 7	-0.01*	-0.01**	-0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
x Years 8 - 10	-0.01**	-0.01***	-0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Year Fixed Effect	Yes	Yes	Yes	Yes
APV Pre-trend	Yes	Yes	Yes	Yes
ZEP Pre-trend	Yes	Yes	Yes	Yes
Nb d'obs.	63,915	63,915	63,915	63,915

Note: Robust standard errors clustered by school. Each column corresponds to a single regression. ***: 1 % level; **: 5 % level; *: 10 % level.

Table 6 – Impact of the 2005 Reform on Teachers Average Number of Years of Experience in APV schools (2002-2015)

	Average experience	Average experience of teachers... entering	exiting
	(1)	(2)	(3)
APV	-2.78***	-2.26***	-1.45***
	(0.15)	(0.20)	(0.30)
ZEP	-1.04***	-1.23***	-0.77***
	(0.13)	(0.20)	(0.29)
APV x Years 1 - 2	-0.48***	-0.17	0.02
	(0.12)	(0.30)	(0.38)
x Years 3 - 4	-0.24***	-0.03	0.10
	(0.12)	(0.28)	(0.37)
x Years 5 - 6	-0.15	-0.47*	-0.46
	(0.13)	(0.27)	(0.38)
x Years 7 - 8	-0.15	-0.29	-0.85**
	(0.13)	(0.29)	(0.39)
x Years 9 - 10	-0.13	-0.99***	-1.19***
	(0.15)	(0.32)	(0.40)
ZEP x Years 1 - 2	-0.30***	0.07	0.13
	(0.10)	(0.29)	(0.37)
x Years 3 - 4	-0.49***	-0.54**	-0.52
	(0.11)	(0.26)	(0.36)
x Years 5 - 6	-0.44***	0.17	0.16
	(0.13)	(0.27)	(0.37)
x Years 7 - 8	-0.31**	-0.01	0.30
	(0.13)	(0.28)	(0.38)
x Years 9 - 10	-0.46***	0.05	0.34
	(0.14)	(0.30)	(0.39)
Year Fixed Effect	Yes	Yes	Yes
APV Pre-trend	Yes	Yes	Yes
ZEP Pre-trend	Yes	Yes	Yes
Nb d'obs.	63,915	63,915	63,915

Note: Robust standard errors clustered by school. Each column corresponds to a single regression. ***: 1 % level; **: 5 % level; *: 10 % level.

Table 7 – Impact of the 2005 Reform on Student Test Scores in APV schools (2002-2015)

Standardised test score in the 9th grade exam	
APV	-0.15***
	(0.01)
ZEP	-0.32***
	(0.01)
APV x Years 1 - 2	-0.00
	(0.02)
x Years 3 - 4	-0.02
	(0.02)
x Years 5 - 6	-0.03*
	(0.02)
x Years 7 - 8	-0.03*
	(0.02)
x Years 9 - 10	-0.02
	(0.02)
ZEP x Years 1 - 2	-0.00
	(0.01)
x Years 3 - 4	-0.01
	(0.01)
x Years 5 - 6	-0.03**
	(0.01)
x Years 7 - 8	-0.03**
	(0.01)
x Years 9 - 10	-0.02
	(0.02)
Year Fixed Effect	Yes
APV Pre-trend	Yes
ZEP Pre-trend	Yes
Nb d'obs.	59,481

Note: Robust standard errors clustered by school. Each column corresponds to a single regression. ***: 1 % level; **: 5 % level; *: 10 % level.

Table 8 – Impact of the 2005 Reform on Inexperienced Teachers Exits (2002-2015)

Exit Rate (Teachers with less than 10 yrs of exp)	
APV	0.0081***
	(0.0030)
ZEP	0.0002
	(0.0022)
APV x Years 1 - 2	- 0.0051
	(0.0034)
x Years 3 - 4	-0.0058
	(0.0033)
x Years 5 - 6	-0.0092***
	(0.0035)
x Years 7 - 8	-0.0082**
	(0.0034)
x Years 9 - 11	-0.0080**
	(0.0033)
ZEP x Years 1 - 2	0.0012
	(0.0030)
x Years 3 - 4	-0.002
	(0.0030)
x Years 5 - 6	0.0039
	(0.0030)
x Years 7 - 8	0.0020
	(0.0030)
x Years 9 - 10	-0.0020
	(0.0030)
Year Fixed Effect	Yes
APV Pre-trend	Yes
ZEP Pre-trend	Yes
Nb d'obs.	63,915

Note: Robust standard errors clustered by school. Each column corresponds to a single regression. ***: 1 % level; **: 5 % level; *: 10 % level.

Figure 2 – Average Teacher Mobility Rate by School Year

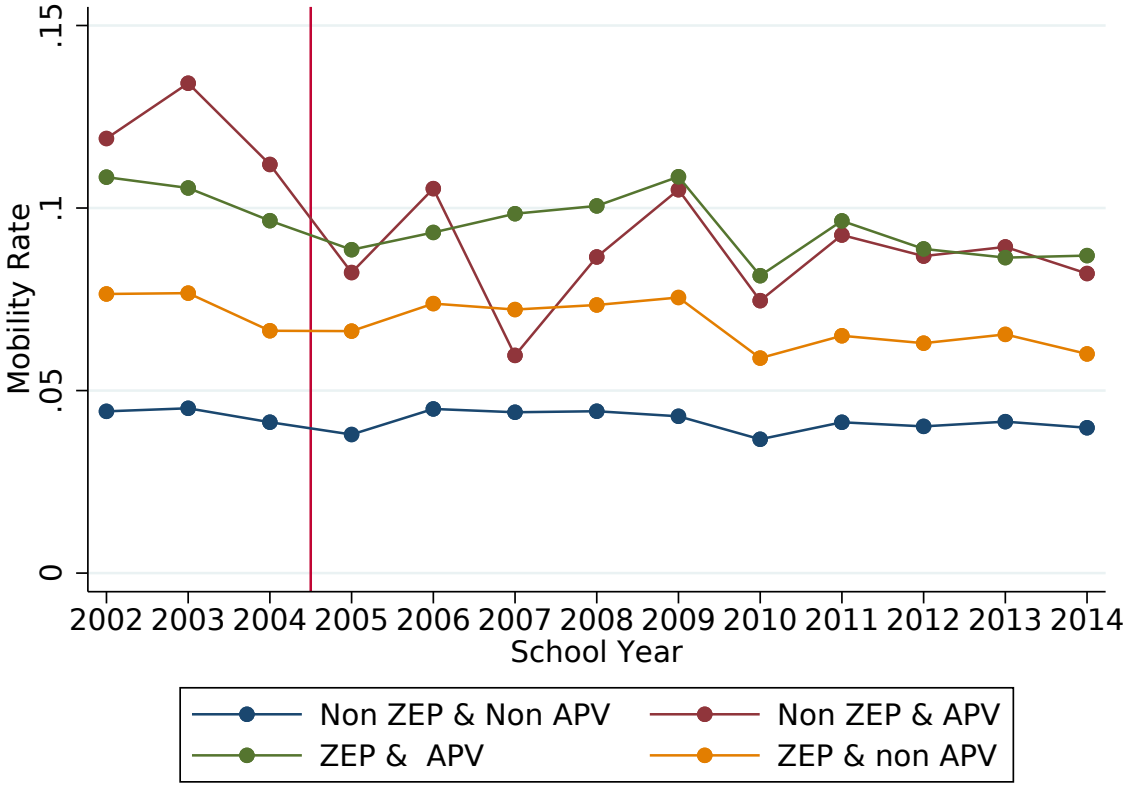
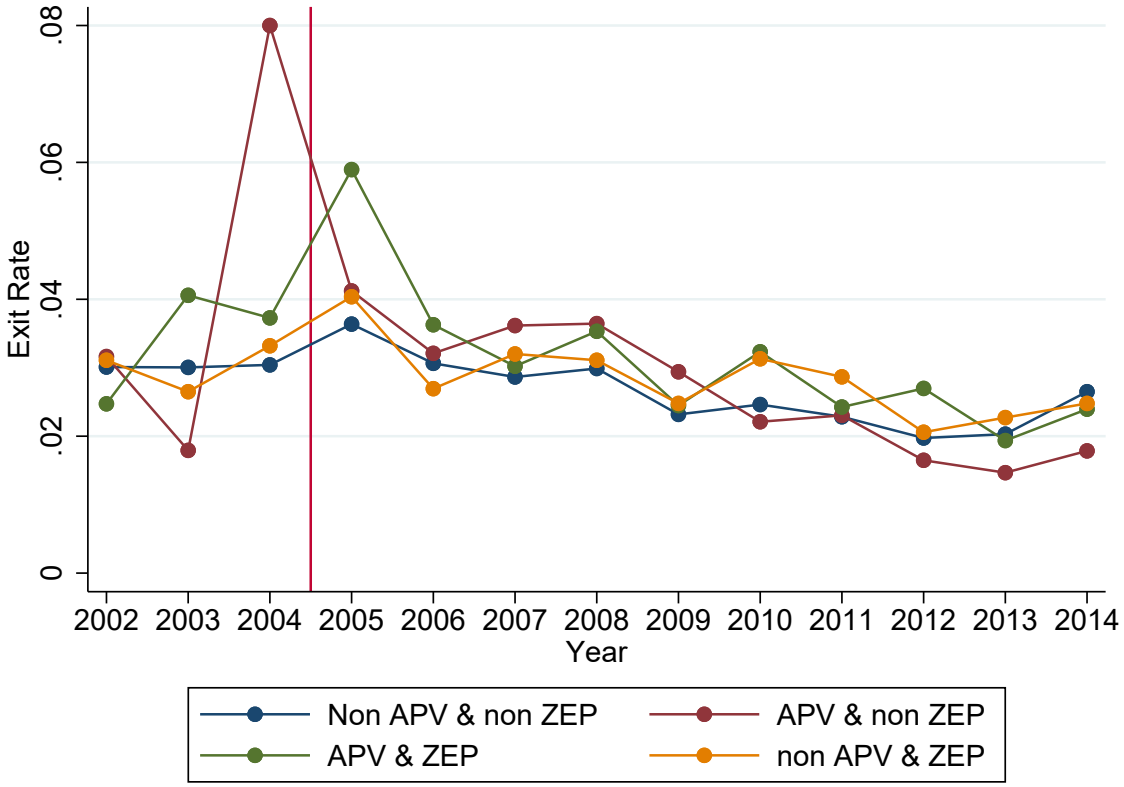


Figure 3 – Average Inexperienced Teacher Exit Rate by School Year



Inexperienced teachers; having less than ten years of experience.

Figure 4 – Average Number of Years of Teacher Seniority by School Year

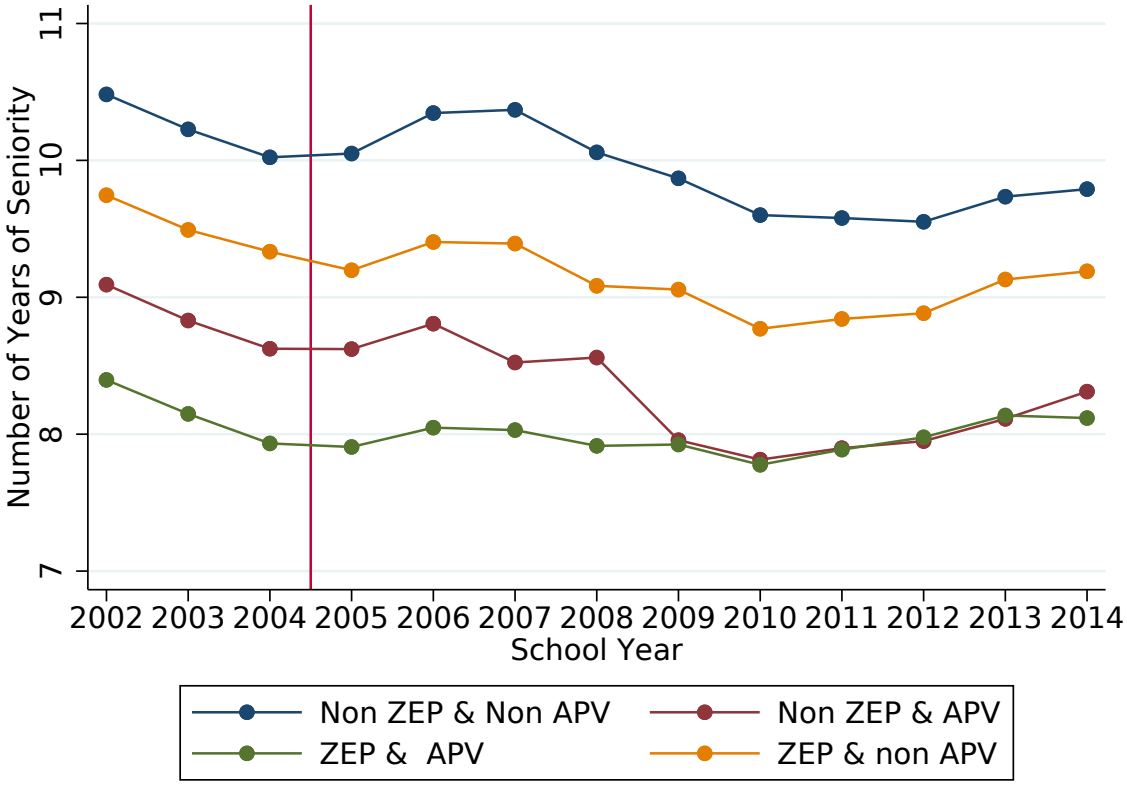


Figure 5 – Average Number of Years of Teacher Experience by School Year

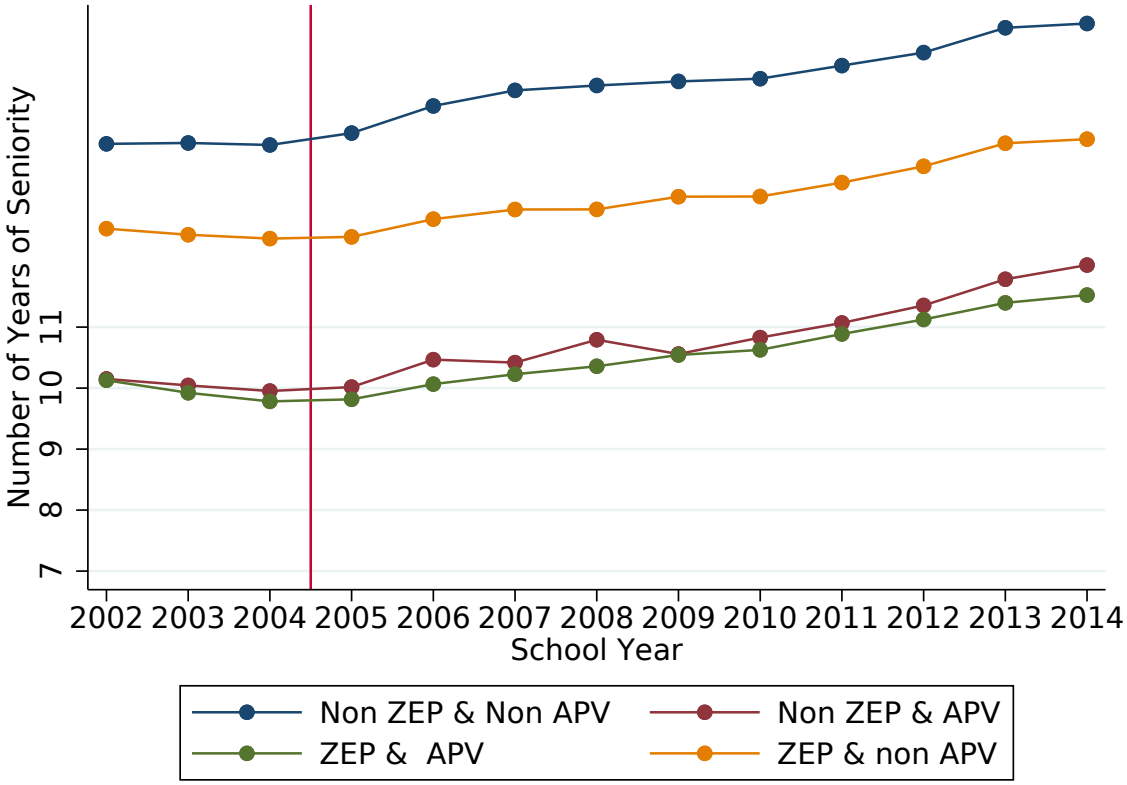


Figure 6 – Mobility Rate by Number of Years of Seniority – Before the Reform (2002-2004)

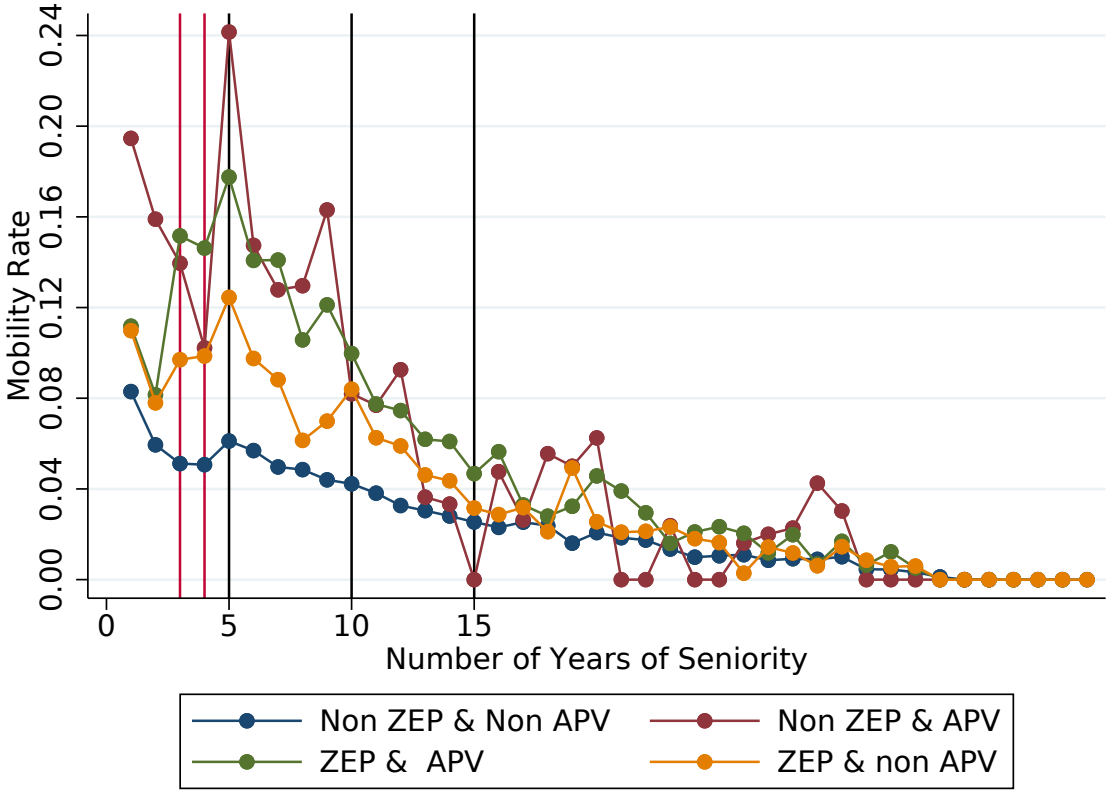


Figure 7 – Mobility Rate by Number of Years of Seniority – Year of the Reform (2005)

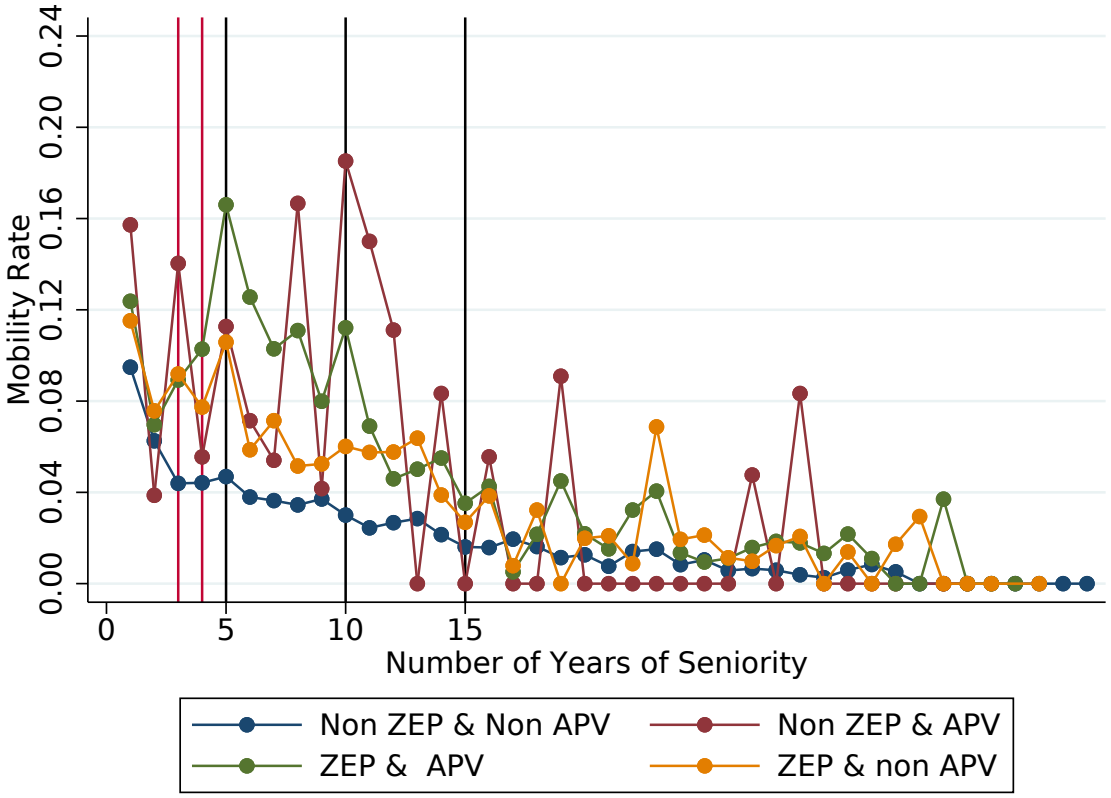


Figure 8 – Mobility Rate by Number of Years of Seniority – Transition Years (2006 - 2007)

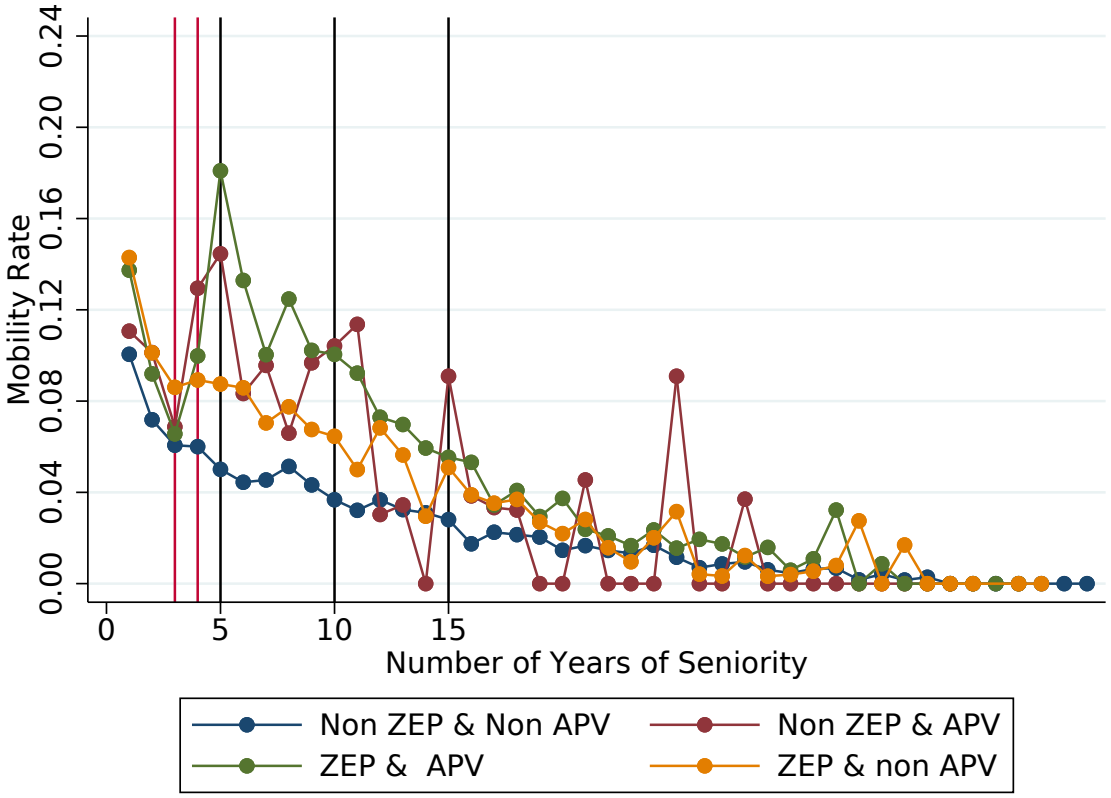


Figure 9 – Mobility Rate by Number of Years of Seniority – After the Reform (2008 - 2014)

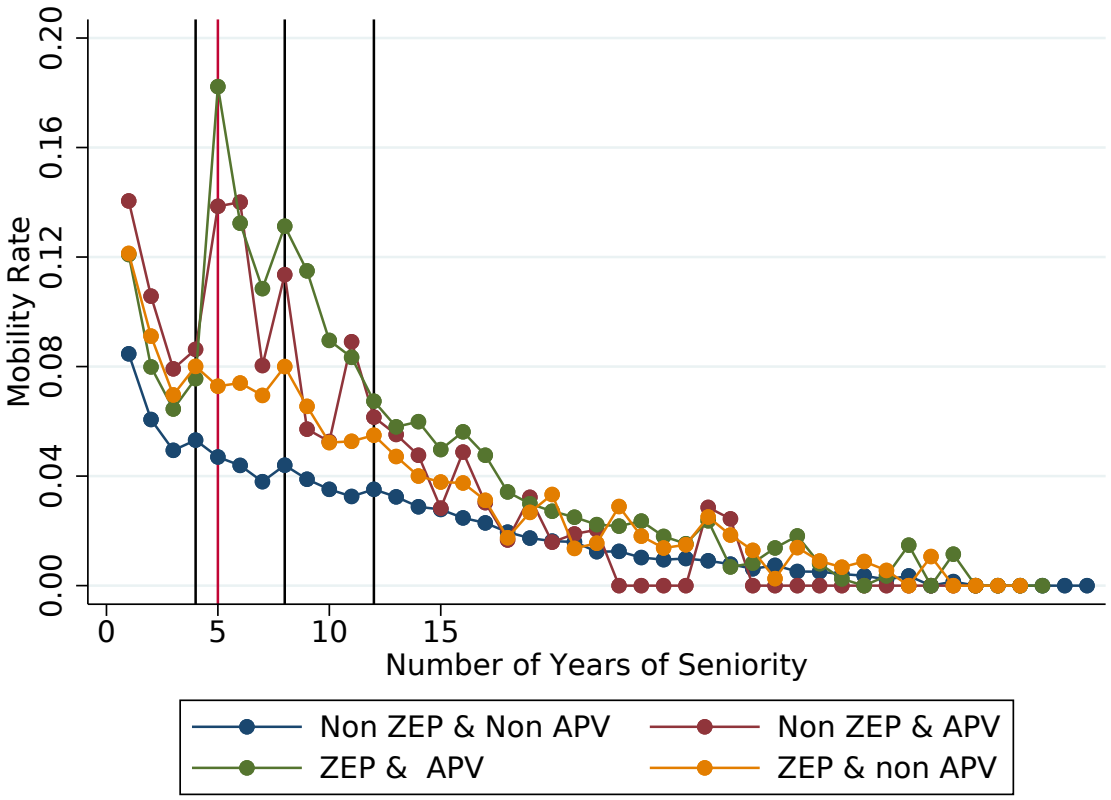


Figure 10 – Exit Rate by Number of Years of Seniority of Inexperienced Teachers – Before the Reform (2002 - 2004)

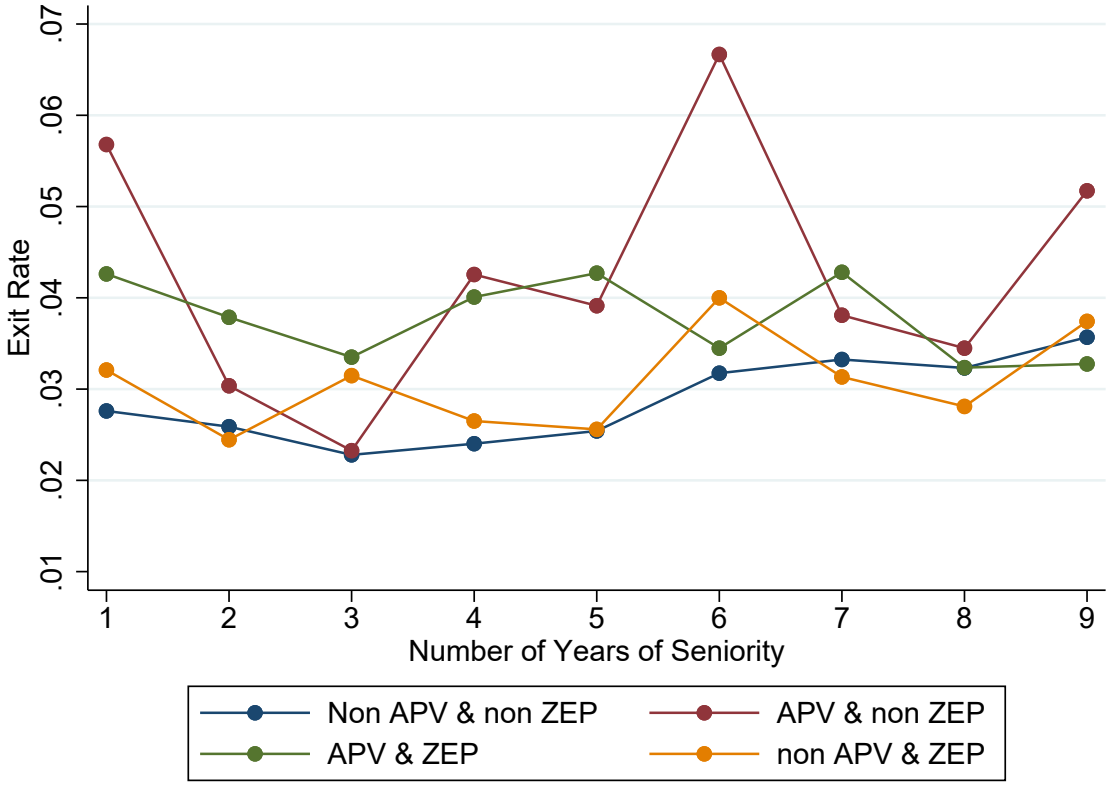


Figure 11 – Exit Rate by Number of Years of Seniority of Inexperienced Teachers – After the Reform (2005 - 2014)

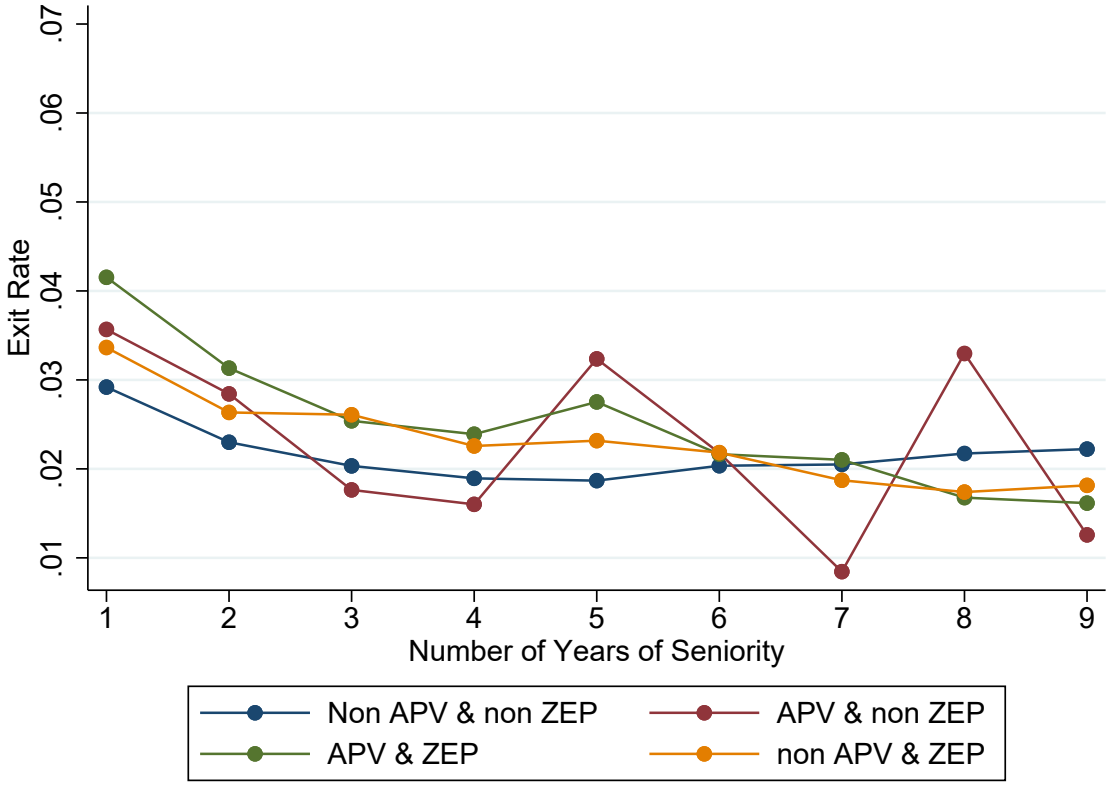
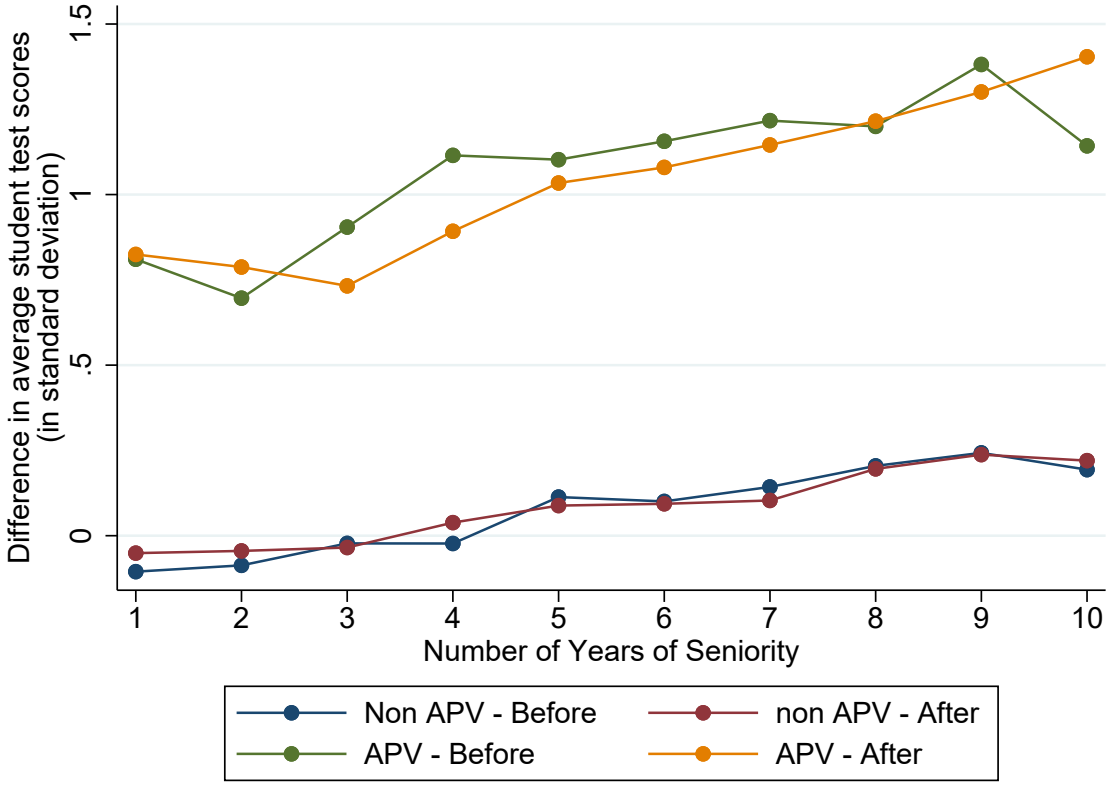


Figure 12 – Average 9th Grade Student Test Scores Gap for Movers between Previous School and New School



A Appendix

Figure A1 – Retirement Rate per Year

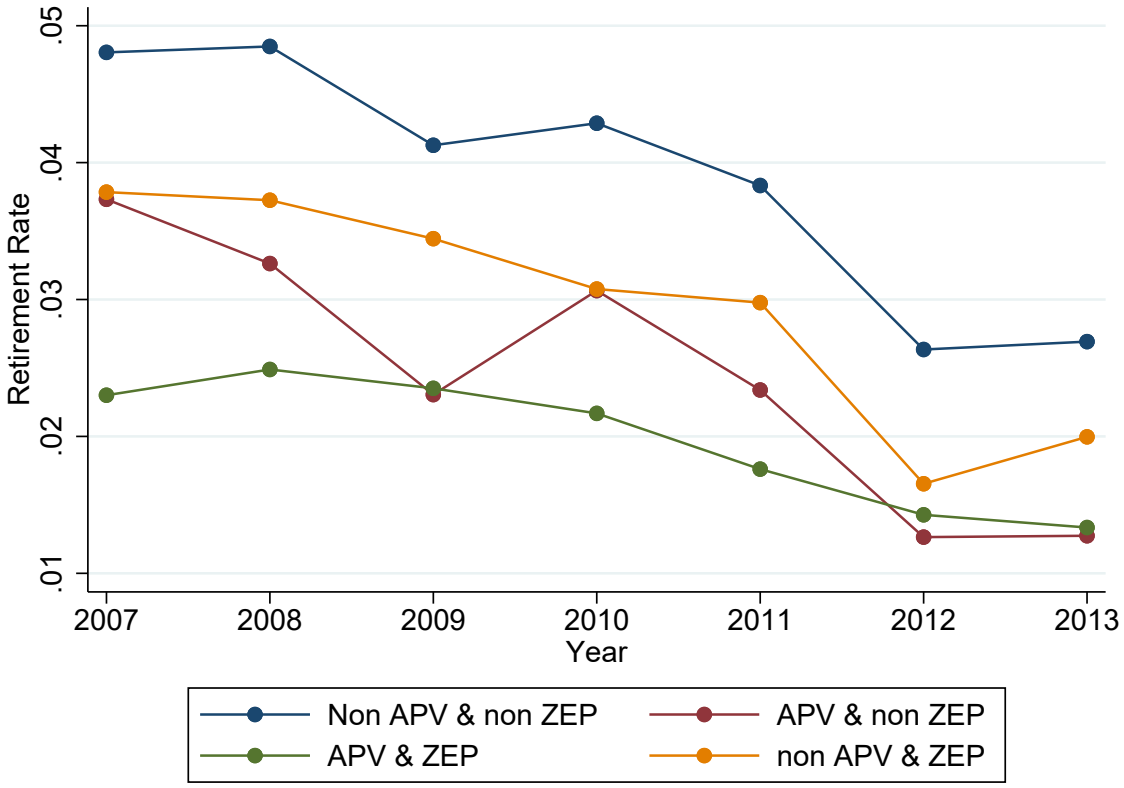


Figure A2 – Exit Rate per Year

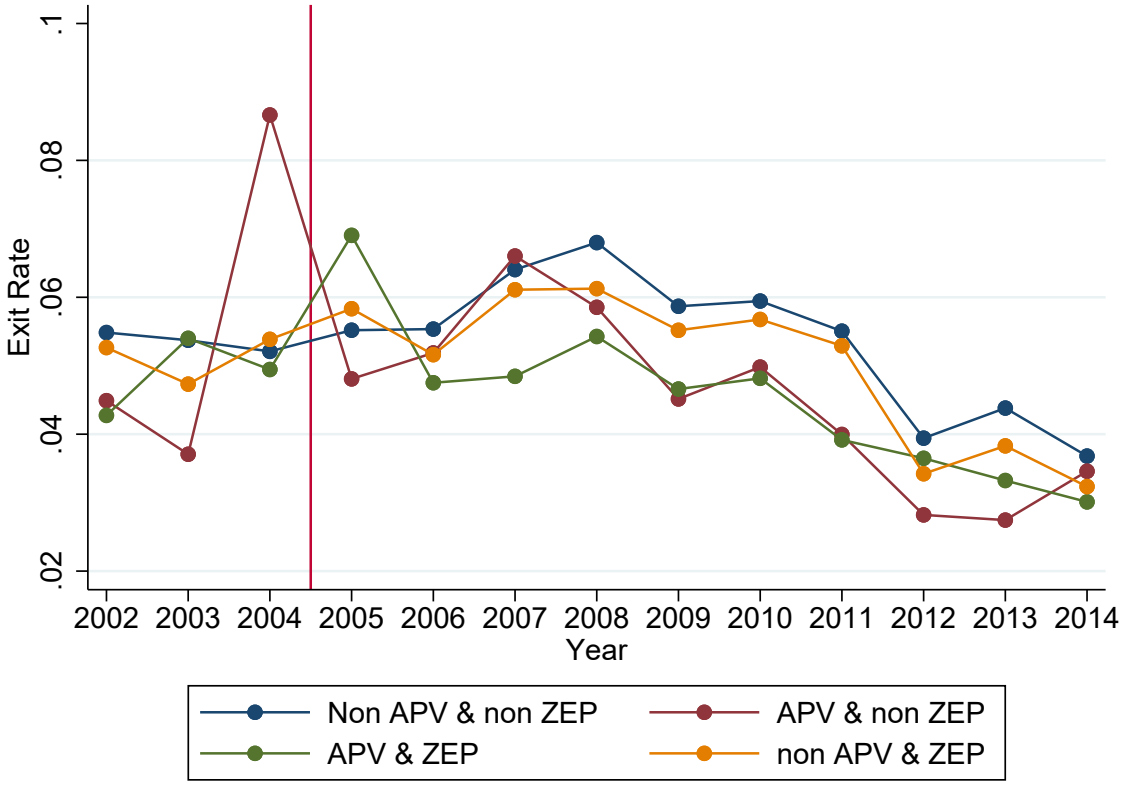
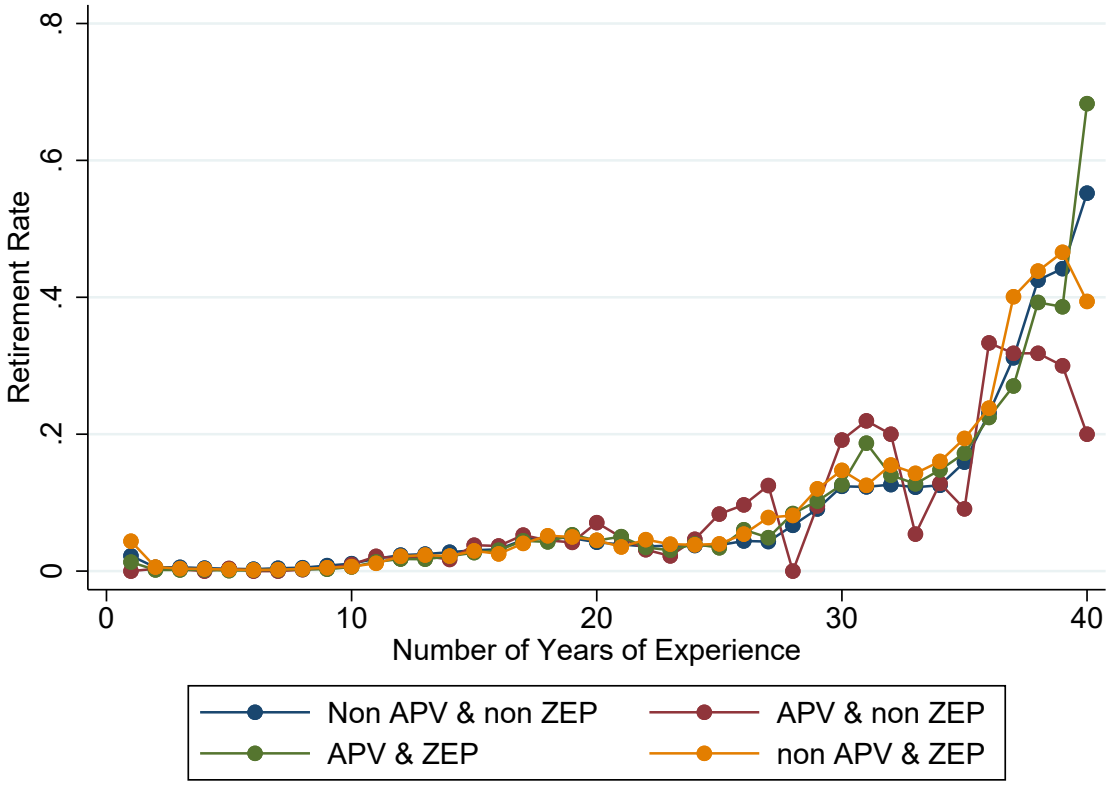


Figure A3 – Retirement Rate by Number of Years of Experience



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