Employment effects of Incentivized Gradual Retirement Plans

A.T.G.J. Rutten

M.G. Knoef

D.J. Van Vuuren

We investigate the effect of Incentivized Gradual Retirement plans (GRPs) on the retirement behavior of older civil servants and the employment of younger civil servants. GRPs aim to increase the labor participation of older workers, by offering older employees a reduction in working hours with only a limited decrease in net earnings, and little to no reduction in pension accrual. A second policy aim is that municipalities use this freed up capacity to hire more young employees. We exploit variation in the availability of GRPs between Dutch municipalities to identify its employment effects. Using a difference-in-differences design, we find that GRPs have a positive effect on employment of older civil servants (+257 hours over a period of 5 years). This positive effect is rooted in both an increase in hours worked (intensive margin) and an increase in the retirement age (extensive margin). We do not find an increase in the hiring of workers in the age group 18-30.

I Introduction

Most western countries are confronted with an increasing life expectancy and a decreasing fertility rate. Because of these developments, most countries implemented numerous reforms to increase the labor force participation rate among older workers (OECD, 2011). However, the implementation of these reforms raised questions about whether older workers are able to work longer. Therefore, different countries proposed different solutions. For instance, Austria implemented an early retirement scheme for workers in heavy occupations. In the Netherlands, several sectors chose to implement an incentivized gradual retirement plan[1] (hereafter referred to as GRP or the plural GRPs).

GRPs have been introduced in multiple sectors in the Netherlands such as construction, education, and various governmental organizations via collective labor agreements. The first goal of a GRP is to help older workers to reach the statutory retirement age healthily. This became especially important as the statutory retirement age has increased since 2013 and substitution pathways into early retirement have been reduced during the last two decades (de Vos, Kapteyn, & Kalwij, 2018). From an employer's perspective, there are also reasons to introduce a GRP. For instance, an employer benefits from healthy and motivated employees (Veth & Van Vuuren, 2020). A GRP tries to achieve these goals by giving older employees a strong reduction in working hours, a small reduction in salary, and little to no reduction in pension accrual. For example, the most often offered GRP plan in our data gives older workers the possibility to work 60% of their initial working hours while getting 80% paid and no discount on pension accrual. In other words, a GRP aims at creating an attractive package for older workers to reduce their working hours and increase their retirement age.

Goldin and Katz (2007) find that the labor force participation of older workers is partially determined by their skill compositions whereas Van Soest and Vonkova (2014) find that financial incentives play an important role. Euwals, Van Vuuren & Wolthoff (2010) find that individuals are more sensitive to the price of leisure than to changes in individual's pension wealth, indicating that the price of leisure is more important in the retirement decision. The introduction of GRPs reduce these opportunity costs. Lastly, the health of individuals (Weir, 2007) and social norms regarding labor force participation (Euwals, Knoef, & Van Vuuren, 2011) play as well an important role in labor force participation at higher ages.

The second goal of GRPs focus on the reduction of youth unemployment. As older workers reduce their labor supply, this could potentially create vacancies for younger workers and reduce youth

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[1] The Dutch name for those plans is "Generatiepact".

unemployment in particular regions of the Netherlands. Therefore, the GRP is meant to be an effective tool to create a good mix between young and old workers.[2]

Regarding the second goal, previous studies analyzed lump of labor fallacy, which concerns the substitutability of younger and older workers. They found that in the long-run these two groups are not substitutes when observing macro-economic data (Gruber & Wise, 2010). This means that youth and elderly unemployment tend to move in the same direction rather than the opposite, hinting at skill complementarity between those two groups (Kalwij, Kapteyn, & De Vos, 2010).

In the short run, however, younger and older workers could be substitutable. Vestad (2013) analyzes how an early retirement program for older Norwegian workers affects youth labor force participation. He finds that substitution between younger and older workers is almost one-to-one. In a similar vein, Boeri, Garibaldi, & Moen (2016) find that employers with a high number of senior workers were less likely to hire younger workers as a consequence of the increase in the retirement age.

We test whether a GRP in the Netherlands affected the labor supply of older workers and increased the number of younger workers working at municipalities, by making use of monthly Dutch administrative data for the period 2013-2018. We focus on municipalities with more than 100,000 citizens. As of January 2014, nineteen municipalities (out of 32 with more than 100,000 citizens) adopted a GRP. Our rich administrative dataset provides us with monthly data on income and monthly hours worked on the individual level, as well as a large number of socio-economic characteristics including birth year[3] and gender. This makes it possible for us to exactly pinpoint the effects of the GRPs.

Using the municipalities that did not adopt a GRP as the control group, we make use of a difference-in-differences framework to establish the causal effects of GRPs.[4] We observe that there is a common trend when comparing youth unemployment, indicating that youth unemployment differences likely did not play a role in the adoption of a GRP. Also, for the labor force participation of older civil servants, we find that the common trend assumption holds.

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[2] For local government institutions (i.e. municipalities), there are two other minor reasons to implement a GRP. First, municipalities should integrate workers with a distance from the labor market. Second, the GRP can provide additional opportunities for the disadvantaged group(s) (de Pijper, et al., 2019).

[3] We select older workers, who were born after 1950. Individuals born before 1950 were eligible for an attractive early retirement arrangement for older civil servants.

[4] Because the common trend assumption for older civil servants is less likely to hold when we include the four largest municipalities in the Netherlands, we exclude those from our main analysis. The regression results where we include the four largest municipalities are presented in Appendix IV.

Our contribution to the literature is threefold. First, we contribute to the retirement literature on revealed preferences. As gradual retirement plans are often offered via informal agreements, it is difficult to examine revealed preferences when a gradual retirement scheme is introduced (Elsayed, de Grip, Fouarge, & Montizaan, 2018). In our research design, however, it is perfectly clear how the gradual retirement plan looks like and who is eligible, which makes it possible to examine revealed preferences regarding retirement behavior. This as well helps us to identify the effect of gradual retirement plans on labor supply at higher ages (Gielen (2009), Albanese, Cockx, &Thuy (2020)). With these results, we add to the broader discussion on the employment of older employees (Bolhaar, Dillingh, & van Vuuren, 2017).

Second, we add to the literature regarding the substitutability between younger and older workers. Gruber and Wise (2010) and Bertoni & Brunello (2017) focus respectively on several countries and a region to analyze short-term substitution effects. We focus on a particular sector instead. Moreover, we address whether the job prospects of young civil servants are positively or negatively affected by the introduction of a GRP. In particular, when older civil servants enroll in a GRP it may provide younger workers the opportunity to climb the career ladder and obtain a higher wage (Mohnen, 2019). Third, we add to the already small existing literature on GRPs. Van Dalen and Henkens (2019) argue that especially older wealthy individuals would be interested in participating in a GRP. Veth and Van Vuuren (2020) conduct interviews with older workers that participate in a GRP that was offered by their employers (both government and non-government employers). Their results are in line with Kantarci and Van Soest (2008). They found that gradual retirement plans could reduce the burden of work, resulting in a decrease of work-related stress and the motivation of employees. Our paper is, to our knowledge, the first paper that quantifies the effect of a GRP on a larger scale by looking at the employment of older workers and the hiring of young employees within the local government sector.

Analyzing the labor supply of older civil servants, we find that the treatment group increases their labor supply by on average 2.8 hours a month. There is however large heterogeneity for different ages. Moreover, we find that this increase in labor supply is particularly present in the middle- and high- wage income groups. In other words, the GRPs in the low wage income group, which is most likely the group that needed the most help to reach the pension eligibility age healthily, is the group that does not face a significant increase in hours worked after GRPs are implemented.

Examining the second goal of a GRP, we use again a difference-in-differences framework to estimate whether municipalities with a GRP hire more young workers when compared to municipalities

without this program. We find that the number of younger workers does not significantly increase. In addition, we barely find an effect on wage growth.

The setup of the rest of this paper is as follows. Section II provides a literature review. Section III describes the institutional setting. Section IV discusses the descriptive statistics and section V describes the estimation method and the results. Lastly, section VI discusses and concludes.

II Literature Review

The aim of a GRP is twofold. The first aim of a GRP is to make sure that older workers can reach the pension eligibility age and, hence, to prevent older workers from dropping out of the labor force. The second aim of a GRP is to increase the employment rate of younger workers. To start with the already existing literature on the former, most OECD countries see an increase in the labor force participation of older workers. The Netherlands is no exception to this (Verkooijen, 2017). The first subsection provides an overview of the policies that may already have contributed to the increased labor force participation of older workers. In general, three types of policy measures affect the employment levels of older workers: supply-side policies, demand-side policies, and policies that influence institutional factors. For the latter factor, we limit ourselves to the Netherlands in this review. In the second subsection we discuss the substitutability between young and old workers.

II.A. Employment of older workers

The skill composition of workers is an important component for explaining the supply-side factor. Especially education plays an important role (Goldin & Katz, 2007). Their paper argues that an increase in education level increased labor force participation as the opportunity cost of not working is higher. Second, on the job training seems to have a positive effect on employment prospects for older workers in the Netherlands (Picchio & Van Ours, 2013). In particular, if workers know that they need to work longer, they have an incentive to maintain their skill level and therefore take up additional training (Montizaan, Cörvers, & De Grip, 2010).

Third, financial incentives play an important role for older workers to leave the labor force. For instance, it seems that during recession older workers are more likely to leave the labor force and retire. These effects are particularly strong for the lower educated workers who depend heavily on their first pillar pension benefits and therefore have lower opportunity costs to retire (Coile & Levine, 2011). On the other hand, lower income workers are more liquidity constraint. Therefore, they are more likely to work until higher ages (Bolhaar, Dillingh, & van Vuuren, 2017). The question how flexible labor supply at higher ages affect retirement decision and total labor supply is still an open question (Gielen, (2009); Machado & Portela, (2014); Hernæs, Jia, Piggott & Vigtel, (2020)). A paper

by van Soest & Vonkova (2014) use stated preferences to investigate whether older workers like to retire earlier with actuarially fair adjusted replacement rates. They find that retirement behavior is very sensitive to financial incentives. If the rewards for retiring later and the penalties for retiring earlier were reduced by 50%, this would result in a fall of the average retirement age by about 10 months. Analyzing the labor supply of older workers using vignettes, Elsayed et al. (2018) find that the full-time retirement age is on average one year later. However, the total labor supply decreases over the period by 3.4 months. This indicates that gradual retirement plans do not contribute to an increase in the aggregate labor supply of workers close to retirement. Analyzing revealed preferences, Euwals, Van Vuuren & Wolthoff (2010) exploit the variation in the starting dates of the transitional arrangements from actuarially unfair schemes to more actuarially fair schemes for older workers. They find that the individuals are more sensitive to the price of leisure (substitution effect) than to changes in an individual's pension wealth (wealth effect). This indicates that foregone wages is a more important opportunity cost than foregone pension accumulation. In a similar vein, Albanese et al. (2020) study the effect of a gradual retirement scheme in Belgium. They find that gradual retirement increases labor force participation at younger ages (below 60), but it decreases thereafter. This could be explained by employers who view enrollment into gradual retirement as a preference for early retirement. A fourth and fifth explanation for the increase in the labor supply of older workers is social norms (Euwals, Knoef, & Van Vuuren, 2011) and reference points regarding the retirement age (Behaghel & Blau, 2012). Lastly, the increase in health at older ages and the fact that higher educated jobs are less physically demanding makes it possible for workers to work at higher ages. Although health does on average decline with age, Weir (2007) shows that a large part of workers in their 60s and 70s are still physically capable of working.[5]

There are as well several demand-side factors that could explain an increase in the labor force participation of older workers. As the education gap between younger and older cohorts decreases, younger and older workers become closer substitutes. An analysis of US data shows that the oldest generation had on average 2.6 years less education when compared to the youngest generation in 1990. In 2030, it is projected to be only 0.5 years. The increase in substitutability is particularly the case in jobs where experience plays a dominant role, making it more attractive for employees to hire older workers (Goldin & Katz, 2007). On the other hand, age discrimination makes it more difficult for older workers to remain employed (Lahey (2008); Schippers & Vlasblom (2019)).

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[5]Damman & van Solinge (2017) use Dutch data to show that paid work is substitutable for unpaid (voluntary) work, indicating that older workers are not necessarily longer active in the labor force.

Lastly, several institutional changes increased the labor force participation of older workers. Limiting ourselves to changes in the Netherlands, the increase of the statutory retirement age as of 2013 and the abolition of publicly funded partner pension in 2015 provided a financial incentive for workers to work longer (Atav, Jongen, & Rabaté (2019); Doove, ter Haar, Schalken, & Span (2019)). Focusing on GRPs, one study shows that older workers with a high level of equity are particularly interested in a GRP (van Dalen & Henkens, 2019). Another interview-based study concluded that both employers and older employees are satisfied with the introduction of a GRP (Veth & van Vuuren, 2020). In particular, they find that the motivation and energy level of older workers increase when they participate in a GRP-arrangement, contributing to a positive effect on overall well-being. Kantarci and Van Soest (2008) find similar results for gradual retirement plans in general.

II.B. Substitution between younger and older workers.

Having discussed the literature on the employment levels of older workers, we now describe the existing literature on the substitutability between younger and older workers. Starting at long-run macroeconomic effects, Kapteyn, de Vos, & Kalwij (2010) examine the VUT arrangement in the Netherlands. This program was originally implemented in 1975. This arrangement aimed at reducing youth unemployment by letting older workers retire earlier. By analyzing time series data, they conclude that this program did not succeed in its goal. Instead, they found that there is a positive relationship between youth employment and the employment of older workers, indicating that younger and older workers compete in different segments of the labor market. These findings are in line with various other OECD countries (Gruber & Wise, (2010); Kapteyn, de Vos, & Kalwij, (2010)).

However, these estimates are based on long-run macro-data. Several studies find that in the short-run substitution is still possible. Vestad (2013) analyzes how a national early retirement program in Norway affected youth employment. He found that there is a one-to-one substitution between an older worker that retires early and every (young) new labor entrant. When focusing on micro-level data, Boeri, Garibaldi, and Moen (2016) analyze how an increase in the statutory retirement age in Italy affected youth employment. By making use of a database from the Italian social security administration, they can identify which private firms have a large share of workers that are exposed to this increase. They find that firms with a high number of senior workers significantly reduce youth hirings. More precisely, they find that out of 150 thousand youth jobs lost during the Great Recession, 36 thousand job losses can be attributed to the increase in the statutory retirement age. Bertoni & Brunello (2017) find similar results when analyzing the same reform while focusing on regional employment. However, Carta & Von Wachter (2021) find there does exist complementarity

between the hiring of younger and older workers. In particular, they find that that an increase in the number of older workers by 10%, increases in the number of young workers by 1.8%.[6]

III Institutional Framework

Before focusing on the GRPs in municipalities, it is important to know that other sectors in the Netherlands offer as well GRPs. For instance, the education sector, the engineering sector, and the construction sector offer similar plans. Also, some other governmental bodies, such as the provinces[7], have implemented GRPs. This shows that GRPs are becoming a widely implemented program in the Netherlands. This makes a large-scale economic analysis of its effects important. However, the municipality sector differs in several ways of other sectors in the Netherlands. For instance, the percentage of female workers tend to be slightly higher (2%-points) for civil servants when compared to the overall labor force.[8] Next to this, civil servants work more often full-time compared to the labor force (A+O fonds Gemeenten, 2018). The share of civil servants that are highly educated is also high when compared to other sectors. In 2014, 55.5% of all civil servants have obtained a form of higher education (Walstra, 2017). Besides, civil servants tend to be older than workers in other sectors. In particular, the group of workers above the age of 55 is almost twice as large in the municipality sector compared to the overall labor force (A+O fonds Gemeenten, 2014). Moreover, the sickness leave is as well higher when compared to other national organizations (A+O fonds Gemeenten, 2018). We first analyze why both demand and supply of labor are in favor of GRPs. Thereafter we discuss how GRPs were implemented in municipalities.[9] Lastly, we mention other potential municipality programs that may affect the take-up rate of a GRP.

Reasons for implementing a GRP

Both employers (labor demand) and employees (labor supply) could benefit from GRPs. In this paragraph, we discuss why each of these groups could be in favor of a GRP. Analyzing the employer's side, it is important to distinguish the two roles for local government bodies, namely the municipality as an employer and the municipality as a government institution. Both of these roles can play a role

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[6] The differences in the studies can most likely be explained by the use of different datasets. In particular, Boeri, Garibaldi, and Moen (2016) have data for the years 2008, 2011, and 2014 whereas Carta & Von Wachter (2021) have data for the period 2010-2014 for every year.

[7] The Dutch name for this governmental body is the "Provinciale Staten".

[8] In 2013, the percentage of female civil servants was 48% where in the overall labor force this percentage was equal to 46. In 2017, the percentage of female civil servants was 50% compared to 47% in the total labor force.

[9] The reason we limit our scope to municipalities is that for this group we can exactly determine at which municipality people work. We do not have data for private sector firms at the local level.

in implementing GRPs. From a government perspective, one of the main reasons is to be able to reduce youth unemployment. This is in line with the local government's task regarding labor market integration. This states that it is the task of municipalities to help workers find a job if they are unlikely to succeed in this task by themselves[10] (de Pijper, et al., 2019). Another reason for offering GRPs is to help disadvantaged young individuals with a migration background.

The municipality as an employer may as well have several reasons for implementing a GRP. First, a GRP could reduce personnel cost for older employees. Although their hourly wage will increase, their total wage will go down. Second, it may contribute to a good mix of younger and older civil servants. Across all Dutch municipalities, one out of every six employees is older than 60 in 2018. Besides, the average age of civil servants is two years higher when compared than the average age of the labor force (48.1 vs 46.3). Lastly, the amount of young civil servants below the age of 35 is on average 24 percentage points lower when compared to the average of the labor force (Bekkers, 2019). The implementation of a GRP could therefore be used to create a good mix of young and old workers.

Another reason to implement a GRP is to keep older workers healthy and productive. A reduction in working hours may for example reduce stress levels for older employees and/or increase a better work-life balance. Several older civil servants that participated in the GRP already indicated that they feel more energized when compared to the time they worked full-time. Besides, letting older workers work part-time until their pension eligibility age may have positive side effects. It could for instance lead to less days of sick leave and, hence, decrease labor costs. Second, it may lead to more motivated workers due to a better work-life balance. This could result in more satisfied employees and an increase in labor productivity (A&O fonds Gemeenten, 2020).

From the employee's side, Labor unions are in favor of GRPs for two reasons. First, it spares older workers and gives them more time to recover from their work. It is as well possible to see this as a claim for higher wages for the effective time worked. Second, the Dutch labor unions support this plan as they see it as a way to increase the employment chances of younger workers (although this argument is disputable when examining the literature as was done in the previous chapter). They argue that if, for instance, two older workers decrease their labor supply by 40% in a full-time contract, a young worker can receive a contract of 0.8 FTE. Apart from reducing youth unemployment, they as well claim that the quality of the jobs for younger workers may improve (FNV, sd).

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[10] In case the municipality thinks it is highly unlikely this person finds a paid job, then the focus will shift towards any form of participation within the society.

The Incentivized Gradual Retirement Plans

As of 2014, some municipalities adopted a GRP. It is important to know that municipalities can decide on their own whether they adopt a GRP or not. More precisely, the option of offering a GRP can be part of a collective labor agreement when this is the outcome of the negotiations between the social partners. However, this does not mean that every municipality is obliged to offer a GRP once it is part of the collective labor agreement. Investigating the aims of GRPs, the goal of this plan is twofold. First, it should prevent older civil servants working at municipalities to drop out before reaching the statutory retirement age. Second, as older employees start to reduce their labor supply, local municipalities need to hire new workers. Municipalities aim to fill these vacancies with young employees, thereby reducing local youth unemployment.

Focusing on the first goal, due to the increase of the Dutch statutory retirement age to 66 in 2018, it is unknown how many workers can work full-time at higher ages. Therefore, Dutch municipalities offer their older employees different forms of GRPs that allows them to work less with a small reduction in salary and no (or little) reduction in pension accrual. These programs are, for instance, abbreviated in the form of 60-80-100. This means that a civil servant works 60 percent of his initial working hours against 80 percent of his original salary while maintaining a 100 percent pension accrual when participating in a GRP.[11] Other arrangements such as 50-75-100 or 80-88-88 have a similar meaning. Once a civil servant participates in a GRP, the decision cannot be reversed. More precisely, provided that the civil servant does not switch to another sector, he or she will be paid according to what is agreed upon in that particular GRP up to reaching the statutory retirement age. Moreover, in the case of disability, only the employee can decide to end the participation in a GRP. Lastly, the employer may decide in some cases that a particular person is not allowed to enroll in a GRP. This could be the case when a certain department already has a large number of civil servants enrolled in a GRP and the head of that department fears that a further reduction of experienced workers may negatively affect the department's productivity.

It is important to note that each municipality decides on its own 1) whether it offers a GRP for its older employees and 2) in what form, which creates heterogeneity between GRPs across municipalities. Niemeijer (2017) shows that smaller municipalities are often not willing to introduce a GRP. This is because smaller municipalities are not able to free-up sufficient capacity to hire younger employees. However, also when looking at larger municipalities with more than 100,000 citizens, there is considerable variation between municipalities that introduce a GRP and those that do not.

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[11] Note that the Netherlands has a progressive income tax, meaning that the net differences before participating in the municipalities GRP and thereafter is smaller than a decrease in salary of 20 percent.

Table 1 below provides an overview of which municipalities did and did not introduce a GRP over the period 2012-2018. We focus on these years as those are the years we have data on as we will show in the next section. The treatment group consists of all municipalities that adopted a GRP in the period 2012-2018 and have more than 100,000 citizens. The control group consists of municipalities that did not adopt a GRP in the period 2013-2018 and have more than 100,000 citizens.

Treatment Group (municipalities with GRP)	Control group (municipalities without GRP)
Den Haag	Amsterdam
Utrecht	Rotterdam
Eindhoven	Almere
Groningen	Breda
Tilburg	Apeldoorn
Nijmegen	Zaanstad
Haarlem	Arnhem
Enschede	`s-Hertogenbosch
Amersfoort	Zoetermeer
Haarlemmermeer	Maastricht
Zwolle	Dordrecht
Leiden	Venlo
Leeuwarden	Ede
Alphen aan den Rijn	
Westland	
Alkmaar	
Emmen	
Delft	
Deventer	
Total: 19	Total: 13

Table 1 Overview of treatment and control group

Table 2 shows an overview of the type of GRP that each municipality in the treatment group offered. In particular, Table 2 shows that there are several dimensions in which GRPs differ across municipalities. To start with, the age at which a civil servant can enroll differs. Most municipalities allow civil servants to enter the program when they reach the age of 60. Deventer, Alkmaar, and Zwolle, however, allow people to enter earlier as of age 55, 57, and 58, respectively. There are as well some municipalities that only allow workers to enroll in the program after they reach the age of

60. More precisely, Westland, Eindhoven, and Amersfoort have an eligibility age of 61, 62, and 63, respectively. Analyzing the contractual details, some municipalities require civil servants to have a minimum number of service years at that municipality, while others require them to have a permanent contract. Municipalities like Tilburg and Alphen aan den Rijn require both a minimum number of service years and a permanent contract. Focusing on the minimum hours that an employee needs to work after participating in a GRP, there is as well variation between municipalities. Most municipalities do not require a minimum number of hours that need to be worked after participating. However, Deventer and Amersfoort require a minimum amount of working hours of at least 21.6 hours, the highest of all municipalities that adopted a GRP. When examining the options regarding payment, most municipalities offer a GRP in which there is no discount on pension accrual. However, some municipalities like Enschede, Zwolle, Emmen, and Deventer offer a discount on pension accrual once participating. In case the program has the word "different" as an option it means that there is the possibility to tailor a GRP for each civil servant that wants to participate. Lastly, the starting dates of a GRP across all municipalities are somewhere between January 2014 and July 2018.

In Appendix I, we discuss whether endogenous adoption could have played a role in the adoption of GRPs by comparing the youth unemployment rates (25-45), the difference in political orientation between the treatment and control group before the GRPs were implemented, and the financial position of municipalities. We conclude that there is a common trend across treatment and control municipalities. Regarding the voting behavior we only observe small differences, but none are significant at the 5% level when focusing on the p-value. The same holds as well for the financial position when comparing solvency ratios between the treatment and control group. Moreover, we do not see that over time the inflow of older workers is higher in municipalities with a GRP when compared to municipalities without a GRP.

Other programs & limitations

Having discussed the GRPs and its details for multiple municipalities, it is also important to discuss other programs that may affect the willingness of civil servants to participate in a GRP. For instance, civil servants born before 1950 could make use of the FPU-arrangement. This arrangement made it attractive for workers to retire earlier than the statutory retirement age. Other programs that make it less likely for participants to participate in a GRP are the "55-years arrangement" and the "60-years arrangement"[12]. The content of these arrangements differs per municipality and are therefore often

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[12] The implementation of these programs do not coincide with the adoption of a GRP.

informal arrangements between the municipality and their employees (i.e. they are not the same for all municipalities in the Netherlands). For instance, in the municipality of Alkmaar, it is possible to work fewer hours a week (up to 2.5 hours) without receiving any discount in salary. In Amsterdam, however, it "only" states that a civil servant does no longer has to work night shifts and overtime after reaching a particular age. It is important to note that these arrangements exist in municipalities regardless of whether they adopted a GRP or not, indicating that these arrangements are not a substitute for GRPS.

Moreover, several financial incentives for older civil servants changed over the period 2013-2018. Considering the labor supply side, the work bonus[13] was abolished for workers born after 1953. This both affected civil servants in the treatment and control group. The work bonus consisted of an income-dependent tax credit for older workers, which made it more attractive to continue working (Ambtenarensalaris.nl, 2020). Considering the labor demand side, the premium discount for younger and older workers was replaced by a wage cost-benefit scheme as of January 2018[14]. The latter is as well a premium discount for workers with a distance from the labor market, but the new discounts are less generous when compared to the previous premium discounts (Rijksoverheid, sd). This affects both the treatment and control group equally.

Lastly, when looking at the effect a GRP has on hiring younger workers it is important to know that municipalities could receive a subsidy via the A&O fund[15] (when hiring young employees in the period 2015-2018. The effect of this subsidy is unknown as municipalities seemed unresponsive to incentive changes to remain eligible for the subsidy.[16] Therefore, the Ministry of Internal Affairs concluded that the subsidy did not seem to have a big influence on the hiring decision of municipalities in the first place (Ministry of Internal Affairs, 2019). All the above mentioned financial incentives affect both the treatment and control group. In other words, it is not likely that either our treatment or control group is affected by the change in financial incentives.

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[13] In Dutch: werk bonus.
[14] In Dutch: Loonkostenvoordelen (LKV).
[15] In Dutch: A&O fonds gemeenten.
[16] In 2018, municipalities had to offer young employees a two-year contract instead of one. However, rarely did municipalities deviate from the standard one-year contract they regularly offered.

Municipality	Minimal age	Minimal service years	Option(s)	Start-date (dd-mm-yyyy)	Permanent contract	Minimum hours after GRP
Den Haag	60	2	60-80-100	01-10-2015	X	-
Utrecht	60	-	60-75-100	01-03-2016	X	-
Eindhoven	62	-	60-75-100 60-80-100	01-04-2017		-
Groningen	60	1	Different[a]	01-01-2014		-
Tilburg	60	5	80-90-100	01-07-2018	X	14.4
Nijmegen	60	-	50-75-100 60-80-100 80-90-100	01-09-2017	X	-
Haarlem	62 (60)	-	60-80-100 (80-90-100)[b]	01-04-2017 (01-04-2018)		18
Enschede	60	-	80-80-90 60-70-85	01-02-2016		16
Amersfoort	63	-	60-70-100	01-10-2017	X	21.6
Haarlemmermeer	60	-	60-80-100	01-07-2018		-
Zwolle	60 (58)[1]	-	80-90-90 (80-95-95)	01-07-2017 (01-10-2017)	X	18
Leiden	60	5	Different[c]	01-05-2016		-
Leeuwarden	60	3	80-90-100	01-05-2016		18
Alphen aan den Rijn	60	2	70-85-100	01-04-2017	X	18
Westland	61[2]		60-80-100 80-90-100	01-01-2017		-
Alkmaar	57[3]	5	50-75-100 65-80-100 80-85-100	04-01-2018		-
Emmen	60	1	80-90-90	01-03-2015		18
Delft	60[4]	0	60-80-100 80-90-100 50-70-100	01-01-2017		-
Deventer	55	1	80-88-88 60-76-76	01-10-2015	X	21.6

Table 2: Overview of GRP across municipalities. 1: The municipality of Zwolle changed their GRP in October 2017, 3 months after the initial implementation. Another option became available (80-95-95) as well as a decrease in the eligibility age. 2: 5 years prior to pension eligibility age, 3: 10 years prior to pension

eligibility age, 4: 7 years prior to pension eligibility age. a: their GRP was here part of a Social arrangement, b: that option became one year later available, c: An employee can ask for a reduction of working hours up to 40%.

Sources: Gemeente Alkmaar (2018), Alphen aan den Rijn (2017), Gemeente Amersfoort (2017), Gemeente Delft (2016), Gemeente Den Haag (2015), A+O fonds Gemeenten (2015), Gemeente Eindhoven (2017), Gemeente Emmen, A+O fonds Gemeenten (2016), Gemeente Groningen (2013), Gemeente Haarlem (2017), Gemeente Haarlem (2018), Gemeente Haarlemmermeer (2019), Gemeente Leeuwarden (2016), Gemeente Leiden (2018), Gemeente Nijmegen (2017), Gemeente Tilburg (2018), Gemeente Utrecht (2015), Gemeente Westland (2016), and Gemeente Zwolle (2015), and Gemeente Zwolle (sd).

IV Descriptive statistics

Having discussed the institutional framework, this section describes the data we use. We focus on municipalities with more than 100,000 citizens. We focus on big municipalities as smaller municipalities may be less likely to introduce a GRP (Niemeijer, 2017). We will implement in section V a difference-in-differences strategy to analyze the effect of GRPs. Therefore, we will order the data in this section into a treatment and control group. The treatment group consist of those municipalities that obtain a GRP in the period 2012-2018. The control group consist of municipalities that do not introduce a GRP (see table 1 for an overview of treated and non-treated municipalities). We as well check whether the common trend assumption holds, which is the key identifying assumption of a difference-in-differences design. In this case it means that there is a common trend visible in the number of hours worked before a GRP is implemented. The same also holds for the percentage of young civil servants employed by a particular municipality. We show this common trend later in the subsection graphical evidence.

We use administrative microdata from Statistics Netherlands to analyze the effects of GRPs. Using these data[17], we construct the number of old and young civil servants that work at a particular municipality in a particular month over the period 2012-2018.[18]

We select older workers at municipalities as follows. We select older workers that worked for one municipality continuously since 2010. Older workers are 60 years or older and should be born after 1949. By selecting older civil servants in this way, we make sure that the FPU-early retirement arrangement does not play a role in determining the effect of a GRP. Moreover, we drop civil servants that are employed by more than one employer in the period 2012-2018.[19] Besides, we omit

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[17] We will make use of the following files: gbahuishoudensbus, spolisbus, gbapersoontab, gemeentestpltab. The latter file is used to pinpoint in which municipality a civil servant works. More precisely, when using the "rinpersoons", "rinpersoon", and "ikvid" number from spolisbus after determining that individuals have the "scaosector" of a municipality, we can match the likewise named variables with the variables in gemeentestpltab.

[18] See section III Other programs & limitations.

[19] The reason for this is twofold. First, we do this to drop older civil servants that select into GRPs to increase their labor supply in another sector. In particular, if older workers use the municipalities' GRP to increase their labor supply in another sector, then a GRP does not help workers to remain employable at a higher age. As we want to test the latter, it does not make much sense to have workers in our sample that use the municipalities' GRP for other reasons. Second, it is impossible to determine the effect of the introduction of GRP for civil servants that are employed by multiple or switch between municipalities. In particular, consider a civil servant to increase his or her labor supply in a municipality without a GRP and decreases their labor supply in a municipality with a GRP. This pattern can arise because 1) one municipality has an increase in demand and the other one a decrease or 2) the civil servant participated in the municipalities' GRP and as a result of this decrease in his or her labor supply in one municipality and increases his or her labor supply in the other one.

observations for civil servants that are employed after the statutory retirement age.[20] In case civil servants retires earlier than the pension eligibility age, we set their labor supply and earnings equal to zero for all months until they reach the pension eligibility age. In case the pension eligibility age is later than December 2018 and stopped working before December 2018, we set their labor supply and earnings equal to zero until the previously mentioned date. We define younger workers when they are older than 18 and younger than 30. For younger workers, we do not impose any restrictions. More precisely, this means that younger workers are allowed to have multiple employers. The reason we do this is that the introduction of a GRP does not necessarily mean that younger workers get a full-time contract at a municipality.[21]

In our dataset, we have several socioeconomic variables on each civil servant as well as work-related variables. Regarding the socioeconomic variables, we observe the civil servants' gender, birthdate, age, the presence of children in the household, and their marital status. Regarding the economic variables, we observe the monthly salary, the monthly hours worked, the number of full-time days per month as well as the number of days a civil servant was employed in a particular month. These last two variables allow us to create a part-time factor for each civil servant in a particular month. This part-time factor is defined as hours worked divided by full-time hours. The part-time factor allows us to measure how the labor supply of civil servants increases (or decreases) at the intensive margin. Therefore, we expect the part-time factor for older workers to decrease at municipalities after a GRP is introduced. Tables 2-5 below provide summary statistics of older and younger workers based on the adoption of a GRP. In other words, we divide our statistics into a treatment and control group. We omit the four largest municipalities Amsterdam, Rotterdam, Den Haag, and Utrecht (hereafter referred to as G4). When including these municipalities, it seems that the common trend assumption does not hold. In Appendix II, we show graphs that visualize this problem.

Tables 2 and 3 below provide summary statistics for older civil servants at municipalities (with more than 100,000 citizens) that did and did not adopt a GRP in the period 2012-2018. Observing the monthly income of civil servants at municipalities that did and did not adopt a GRP, we see that the income of civil servants working in a municipality without GRP increases over time. In 2012, the difference between those groups was €426, - and in 2018 this has decreased to €323, -. This

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For all municipalities in the Netherlands, this means that we drop 40% of all our observations over the period 2010-2018.

[20] The main aim of the GRPs are to let older civil servants reach the pension eligibility age. If civil servants decide to continue working after the pension eligibility age, this can be due to other institutional factors as well such as the Continuing to Work Act (in Dutch: "Wet langer doorwerken na AOW").

[21] This is approximately 5% of our sample.

decreasing wage gap is associated with a smaller decrease in the part-time factor as well as working hours for municipalities that introduced a GRP. For municipalities without a GRP, this decrease is larger.

	Municipalities without GRP – older workers (60+) Excl. G4						
Variable/year	2012	2013	2014	2015	2016	2017	2018
Income	3206	2625	2467	2279	2289	2338	2258
Working Hours (month) (Part-time factor)	121.1 (0.78)	100.7 (0.64)	92.8 (0.59)	83.4 (0.53)	81.6 (0.52)	79.4 (0.50)	78.0 (0.49)
% male	67.5	66.4	65.7	64.3	63.2	62.3	60.4
% 1st immigrant	6.6	6.2	5.7	5.8	5.7	5.8	5.8
% 2nd immigrant	6.1	6.3	6.3	6.5	6.7	6.5	6.4
%married/ cohabiting	79.5	78.7	78.8	78.4	77.7	77.2	76.5
% with child	19.9	17.6	17.2	16.8	16.2	16.7	17.5
Mean age	61.2	61.7	62.2	62.5	62.7	62.9	63.0
Number of observations	18,237	27,039	36,134	42,821	46,500	50,061	53,069
Number of municipalities	11	11	11	11	11	11	11
Civil servants	5,982						

Table 3: Summary statistics for older workers working at municipalities that did not adopt a GRP

	Municipalities with GRP – older workers (60+) Excl. G4						
Variable/year	2012	2013	2014	2015	2016	2017	2018
Income	2780	2267	2142	2012	2029	2056	1935
Working Hours (month) (Part-time factor)	101.1 (0.65)	87.3 (0.56)	80.4 (0.51)	73.4 (0.47)	71.6 (0.46)	68.9 (0.44)	66.3 (0.42)
% male	63.7	63.7	63.0	62.5	60.6	59.3	57.9
% 1st immigrant	5.4	5.3	5.2	5.1	5.0	5.0	4.9
% 2nd immigrant	4.9	5.2	5.1	5.4	5.5	5.5	5.7
%married/ cohabiting	79.3	79.0	78.7	78.4	78.0	78.1	77.3
% with child	18.5	16.8	16.6	16.3	16.1	16.2	16.9
Mean age	61.2	61.7	62.2	62.5	62.7	62.8	63.0
Number of observations	28,885	42,585	57,740	70,318	78,305	84,491	90,612
Number of municipalities	17	17	17	17	17	17	17
Civil servants	8,407						

Table 4: Summary statistics for older workers working at municipalities that adopted a GRP

Discussing the socioeconomic characteristics, we observe that the percentage of male workers is approximately equal between municipalities with and without GRP. The same holds as well for the percentage of married / cohabiting civil servants. When considering immigrant status, municipalities without a GRP tend to have both a higher rate of first and second-generation immigrants. More precisely, municipalities with a GRP have 4.9-6.6% first or second-generation immigrants whereas municipalities without GRP have 5.7-6.7% of immigrants working as civil servants. Lastly, the mean age is the same in each year for both groups when rounded to one decimal. In total, we have 14,389 unique observations of which 5,982 are working for municipalities without a GRP, and 8,407 are employed for municipalities that introduce a GRP over the period 2014-2018.[22]

Tables 4 and 5 show the summary statistics for younger civil servants aging from 18-30. We again show the summary statistics separately for workers that work for municipalities with and without a GRP. The differences between those two groups are again small. We observe that the mean monthly income, the part-time factor, and the mean of working hours per month are approximately equal. The percentage married / cohabiting and the percentage with child is approximately 2-6%points higher for municipalities without a GRP.

Lastly, the age difference between younger civil servants that work at municipalities with and without a GRP is almost negligible. In total, we have 6,184 young civil servants that work for municipalities without a GRP and 8,274 civil servants that work for municipalities that introduce a GRP over the period 2013-2018.

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[22] We allow workers to work for another municipality for the period 2013-2018. This means as well for instance civil servants could be employed for a municipality that did not have a GRP in the period 2013-2015 and thereafter switch to a municipality with a GRP. However, we find the number of civil servants switching between those groups (and switching to both sides) to be very small (less than 25. The amount is 25 when we include G4 municipalities). Therefore, we do not believe that self-selection plays an important role.

	Municipalities without GRP – younger workers (18-30) Excl. G4						
Variable/year	2012	2013	2014	2015	2016	2017	2018
Income	2181	2092	1736	1989	2022	2126	2215
Working Hours (month) (Part-time factor)	132.6 (0.86)	134.4 (0.86)	133.2 (0.86)	137.4 (0.87)	138.6 (0.85)	153.9 (0.87)	135.3 (0.87)
% male	47.8	48.7	58.7	51.1	51.4	49.9	47.7
% permanent contract	74.1	73.0	73.3	61.5	61.8	60.4	61.6
% 1st immigrant	4.3	3.8	3.1	3.7	3.8	4.8	4.2
% 2nd immigrant	12.6	12.7	10.4	12.6	12.2	12.2	11.8
%married/ cohabiting	74.4	75.8	76.9	74.2	73.8	73.3	71.3
% with child	42.7	44.1	49.5	43.9	42.3	42.6	40.0
Mean age	26.3	26.6	26.3	26.5	26.4	26.4	26.5
Number of observations	18,391	14,900	16,624	13,370	14,446	15,295	16,976
Number of municipalities	11	11	11	11	11	11	11
Civil servants	6,184						

Table 5: Summary statistics for younger workers working at municipalities that did not adopt a GRP

	Municipalities with GRP – younger workers (18-30) Excl. G4						
Variable/year	2012	2013	2014	2015	2016	2017	2018
Income	2439	2137	2054	1982	1984	2167	2309
Working Hours (month) (Part-time factor)	137.2 (0.88)	137.7 (0.89)	130.8 (0.84)	126.6 (0.82)	124.7 (0.80)	127.0 (0.82)	130.4 (0.84)
% male	47.0	47.4	48.0	47.3	47.6	45.5	44.6
% permanent contract	65.6	66.8	63.5	56.5	49.3	48.4	53.2
% 1st immigrant	4.0	3.2	3.3	3.2	3.0	3.3	3.2
% 2nd immigrant	11.7	11.3	11.3	11.6	11.4	12.2	13.1
%married/ cohabiting	72.3	73.1	72.6	71.7	70.6	68.0	67.6
% with child	37.6	37.6	37.4	38.9	39.0	37.9	34.6
Mean age	26.6	26.6	26.6	26.4	26.3	26.4	26.4
Number of observations	21,415	17,641	15,940	15,706	17,703	20,005	22,298
Number of municipalities	17	17	17	17	17	17	17
Civil servants	8,274						

Table 6: Summary statistics for younger workers working at municipalities that adopted a GRP

Graphical evidence

Having discussed the differences between municipalities with and without a GRP, it is important to analyze whether there is a common trend between those two groups of municipalities as it is the key identifying assumption in a difference-in-differences framework. Figure 1 shows the monthly average hours worked of civil servants above 60 at municipalities with and without a GRP. We observe that in the years 2012 and 2013 there is a common trend between the (treated) municipalities with a GRP and the (non-treated) municipalities that did not adopt a GRP. After 2014, the monthly average hours worked starts to decline while the gap between the treatment and control group slightly decreases over time. In Appendix II, we plot the same graph but include the G4 municipalities. We observe that there is a spike around January 2015. Overall, however, the pattern does not change compared to the graph shown in Figure 1.
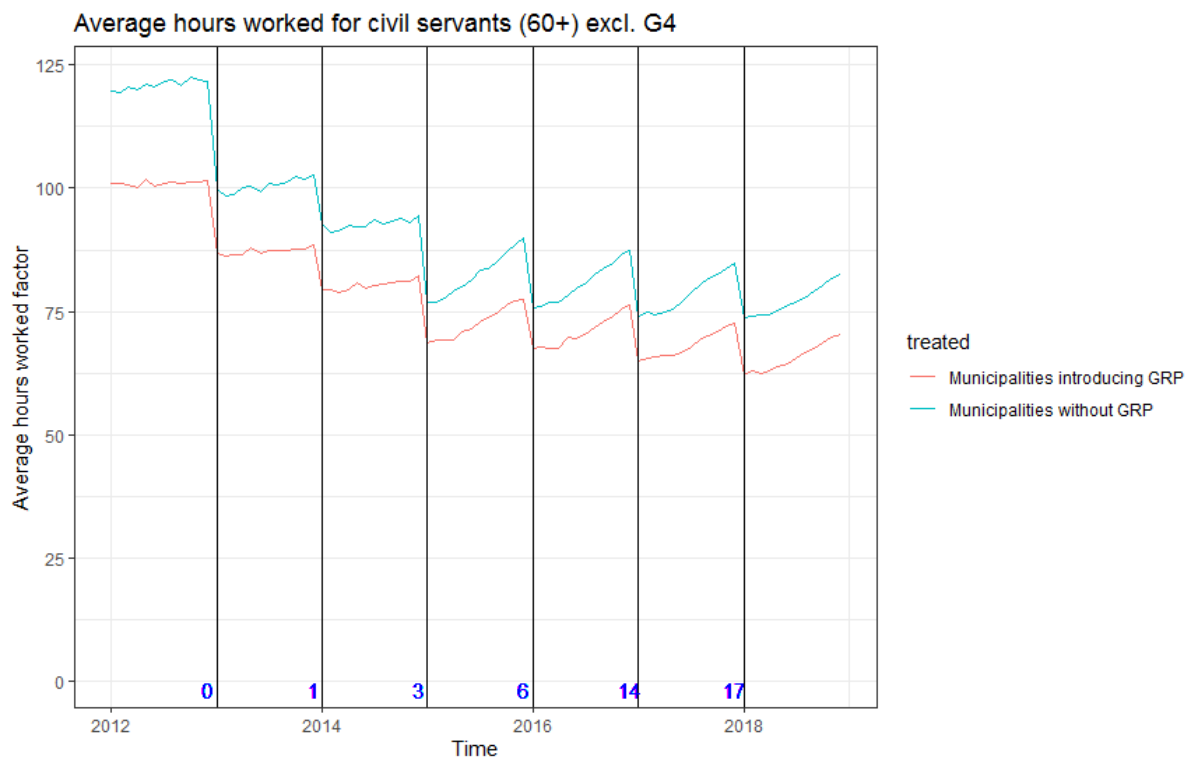
Figure 1: Average hours worked for civil servants (60+) for municipalities that did and did not adopt a GRP. The vertical lines accompanied by a blue number indicate how many municipalities adopted a GRP in that year or earlier (i.e. 2014 there was one municipality, 2015 there were 4 municipalities, etc.).

Figure 2 shows the extensive margin for the (treated) municipalities with a GRP and the (non-treated) municipalities that did not adopt a GRP. More precisely, we create an intensive margin variable that is equal to unity in case a civil servant works at least one hour in a particular month. If the civil servant does not work, this variable is equal to zero. We observe that there is a large decline in the intensive margin between the treatment and control group. More precisely, in 2012 there is a

difference of approximately 0.2 between the treatment and control group. At the end 2018, this is gap decreased by approximately 0.1. This may indicate that under the GRP workers are better able to work longer.[23]
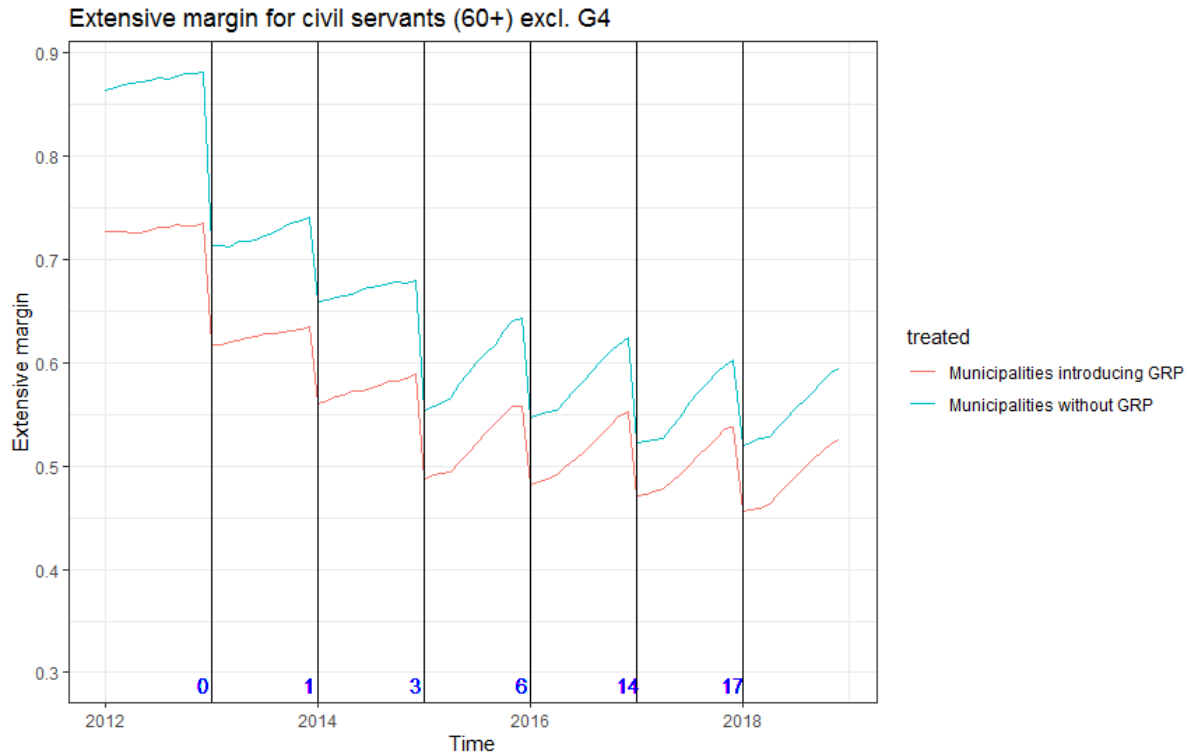

Figure 2: Extensive margin for older workers (60+) for municipalities with and without a GRP

Figure 3 shows the monthly percentage of young civil servants employed at municipalities with and without a GRP. More precisely, we divide the number of young civil servants (18-30) by the total amount[24] of active civil servants for the treatment and control group separately. After multiplying this number by 100, we get the percentage of young civil servants working at municipalities for each month. In the year 2013, we again observe a common trend between municipalities that adopted and did not adopt a GRP. We as well observe that for both the treatment and control group the percentage of young civil servants increase over time. Lastly, we observe an increase in the number of young civil servants in the last quarter of each year followed by a drop in the number of civil servants in January. This is probably due to the inflow of young workers trainees by municipalities.

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[23] Note, that despite our dataset ends at 2018, we still have data that indicates whether civil servants are still employed in January 2019. Therefore, we do not have to exclude December 2018 from our analysis.

[24] All civil servants are defined as all civil servants born after 1950. In this way, we prevent that the FPU-arrangement may affect the percentage of young workers employed in a particular month.

The sharp decrease is in line with a large group of young civil servants that leave the municipality within one year.[25]

Unlike the previous figure, it is hard to observe any increasing or decreasing trend for the treated and non-treated municipalities.[26] We observe a similar pattern. We as well plot the absolute number of young workers between the treatment and control group in Appendix II.
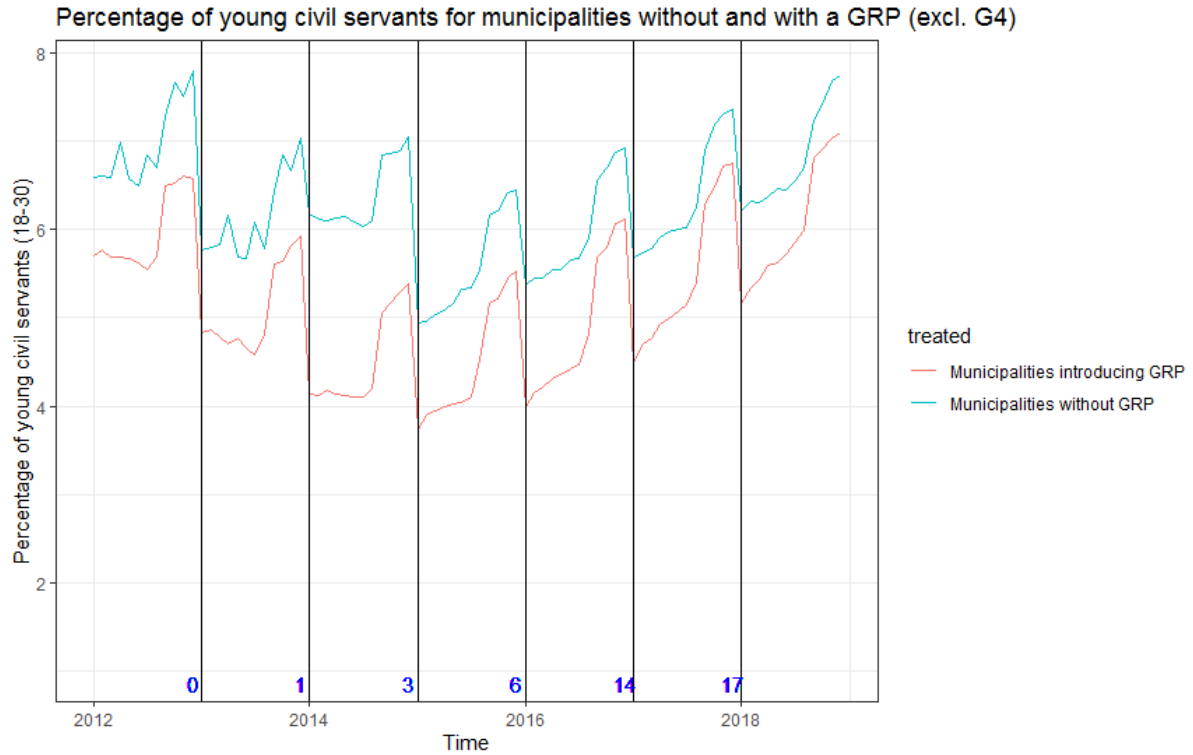
Figure 3: The number of young civil servants working at municipalities that did and did not adopt a GRP. The vertical lines accompanied by a blue number indicate how many municipalities adopted a GRP in that year or earlier (i.e. 2014 there was one municipality, 2015 there were 4 municipalities, etc.).

V Estimation method & results

We analyze the effect of GRPs on the labor supply of older workers and the hiring of younger workers. We use a difference-in-differences approach, comparing civil servants in municipalities with and without GRPs, before and after the GRPs become available. Generally, we estimate a regression of the form:

$$y_{imt} = \alpha + \gamma_t + \lambda_m + \beta_1 D_{imt} + \beta_2 A_{imt} + \beta_4 X_{it} + \epsilon_{imt} \qquad (1)$$

---

[25] For all young starting civil servants, approximately 11% leave within one year. Reasons for leaving are a large amount of bureaucracy. More than 50% of young workers indicates that this is their main reason to leave. This is followed by finding it difficult to climb the career ladder (Bekkers, 2020).
[26] In Appendix II, we show similar graphs as in figure 5 but here we include the G4 municipalities.

Here y_{imt} denotes the labor supply of individual i at municipality m in month t, in terms of monthly hours worked (intensive and extensive margin) or the participation rate (only extensive margin). α is a constant. γ_t and λ_m denote time dummies for each year-month combination and municipality dummies, respectively. The variable D_{imt} is a dummy variable equal to unity when an individual works at a municipality that has a GRP available in that month. Its coefficient captures the effect of a GRP on labor supply. The vector X_{it} contains control variables and A_{imt} denotes a set of dummies for the ages 60 to 65. We control for gender, first- and second-generation immigrant, marital status, and whether the civil servant has children living at home. In addition to the basic specification, we also run a regression where we add an interaction term of age and GRP: $A_{imt} * D_{imt}$. Lastly, ϵ_{imt} denotes the error term.

We first analyze the effect of a GRP on monthly hours worked for older civil servants. We restrict our estimation to civil servants born after 1949. We do this to prevent any interference with attractive early retirement arrangements (FPU) for which older civil servants may still have been eligible (see section III). Second, we analyze the effect of GRPs on the participation (extensive margin) of older civil servants. We also perform this analysis for different wage income groups. Finally, we estimate the effect of GRPS on the hiring of young civil servants (18-30) and whether GRPs affect the wage growth of these younger workers.[27]

V.A. Labor supply of older civil servants: intensive and extensive margin

We first analyze the number of monthly hours worked of older workers (age 60+), which is available on a monthly basis. Our main coefficient of interest is the difference-in-differences estimator β_1 in regression (1) and the coefficient for the interaction of age and GRP. In casa a GRP increases (decreases) total labor supply, we expect these coefficients to be positive (negative) (see section IV).

We observe that a GRP increases the number of monthly hours worked by 2.1-2.8 hours (see Table 7, column 1 and 2). This increase is significant at the 1% level. In other words, civil servants that can enroll in a GRP work on average two hours more per month when compared to municipalities where a GRP is unavailable[28].

We compare the effect of GRPs at a particular age by adding interaction terms (columns 3). We observe a significant negative baseline effect of nearly minus four hours per month. Moreover, we observe significantly positive interaction effects between the ages of 62 and 65. At those ages civil servants work significantly more hours per month when compared to the control group. For instance,

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[27] In Appendix IV, we display the results when we include the G4 municipalities.
[28] In Appendix III we show that the results of a GRP are not much different between male and female civil servants.

at the age of 65 civil servants in the treatment group work on average $-3.9 + 16.8 = 12.9$ more hours per month when compared to civil servants who are not able to make use of a GRP[29].

EXCL. G4 Older civil servants (60+): Intensive and extensive margin combined		
D_{imt}	3.133***	2.765***	-3.859***
	(0.864)	(0.828)	(1.348)
$D_{imt} * age(61)$			0.024
			(0.938)
$D_{imt} * age(62)$			4.579***
			(1.342)
$D_{imt} * age(63)$			9.884***
			(1.579)
$D_{imt} * age(64)$			13.298***
			(1.747)
$D_{imt} * age(65)$			16.817***
			(1.697)
Male		18.389***	18.406***
		(0.896)	(0.896)
1st generation immigrant		3.797*	3.783*
		(1.978)	(1.981)
2nd generation immigrant		4.516**	4.502**
		(1.838)	(1.835)
Kidsdummy		5.488***	5.486***
		(1.066)	(1.066)
married		-6.488***	-6.503***
		(1.053)	(1.054)
Age dummies			
61		-3.823***	-3.819***
		(0.309)	(0.380)
62		-10.246***	-11.395***
		(0.506)	(0.626)
63		-18.962***	-21.789***
		(0.694)	(0.876)
64		-32.132***	-36.402***
		(0.872)	(1.106)
65		-62.997***	-69.614***
		(0.962)	(1.189)
α	126.293***	118.821***	118.718***
	(4.579)	(4.481)	(4.479)
Controls	NO	YES	YES
Municipality FE	YES	YES	YES
Time FE	YES	YES	YES
Adj. R^2	8.8%	15.4%	15.5%
Civil servants	14,389	14,389	14,389

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[29] In case we include the G4 municipalities, the sign and significance of the coefficient does not change much. The magnitude is approximately the same. See appendix IV.

Table 7 The effect of adopting a GRP on the number of monthly hours worked for older civil servants. Clustered standard errors at the individual level between parentheses. *** denotes significance at the 1% level, ** denotes significance at the 5% level, and * denotes significance at the 10% level. For the interaction effects between the GRP dummy D_{imt} and age. The age of 60 is the reference category.

In the table below we estimate which wage income group especially has an interest in GRPs. We calculate the hourly wage income by using the work history in the years 2010-2013. This allows us to define a low-, middle-, and high wage income group based on the wage income boundaries of the treatment group. The low wage income group is the group with wages in the bottom 25% of the wage income distribution, and the highest wage income group are the wages in the top 25% of the wage income distribution[30]. In-between is the middle wage income group. Based on these cut-offs, we divide the control group into the same wage income categories. Then we run regression (1) for different wage income groups. We present the results here with the number of monthly hours work as our dependent variable.

The effect of a GRP on monthly hours worked is overall positive for the low- and middle- wage income group, and negative for the high-wage income group (see table 8). Using the results from Table 8, it is possible to calculate the net effect of a GRP over the ages 60-65[31]. For the low wage income group, we find a positive effect of 184.5 (115.784) hours over the years 60-65. For the middle- and high wage income group these numbers are equal to 212.5*** (81.845) and 395.6*** (122.236) hours, respectively. So, we find a positive and significant effect for the middle- and high-wage income group that roughly corresponds to 5 and 10 full time work weeks of forty hours respectively.

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[30] This means that that the salaries benchmark is at €19.70 and €30.65 per hour, respectively. Moreover, as not everyone worked already for the municipality in the period 2010-2013, we lose 6.5% of our observations.

[31] To do so, we use the estimation results from column (3) regarding the baseline coefficient D_{imt} and the age-interaction terms. For example, for the low wage income group the effect of a GRP at age 60 equals $1.906 * 12 = 22.9$ hours per year. For age 61 this is equal to $(1.906 + 0.411) * 12 = 27.8$ hours per year. Doing this for all ages and all wage income groups yield the results mentioned in the text. We use the delta method to calculate the corresponding standard error.

	Low wage income			Middle wage income			High wage income		
EXCL. G4: Older civil servants (60+): intensive and extensive margin combined									
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
D_{imt}	2.396	2.544	1.906	2.285*	1.654	-7.487***	5.293***	4.399***	-5.790**
	(1.0708)	(1.633)	(2.789)	(1.224)	(1.177)	(1.912)	(1.840)	(1.728)	(2.692)
$D_{imt} * age(61)$			0.411			0.113			0.481
			(2.023)			(1.315)			(1.809)
$D_{imt} * age(62)$			2.244			5.632***			7.056***
			(2.889)			(1.883)			(2.648)
$D_{imt} * age(63)$			1.618			13.715***			13.724***
			(3.231)			(2.252)			(3.187)
$D_{imt} * age(64)$			-1.344			20.186***			18.621***
			(3.464)			(2.513)			(3.557)
$D_{imt} * age(65)$			1.010			22.986***			27.825***
			(3.372)			(2.420)			(3.469)
Male		16.503***	16.505***		18.071***	18.174***		17.487***	17.504***
		(1.765)	(1.765)		(1.289)	(1.288)		(2.194)	(2.198)
1st generation immigrant		9.739***	9.746***		4.152	4.394		3.152	2.979
		(2.949)	(2.950)		(2.912)	(2.921)		(5.732)	(5.754)
2nd generation immigrant		4.082	4.093		7.167***	7.159***		-2.289	-2.174
		(3.515)	(3.514)		(2.505)	(2.490)		(3.997)	(3.976)
Kidsdummy		4.959**	4.952**		5.741***	5.701***		4.360**	4.380**
		(2.321)	(2.320)		(1.512)	(1.513)		(1.979)	(1.973)
married		-9.641***	-9.627***		-11.208***	-11.201***		1.550	1.623
		(1.893)	(1.894)		(1.516)	(1.516)		(2.316)	(2.319)
Age dummies									
61		-3.274***	-3.349***		-3.751***	-3.731***		-4.267***	-4.427***
		(0.596)	(0.708)		(0.441)	(0.548)		(0.607)	(0.776)
62		-8.973***	-9.410***		-10.098***	-11.521***		-11.712***	-13.616***
		(0.959)	(1.141)		(0.728)	(0.907)		(1.030)	(1.312)
63		-14.318***	-14.662***		-19.238***	-23.299***		-23.073***	-27.261***
		(1.282)	(1.534)		(1.004)	(1.279)		(1.458)	(1.892)

64		-23.388***	-22.912***		-33.615***	-40.303***		-39.422***	-45.807***
		(1.615)	(1.954)		(1.265)	(1.613)		(1.841)	(2.395)
65		-48.921***	-49.170***		-66.049***	-75.317***		-71.844***	-83.626***
		(1.787)	(2.135)		(1.383)	(1.721)		(2.054)	(2.525)
α	115.433***	111.900***	112.022***	130.065***	128.778***	128.441***	135.413***	118.666***	119.058***
	(10.033)	(9.492)	(9.487)	(6.327)	(6.300)	(6.303)	(8.465)	(8.405)	(8.307)
Controls	NO	YES	YES	NO	YES	YES	NO	YES	YES
Municipality FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Adj. R^2	13.6%	18.7%	18.7%	8.6%	15.7%	16.0%	11.1%	18.2%	18.5%
Civil cervants	3,719	3,719	3,719	6,484	6,484	6,484	3,253	3,253	3,253

Table 8 The effect of adopting a GRP on monthly hours worked for different wage income groups of older civil servants. Clustered standard errors at the individual level between parentheses. *** denotes significance at the 1% level, ** denotes significance at the 5% level, and * denotes significance at the 10% level. Age 60 is the reference category in the above regression.

V.B. Labor supply of older civil servants: extensive margin

Having established that GRPs positively affect the labor supply of older individuals at the intensive margin, we now investigate the effect at the extensive margin. In particular, we are interested at which age civil servants leave the municipality, which is almost equivalent to retirement.

We construct a dummy variable which is equal to one if the civil servant works at least one hour at the municipality of employment during a particular month. If this is not the case, this variable is equal to zero. We use the same independent variables as in equation (1) only now we estimate a linear probability model. If the D_{imt} coefficient is positive, it indicates that civil servants that are employed at a municipality with a GRP are more likely to remain active for a municipality with a GRP. In other words, a positive sign means a positive effect of GRPs on the retirement of older civil servants.

In the baseline regression without controls, the presence of a GRP positively and significantly affects the labor supply at the extensive by on average 4%-points (Table 9). Once we add control variables, this effect reduces to 3.7%-points.

Once we introduce interaction terms between age and the difference-in-differences estimator we find a positive significant effect of being employed at the ages of 62-65. More precisely, a GRP increases the probability of being employed at age 64 and 65 by $0.111 - 0.005 = 10.6\%$-points. The introduction of GRPs do not have an extensive margin effect at the ages of 60 and 61.[32]

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[32] In Appendix III we show that the results of a GRP are not much different between male and female civil servants. In Appendix IV we display the results including the G4 municipalities. The results are the same in terms of sign, magnitude, and significance.

EXCL. G4 Older civil servants (60+): extensive margin			
D_{imt}	0.040*** (0.006)	0.037*** (0.006)	-0.005 (0.009)
$D_{imt} * age(61)$			-0.001 (0.006)
$D_{imt} * age(62)$			0.028*** (0.009)
$D_{imt} * age(63)$			0.063*** (0.011)
$D_{imt} * age(64)$			0.087*** (0.012)
$D_{imt} * age(65)$			0.111*** (0.012)
Male		0.018*** (0.006)	0.018*** (0.006)
1st generation immigrant		0.003 (0.013)	0.003 (0.013)
2nd generation immigrant		0.025** (0.012)	0.025** (0.012)
Kidsdummy		0.032*** (0.007)	0.032*** (0.007)
married		-0.019*** (0.007)	-0.019*** (0.007)
Age dummies			
61		-0.024*** (0.002)	-0.024*** (0.003)
62		-0.064*** (0.003)	-0.071*** (0.004)
63		-0.122*** (0.005)	-0.140*** (0.006)
64		-0.212*** (0.006)	-0.240*** (0.008)
65		-0.436*** (0.007)	-0.480*** (0.008)
α	0.907*** (0.029)	0.912*** (0.029)	0.912*** (0.029)
Controls	NO	YES	YES
Municipality FE	YES	YES	YES
Time FE	YES	YES	YES
Adj. R^2	9.7%	14.9%	15.0%
Civil servants	14,389	14,389	14,389

Table 9 The effect of adopting a GRP on being employed (extensive margin). Clustered standard errors at the individual level between parentheses. *** denotes significance at the 1% level, ** denotes significance at the 5% level, and * denotes significance at the 10% level. Age 60 is the reference category in the above regression.

We run the same regression for different wage income groups as we did in the previous section (see table 10). We observe that a GRP has a positive effect on the labor force participation of the low-, middle-, and high wage income group. Once we add age-interaction terms, the positive sign disappears for the low-wage income group[33]. For the other income groups, we find positive and significant age-interaction effects effect at the ages 62 to 65. Moreover, the effect is stronger at higher ages. For instance, for the middle-wage income group we find a positive effect at age 62 that equals 1.2%-points, while at age 65 this equals 12.2%-points. The same holds as well for the high-wage income group. Thus, the availability of a GRP increases the labor force participation at the extensive margin mainly at higher ages.

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[33] This is probably due to overfitting. When analyzing the (sum) of the age interaction effects and the baseline effect, we observe most are roughly equal to the coefficient in column (2).

	EXCL. G4: Older civil servants (60+): extensive margin								
	Low wage income			Middle wage income			High wage income		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
D_{imt}	0.026**	0.024**	0.013	0.036***	0.034***	-0.025*	0.050***	0.045***	-0.014
	(0.012)	(0.012)	(0.020)	(0.008)	(0.008)	(0.013)	(0.012)	(0.011)	(0.017)
$D_{imt} * age(61)$			0.008			0.001			-0.004
			(0.014)			(0.009)			(0.012)
$D_{imt} * age(62)$			0.015			0.037***			0.038**
			(0.021)			(0.013)			(0.017)
$D_{imt} * age(63)$			0.017			0.087***			0.083***
			(0.023)			(0.015)			(0.021)
$D_{imt} * age(64)$			0.005			0.129***			0.112***
			(0.025)			(0.017)			(0.024)
$D_{imt} * age(65)$			0.031			0.147***			0.169***
			(0.025)			(0.017)			(0.023)
Male		-0.015	-0.015		0.032***	0.032***		0.056***	0.056***
		(0.012)	(0.012)		(0.009)	(0.009)		(0.015)	(0.015)
1st generation immigrant		0.029	0.029		0.006	0.006		0.011	0.009
		(0.019)	(0.019)		(0.019)	(0.019)		(0.038)	(0.039)
2nd generation immigrant		0.010	0.010		0.054***	0.054***		-0.020	-0.019
		(0.024)	(0.024)		(0.017)	(0.017)		(0.025)	(0.025)
Kidsdummy		0.023	0.023		0.036***	0.036***		0.028**	0.028**
		(0.015)	(0.015)		(0.010)	(0.010)		(0.013)	(0.013)
married		-0.029**	-0.029**		-0.049***	-0.049***		0.018	0.012
		(0.013)	(0.013)		(0.010)	(0.010)		(0.015)	(0.015)
Age dummies									
61		-0.024***	-0.025***		-0.025***	-0.025***		-0.022***	-0.021***
		(0.004)	(0.005)		(0.003)	(0.004)		(0.004)	(0.005)
62		-0.064***	-0.067***		-0.065***	-0.075***		-0.064***	-0.074***
		(0.007)	(0.008)		(0.005)	(0.006)		(0.007)	(0.009)
63		-0.104***	-0.108***		-0.127***	-0.153***		-0.133***	-0.159***
		(0.009)	(0.011)		(0.007)	(0.009)		(0.010)	(0.012)

64		-0.173*** (0.012)	-0.173*** (0.014)		-0.224*** (0.009)	-0.267*** (0.011)		-0.242*** (0.012)	-0.280*** (0.016)
65		-0.368*** (0.013)	-0.378*** (0.015)		-0.457*** (0.010)	-0.516*** (0.012)		-0.464*** (0.014)	-0.536*** (0.017)
α	0.878*** (0.063)	0.906*** (0.062)	0.907*** (0.062)	0.940*** (0.041)	0.964*** (0.041)	0.962*** (0.041)	0.926*** (0.052)	0.870*** (0.052)	0.871*** (0.052)
Controls	NO	YES	YES	NO	YES	YES	NO	YES	YES
Municipality FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Adj. R^2	15.6%	19.2%	19.2%	9.5%	15.4%	15.6%	11.7%	18.0%	18.3%
Civil cervants	3,719	3,719	3,719	6,484	6,484	6,484	3,253	3,253	3,253

Table 10 The effect of adopting a GRP on being employed (extensive margin) for different wage income groups of older civil servants. Clustered standard errors at the individual level between parentheses. *** denotes significance at the 1% level, ** denotes significance at the 5% level, and * denotes significance at the 10% level. Age 60 is the reference category in the above regression.

V.C. Hiring decision of young civil servants

Having discussed whether GRPs affect the labor supply of older civil servants, we now examine whether municipalities with a GRP hire more young workers when compared to municipalities that did not adopt a GRP[34]. We estimate the following regression equation:

$$\log(L_{ymt}) = \zeta + \eta_{yt} + \mu_{mt} + \lambda_m + \beta_3 D_{mt} + \rho_{mt} \qquad (2)$$

The dependent variable is the natural logarithm of young workers y at municipality m at time t. The variable ζ indicates the intercept. The variables η_{yt} and μ_{mt} denote year and month dummies, respectively[35]. The variables λ_m have the same interpretation as in regression (1) and the variable D_{mt} denotes a dummy variable whether municipality m at time t has implemented a GRP. If this is the case, the variable is equal to unity and otherwise it equals zero. This is our main coefficient of interest. As GRPs aim at making it possible for municipalities to increase the number of younger workers, we expect this coefficient to be positive. Lastly, ρ_{mt} denotes the error term.

	Age group (18-30)	
	Log (young civil servants)	% of young civil servants
D_{mt}	0.011	-0.114
	(0.076)	(0.301)
Municipality FE	YES	YES
Time FE	YES	YES
Adj. R^2	81.6%	72.7%
Number of observations	2,352	2,352

Table 11 The effect of adopting a GRP on the number of younger workers hired. Clustered standard errors at the municipality level between parentheses. *** denotes significance at the 1% level, ** denotes significance at the 5% level, and * denotes significance at the 10% level.

Table 11 provides us with the difference-in-differences estimator for equation (2). Next to the percentage of young workers, we as well ran a regression with the natural logarithm of young workers as our dependent variable. We observe that for the entire group 18-30 the estimator is positive, yet insignificant at the 5%-level. The difference-in-differences estimator is insignificant for both dependent variables. In other words, the introduction of GRPs seems not to have a positive and significant effect on the hiring rate of young workers.

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[34] To do this, we use the aggregate command from package Stats in R to transform our dataset. This command allows us to sum the total amount of young employees per month and per municipality. This provides us with 2352 observations (= 84 months (=seven years) multiplied by 28 municipalities).

[35] The main reason for creating year and month dummies separately is to prevent overfitting. More precisely, when including for each year-month combination a separate dummy, we would include 84 dummies (83 because of perfect multicollinearity). Now we only include seventeen time dummies (six year dummies and eleven month dummies), reducing our amount of independent variables by more than 80%.

Lastly, it is as well possible to analyze the wage growth of young civil servants. A faster wage growth of young civil servants may indicate that they are able to climb the career ladder faster and end up in better paying jobs. Therefore, it is interesting to analyze how the introduction of GRPS affect the career opportunities of young civil servants. We construct the wage growth as a variable that is equal to the current wage at time t divided by the wage of that same civil servant at time $t - 12$ (i.e., the wage one year ago). For instance, we divide the wage individual i at municipality m earned in January 2017 by the wage he earned in January 2016.[36] We plot the average wage growth for young civil servants (see appendix) and we run the same regression as in equation (1) with our dependent variable now equal to the wage growth of young civil servants. The results are displayed in table 11 below. We observe that there is a negative significant effect of GRPs on the wage growth for young civil servants. This effect remains the same when adding control variables. The effect, however, is rather small. As an example, suppose a civil servant in the control group earns a monthly income of €2000, - gross in this year and the year thereafter. According to the regression results that same person in the treatment group would earn on average €16, - less compared to someone in the control group. Therefore, the effect is of little economic relevance.

	Age group (18-30)	
D_{imt}	-0.009*** (0.003)	-0.008*** (0.003)
Municipality FE	YES	YES
Time FE	YES	YES
Controls	NO	YES
Adj. R^2	12.4%	13.2%
Controls	NO	YES
Number of civil servants	5,387	5,387

*Table 12 Wage growth for young civil servants. Robust standard errors between parentheses. *** denotes significance at the 1% level, ** denotes significance at the 5% level, and * denotes significance at the 10% level.*

VI. Discussion & Conclusion

We analyzed the employment effects of Gradual Retirement Plans (GRPs) in municipalities with more than 100,000 citizens. We compared hours worked and net participation in of older civil servants in municipalities with and without a GRP. As our time span includes the introduction of GRPs, we were able to estimate a difference-in-differences specification.

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[36] We drop young workers whose are at the top and bottom 5% of the wage growth distribution to prevent that outliers have an effect on our estimation.

We found that GRPs increase the labor force participation at the extensive margin. When adding age-interaction dummies we found that the effect was particularly large at the ages of both the intensive and extensive margin. The effect is particularly visible at higher ages (62-65). Analyzing the intensive and extensive margin combined, we have similar findings. We find positive effects as of the age of 62 ranging from 1 to 13 hours per month. There could be additional advantages of part-time work, e.g., regarding health. These additional effects are open for further research.

When analyzing the total effect of GRPs on the labor supply for different wage income groups, we found that the total hours worked for the middle- and high- wage income groups in*creased* at the ages 60-65. Those effects are equal to 5.3 and 9.9 full-time work weeks of 40 hours. For the low-wage income group we did not find a significant effect.

These results are partially in line with Montizaan, et al. (2010) who find in their stated preferences analysis that financial incentives (change in the accural rate and pension income) have a positive and significant effect on the final retirement-age. They also find that the total amount of hours worked decreases at younger ages once gradual retirment plans become available. However, they find that total labor supply decreases once gradual retirement schemes are introduced while we find an increase, particulalry for middle- and high wage income workers. This may indiciate that the financial incentives in GRPs are so strong that total labor supply becomes positive.

Regarding the hiring decision of young civil servants, we observe that both treated and non-treated municipalities see an increase in the number of young civil servants over time. GRPs do not seem to have an impact on youth hirings by municipalities. This is in line with the "lump of labor fallacy" and confirms the findings of Carta & Von Wachter (2021) and Gruber & Wise (2010). They establish that young and old workers rather complement each other than substitute.

It is important to stress that our results are only limited to the public sector. Further research should investigate the outcomes of GRPs or alternative policies in other sectors of industry. It might also be interesting to look at labor supply effects in the longer term. If social norms change, then these effects might become larger as time passes by.

Appendix I: Common trend assumption and endogenous adoption

In appendix I we show several graphs that analyzes whether political reasons could have played a role in adopting a GRP for different municipalities (the full list of municipalities that we analyze is discussed in the next section). To do so, we plot the youth unemployment in the age category 25-45. We use open access yearly data from Statistics Netherlands to do this. We provide data for the period 2006-2015, meaning that we start 8 years before the first municipality in the treatment group introduces a GRP.

The first figure in the appendix (Figure 4) shows that the average yearly unemployment rate for individuals in the age category 25-45. We do not observe much difference between the treatment and control group. More precisely, we observe that the average unemployment rate is 0.1 to 0.6%-points lower in the municipalities in the treatment group. Including or excluding G4 municipalities does not seem to make much of a difference. The biggest difference we observe is in 2015 when youth unemployment is 0.8%-points higher for the treatment group when compared to the control group.
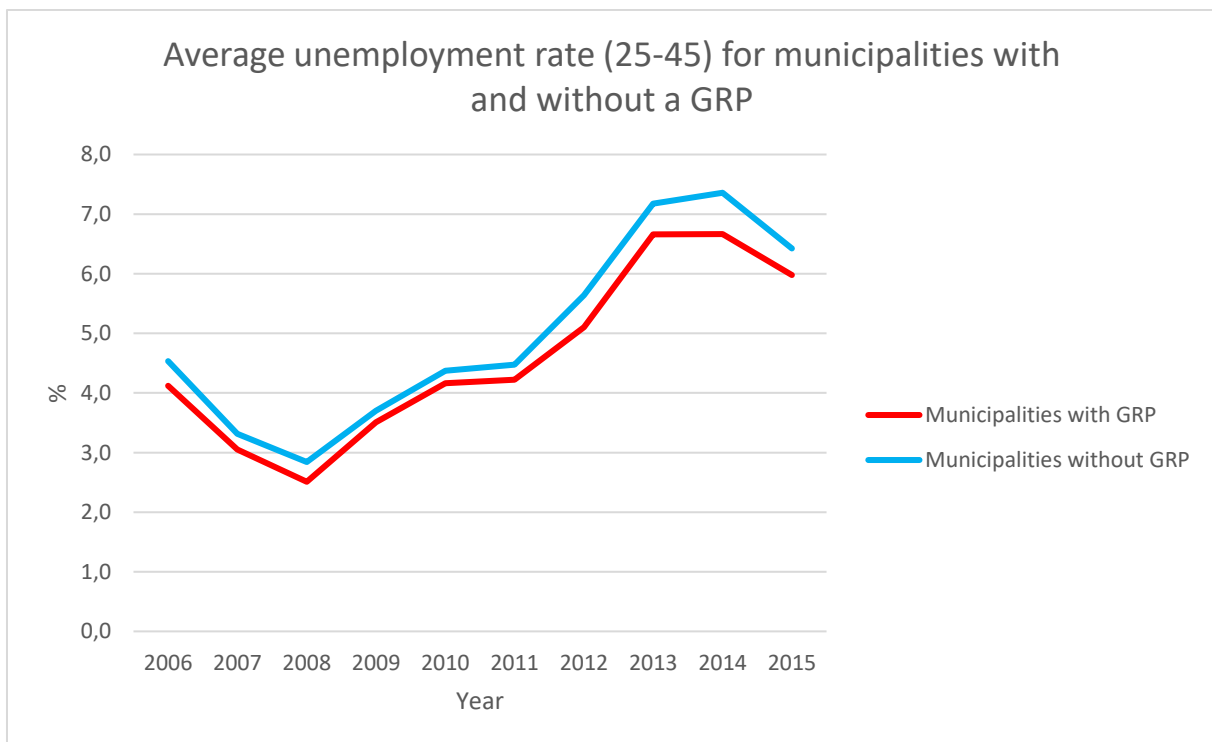

Figure 4 Average unemployment rate (age 25-45) for municipalities with and without a GRP. The p-value of the Chi-squared test is equal to 1.
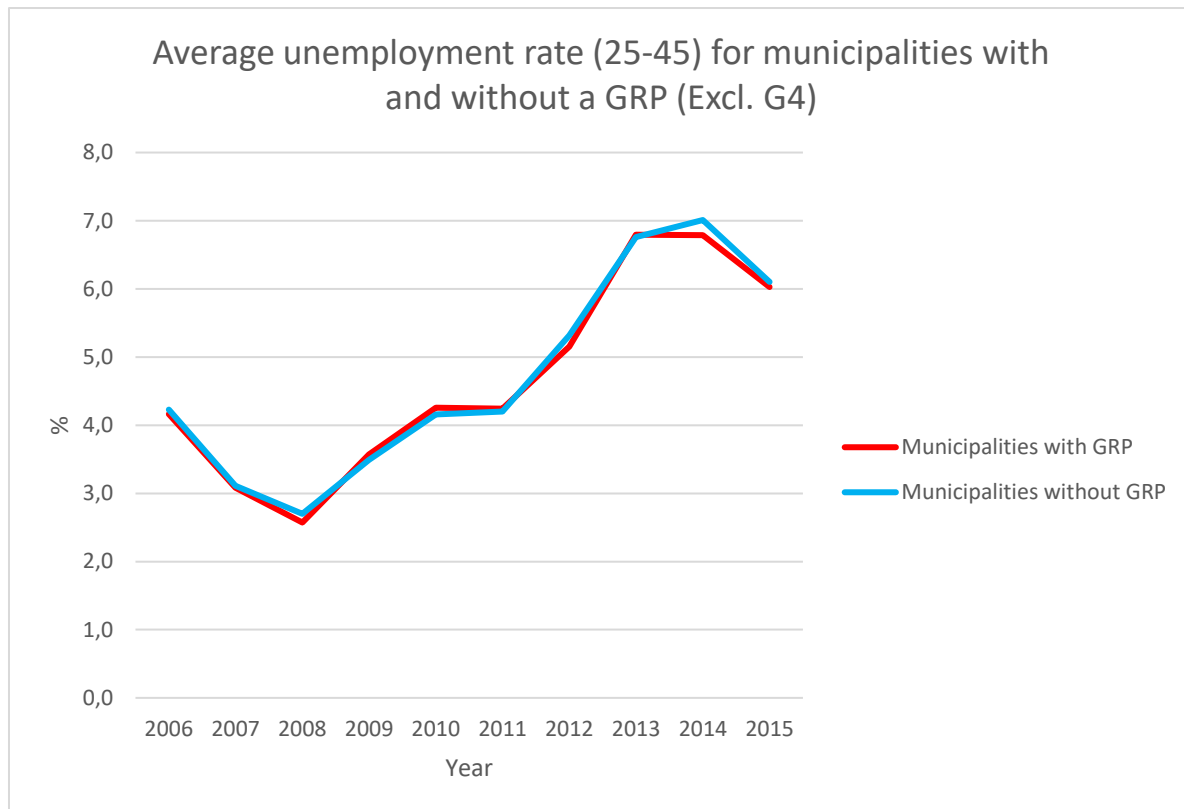
Figure 5 Average unemployment rate (age 25-45) for municipalities with and without a GRP (excluding G4 municipalities). The p-value of the Chi-squared test is equal to 1.

We as well analyzed the differences in voting behavior between municipalities. To do so, we compared the outcome of the municipalities elections of 2014 for municipalities that did and did not introduce a GRP (Kiesraad, (2014); Kiesraad, (2014); Kiesraad, (2013)). We focus on the main national parties that as well participate in municipality elections. Those parties are CDA, VVD, D66, PvdA, SP, GroenLink, and the ChristenUnie/SGP. Considering our dataset, we observe that the last mentioned political party sometimes participates as one party during an election with this name or as two separate parties, namely Christen-Unie and SGP. For our analysis, we merged them together. Local parties are as well merged together in the variable "others".

We calculate the vote share of the main national parties as the number of votes they received divided by the total number of votes casted in that municipality. In case one of the larger national parties did not participate, we set the vote share equal to zero. The vote share of other parties is then defined as one minus the vote share for the national parties. Some national parties like the PVV did only participate in a small number of municipalities in 2014 and are therefore merged together

with "others"[37]. Thereafter we calculate the average percent of the vote share each party received in the treatment and control group.

The figures below shows the difference in voting behavior between municipalities that introduce and do not introduce a GRP. We observe that the differences in voting behavior are rather small. The biggest difference is 2.3%-points for GroenLinks, indicating that for every 1000 votes there will be 23 votes more for GroenLinks in municipalities that adopted a GRP. The differences are not significant and therefore we conclude that political differences cannot have played a major role in choosing to adopt a GRP or not.
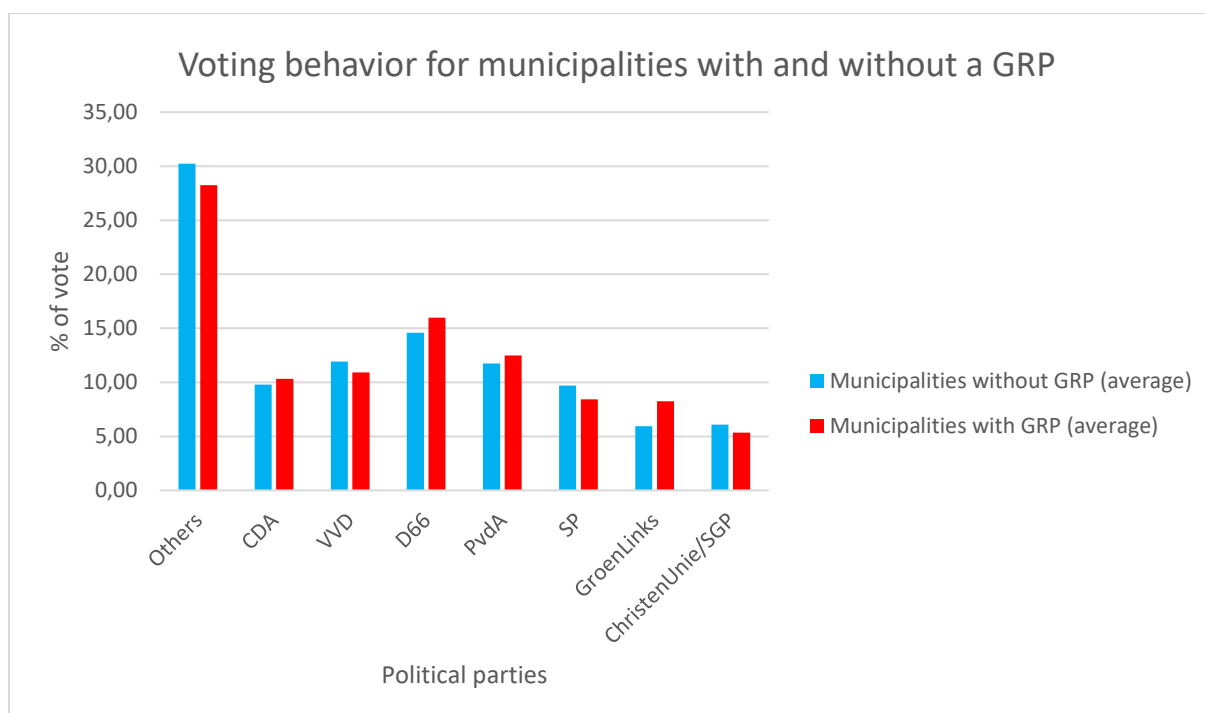

Figure 6 Voting behavior for municipalities with and without a GRP. χ^2-test provides a p-value of 0.98. Hence, the distributions are not significantly different between municipalities with and without a GRP.

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[37] Note that this does not mean that one party received the vote share "others" as it is possible for multiple local parties to participate in a municipality election.
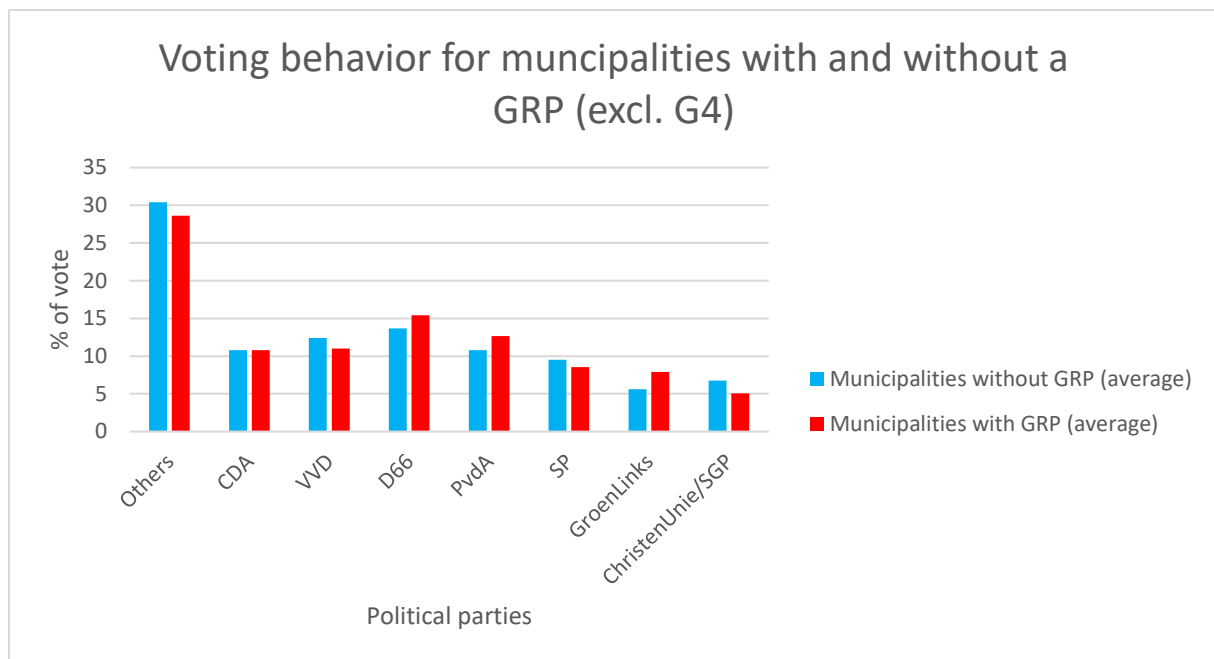
Figure 7 Voting behavior for municipalities with and without a GRP. χ^2-test provides a p-value of 0.95. Hence, the distributions are not significantly different between municipalities with and without a GRP.

Next, we analyze the differences in te municipalities debt position. Municipalities with a higher debt level may be less likely to adopt a GRP as it may have high startup cost both in terms of salary as well as in terms of hiring. Therefore we compare the average solvency ratio for the treatment and control group in the period 2013-2018 (data for earlier years are not available). The solvency ratio indicates how healthy municipalities are. A solvency ratio of less than 20% may indicate that municipalities may face problems in the long run.

The table below shows the average solvency ratio for the periode 2013-2018 for treatment and control group in % and the corresponding p-value. None of the differences are significant. It does not matter whether we include or exclude the G4 municipalities.

Group/year	2013	2014	2015	2016	2017	2018
Municipalities with GRP (%)	28.88	23.44	25.04	26.8	26.05	26.21
Municipalities without GRP (%)	38.92	30.56	29.16	29.03	28.18	29.19
p-value	0.31	0.35	0.56	0.75	0.75	0.65

Table 13. Average solvency ratios for municipalities that do and do not introduce a GRP (Excluding G4 municipalities). Source: (Vereniging van Nederlandse gemeenten, 2020)

Group/year	2013[1]	2014	2015	2016	2017	2018
Municipalities with GRP (%)	28.88	24.61	25.79	27.19	26.58	26.29
Municipalities without GRP (%)	40.67	32.31	31.52	31.45	30.83	31.51
p-value	0.19	0.27	0.38	0.52	0.51	0.39

Table 14. Average solvency ratios for municipalities that do and do not introduce a GRP. 1: For the year 2013 there are no data available for the municipalities Den Haag and Utrecht. Source: (Vereniging van Nederlandse gemeenten, 2020).

Appendix II: additional graphs

Extensive margin including G4 muncipalities
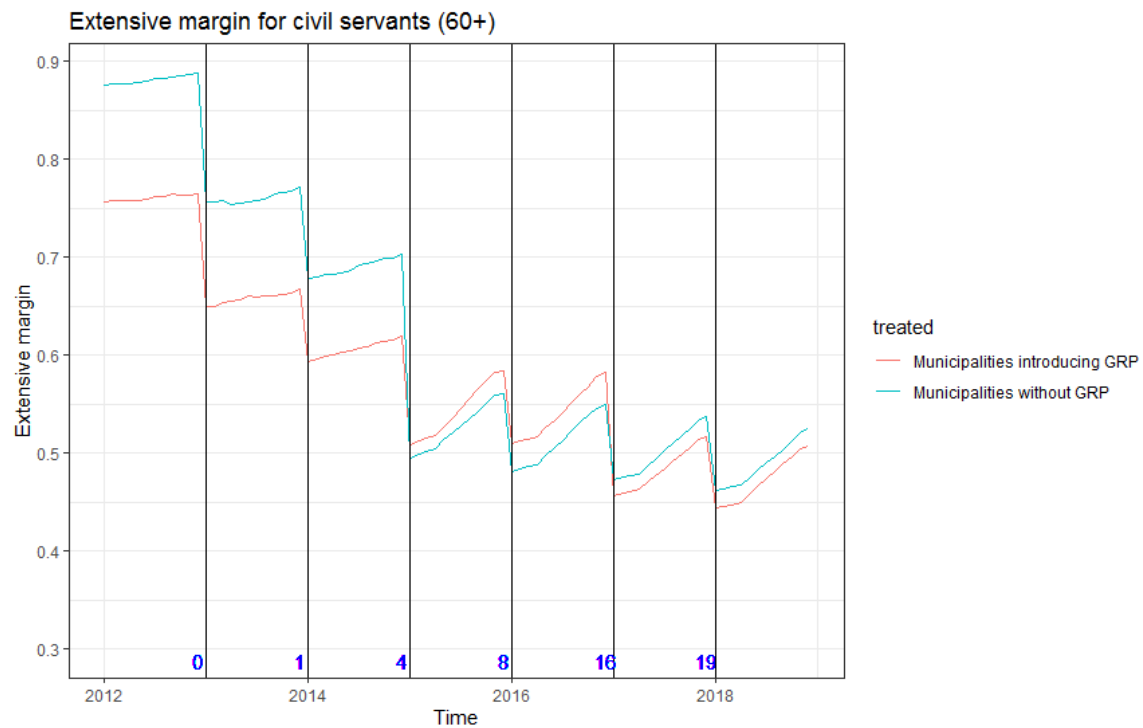
Figure 8 Extensive margin plot for municipalities with and without GRP including G4 municipalities.

Intensive margin including G4 municipalities
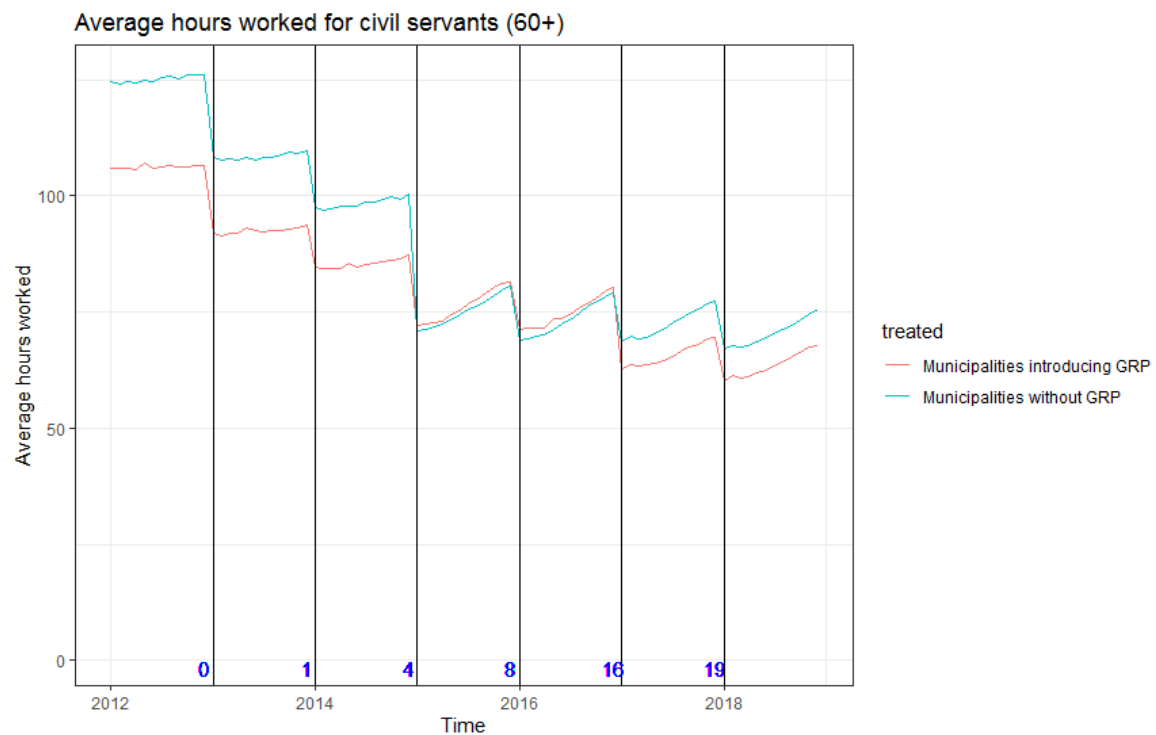
Figure 9 Average hours worked per month for older civil servants (60+) working at municipalities with and without a GRP.

Additional graphs regarding youth employment

Percentage of young civil servants for municipalities without and with a GRP
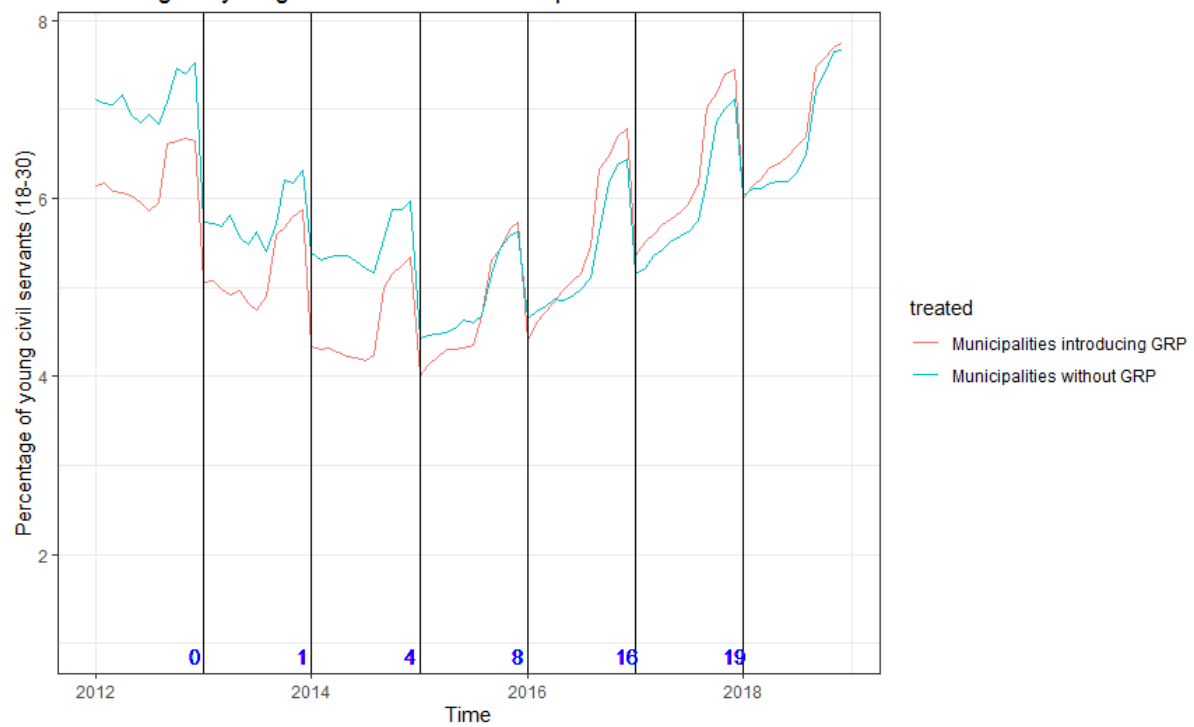
Number of young civil servants for municipalities without and with a GRP
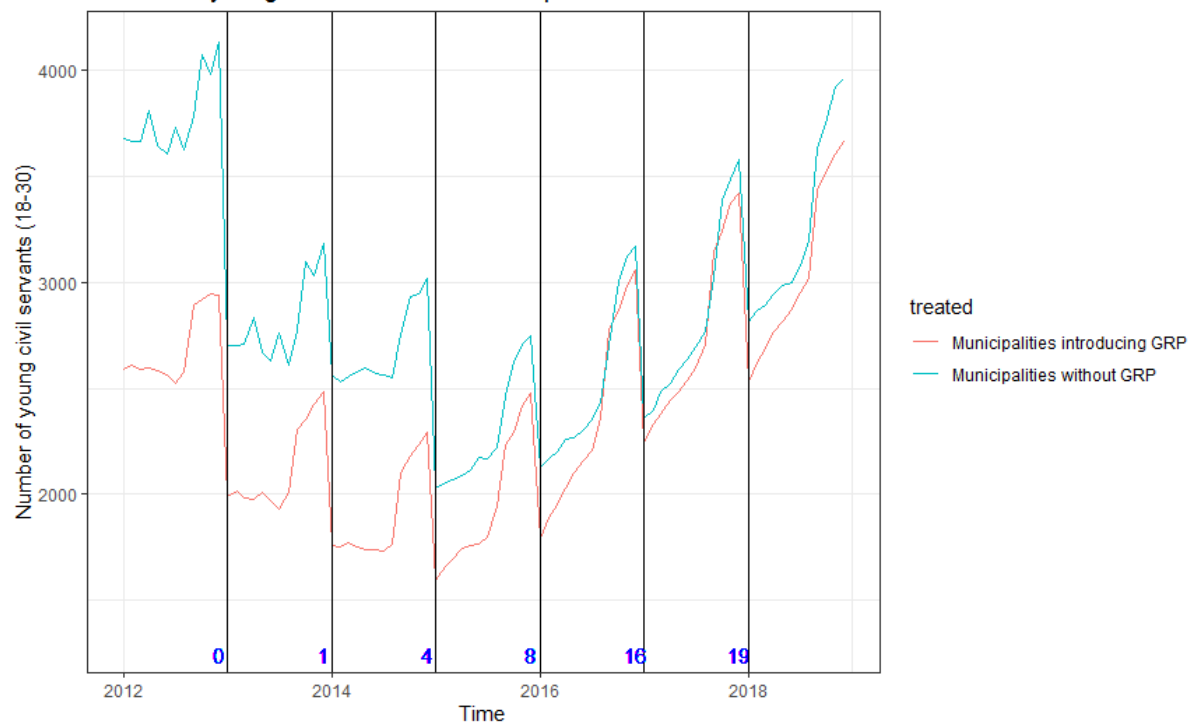
Number of young civil servants for municipalities without and with a GRP (excl. G4)
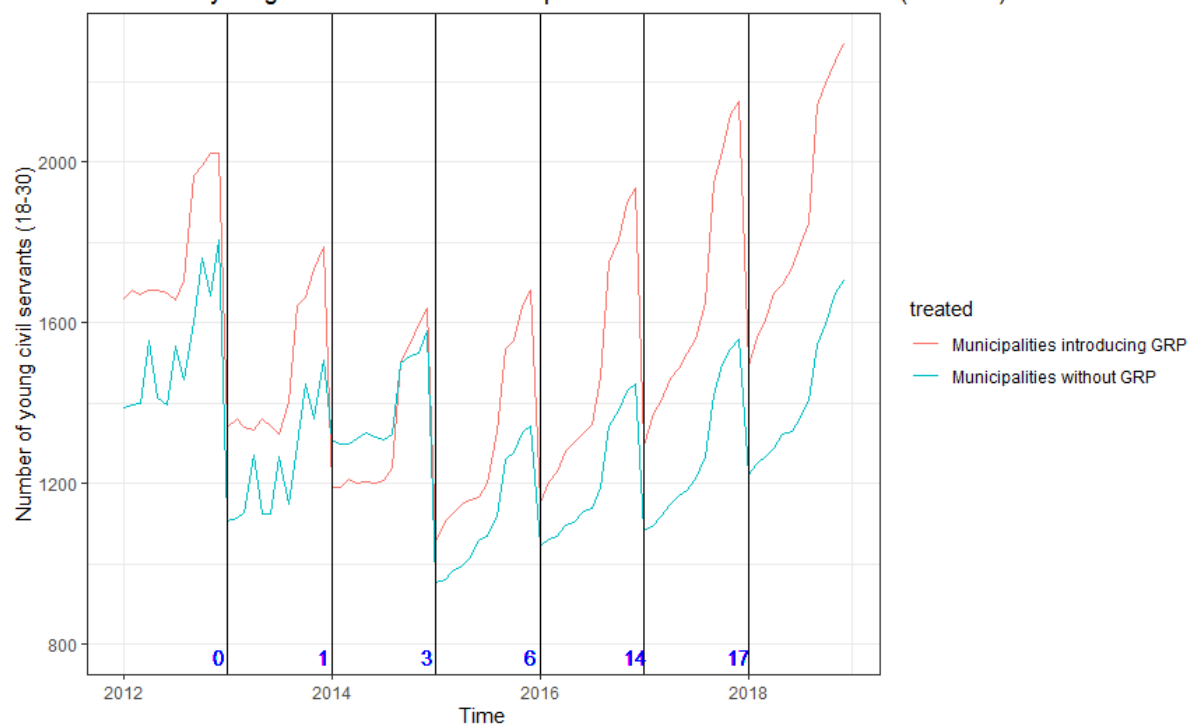
Average Wage growth

Average hourly wage growth for young civil servants (18-30) excl. G4

Average hourly wage growth for young civil servants (18-30)
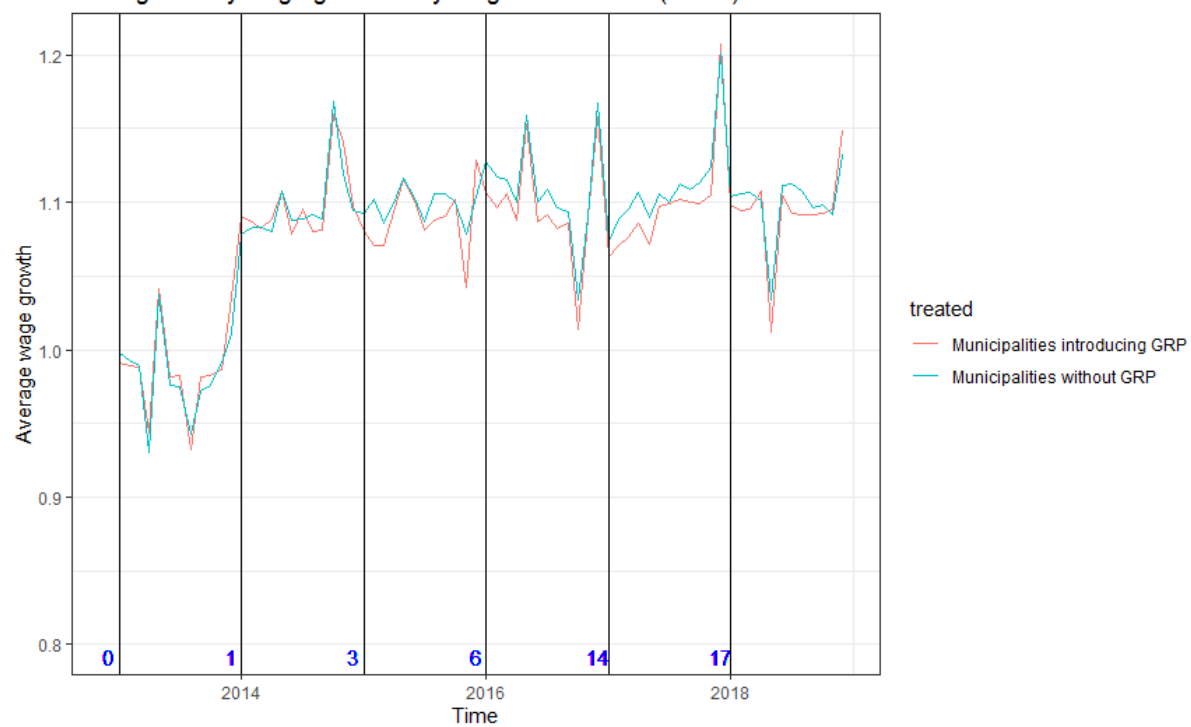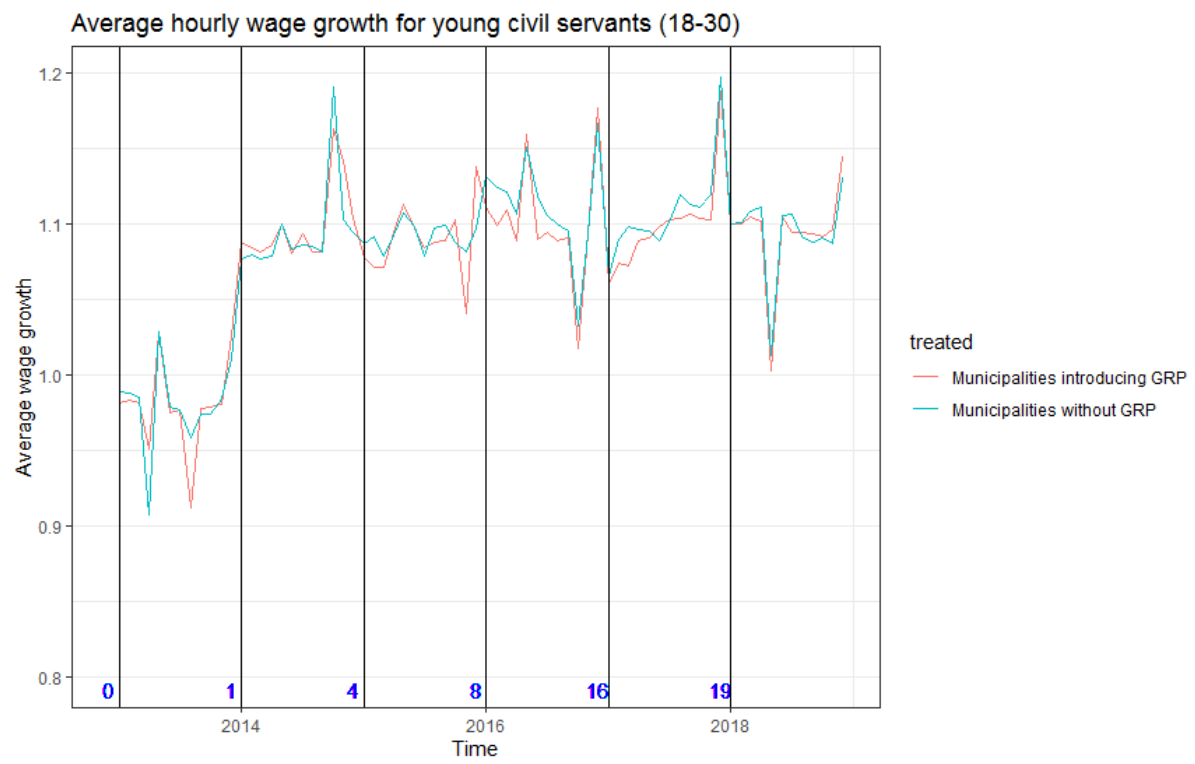
Appendix III: Additional regression tables

To check whether the effects of the GRP are different between older male and female civil servants we run to same regression as (1), but now only on the population of male and female civil servants separately. In this way, we check for heterogeneous effects between men and women. The tables below show that the same conclusions hold for both men and women.

	Male			Female		
EXCL. G4 Older civil servants (60+): Intensive and extensive margin combined						
D_{imt}	2.899**	2.534**	-6.468***	2.759**	2.484**	-1.870
	(1.145)	(1.109)	(1.809)	(1.279)	(1.216)	(1.966)
$D_{imt}*age(61)$			0.285			0.397
			(1.270)			(1.360)
$D_{imt}*age(62)$			6.593***			3.004
			(1.812)			(1.941)
$D_{imt}*age(63)$			13.422***			6.280***
			(2.122)			(2.275)
$D_{imt}*age(64)$			17.375***			8.962***
			(2.356)			(2.498)
$D_{imt}*age(65)$			20.792***			11.955***
			(2.287)			(2.428)
1st generation immigrant		1.135	1.010		6.636**	6.691**
		(2.693)	(2.698)		(2.825)	(2.824)
2nd generation immigrant		1.883	1.953		8.950***	8.904***
		(2.476)	(2.472)		(2.687)	(2.681)
Kidsdummy		5.917***	5.933***		2.147	2.129
		(2.476)	(1.321)		(1.711)	(1.710)
married		3.327**	3.351**		-17.637***	-17.680***
		(1.458)	(1.458)		(1.468)	(1.468)
Age dummies						
61		-3.341***	-3.389***		-4.984***	-5.078***
		(0.413)	(0.500)		(0.452)	(0.567)
62		-9.907***	-11.477***		-11.409***	-12.218***
		(0.681)	(0.830)		(0.736)	(0.926)
63		-19.132***	-22.799***		-19.448***	-21.353***
		(0.933)	(1.157)		(1.007)	(1.294)
64		-33.088***	-38.392***		-31.553***	-34.631***
		(1.173)	(1.458)		(1.253)	(1.630)
65		-66.913***	-74.704***		-57.522***	-62.499***
		(1.298)	(1.572)		(1.366)	(1.725)
α	136.338***	133.813***	133.932***	104.582***	117.381***	117.152***
	(5.574)	(5.520)	(5.510)	(7.698)	(7.322)	(7.326)
Controls	NO	YES	YES	NO	YES	YES
Municipality FE	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES
Adj. R^2	10.5%	15.9%	16.1%	6.8%	13.6%	13.7%
Civil cervants	8,629	8,629	8,629	5,760	5,760	5,760

Table 15 Clustered standard errors at the individual level between parentheses. *** denotes significance at the 1% level, ** denotes significance at the 5% level, and * denotes significance at the 10% level. Age 60 is the reference category in the above regression.

	Male			Female		
	EXCL. G4 Older civil servants (60+): extensive margin					
D_{imt}	0.038*** (0.007)	0.36*** (0.007)	-0.020* (0.012)	0.038*** (0.010)	0.036*** (0.009)	0.004 (0.014)
$D_{imt} * age(61)$			0.001 (0.008)			0.001 (0.010)
$D_{imt} * age(62)$			0.039*** (0.012)			0.019 (0.015)
$D_{imt} * age(63)$			0.083*** (0.014)			0.044** (0.017)
$D_{imt} * age(64)$			0.108*** (0.015)			0.069*** (0.019)
$D_{imt} * age(65)$			0.131*** (0.015)			0.091*** (0.019)
1st generation immigrant		-0.000 (0.017)	-0.001 (0.017)		0.004 (0.019)	0.005 (0.019)
2nd generation immigrant		0.017 (0.016)	0.017 (0.016)		0.040** (0.018)	0.040** (0.018)
Kidsdummy		0.031*** (0.008)	0.032*** (0.008)		0.027** (0.012)	0.027** (0.012)
married		0.017* (0.009)	0.017* (0.009)		-0.061*** (0.010)	-0.062*** (0.010)
Age dummies						
61		-0.018*** (0.003)	-0.018*** (0.003)		-0.034*** (0.004)	-0.034*** (0.004)
62		-0.056*** (0.004)	-0.065*** (0.005)		-0.079*** (0.006)	-0.084*** (0.007)
63		-0.111*** (0.006)	-0.134*** (0.007)		-0.141*** (0.008)	-0.154*** (0.010)
64		-0.201*** (0.008)	-0.234*** (0.009)		-0.234*** (0.010)	-0.258*** (0.012)
65		-0.431*** (0.008)	-0.481*** (0.010)		-0.448*** (0.010)	-0.486*** (0.013)
α	0.916*** (0.035)	0.905*** (0.034)	0.905*** (0.034)	0.887*** (0.052)	0.931*** (0.051)	0.929*** (0.051)
Controls	NO	YES	YES	NO	YES	YES
Municipality FE	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES
Adj. R^2	11.2%	16.3%	16.5%	8.5%	14.1%	14.2%
Civil servants	8,629	8,629	8,629	5,760	5,760	5,760

Table 16 Clustered standard errors at the individual level between parentheses. *** denotes significance at the 1% level, ** denotes significance at the 5% level, and * denotes significance at the 10% level. Age 60 is the reference category in the above regression.

Appendix IV: Regressions results including G4

Older civil servants (60+): Intensive and extensive margin combined			
D_{imt}	2.139***	2.063***	-2.464**
	(0.736)	(0.707)	(1.090)
$D_{imt} * age(61)$			0.188
			(0.697)
$D_{imt} * age(62)$			3.016***
			(1.011)
$D_{imt} * age(63)$			6.263***
			(1.190)
$D_{imt} * age(64)$			9.616***
			(1.286)
$D_{imt} * age(65)$			11.180***
			(1.249)
Male		16.822***	16.809***
		(0.656)	(0.656)
1st generation immigrant		6.324***	6.282***
		(1.037)	(1.038)
2nd generation immigrant		2.804**	2.769**
		(1.261)	(1.260)
Kidsdummy		5.674***	5.630***
		(0.724)	(0.724)
married		-5.032***	-5.053***
		(0.715)	(0.715)
Age dummies			
61		-3.259***	-3.287***
		(0.225)	(0.226)
62		-8.753***	-9.398***
		(0.368)	(0.437)
63		-16.399***	-17.918***
		(0.496)	(0.600)
64		-28.521***	-31.162***
		(0.610)	(0.737)
65		-57.804***	-61.483***
		(0.669)	(0.798)
α	131.610***	123.698***	123.687***
	(4.598)	(4.432)	(4.430)
Controls	NO	YES	YES
Municipality FE	YES	YES	YES
Time FE	YES	YES	YES
Adj. R^2	8.9%	14.4%	14.4%
Civil servants	25,461	25,461	25,641

Table 17 Clustered standard errors at the individual level between parentheses. *** denotes significance at the 1% level, ** denotes significance at the 5% level, and * denotes significance at the 10% level. Age 60 is the reference category in the above regression.

Older civil servants (60+): extensive margin			
D_{imt}	0.035***	0.033***	0.003
	(0.005)	(0.005)	(0.007)
$D_{imt} * age(61)$			0.005
			(0.005)
$D_{imt} * age(62)$			0.022***
			(0.007)
$D_{imt} * age(63)$			0.043***
			(0.008)
$D_{imt} * age(64)$			0.063***
			(0.009)
$D_{imt} * age(65)$			0.067***
			(0.009)
Male		0.026***	0.026***
		(0.004)	(0.004)
1st generation immigrant		0.021***	0.021***
		(0.007)	(0.007)
2nd generation immigrant		0.017**	0.017**
		(0.008)	(0.008)
Kidsdummy		0.033***	0.033***
		(0.005)	(0.005)
Married		-0.014***	-0.014***
		(0.005)	(0.005)
Age dummies			
61		-0.020***	-0.021***
		(0.002)	(0.002)
62		-0.055***	-0.059***
		(0.003)	(0.003)
63		-0.105***	-0.115***
		(0.003)	(0.004)
64		-0.188***	-0.205***
		(0.004)	(0.005)
65		-0.397***	-0.418***
		(0.005)	(0.005)
α	0.940***	0.934***	0.934***
	(0.029)	(0.028)	(0.028)
Controls	NO	YES	YES
Municipality FE	YES	YES	YES
Time FE	YES	YES	YES
Adj. R^2	9.4%	13.8%	13.9%
Civil servants	25,461	25,461	25,641

Table 18 Clustered standard errors at the individual level between parentheses. *** denotes significance at the 1% level, ** denotes significance at the 5% level, and * denotes significance at the 10% level. Age 60 is the reference category in the above regression.

Male and female separately

	Older civil servants (60+): extensive margin					
	Male			**Female**		
D_{imt}	0.032*** (0.006)	0.031*** (0.006)	-0.008 (0.009)	0.037*** (0.008)	0.034*** (0.008)	0.014 (0.012)
$D_{imt} * age(61)$			0.007 (0.006)			0.003 (0.007)
$D_{imt} * age(62)$			0.030*** (0.009)			0.014 (0.011)
$D_{imt} * age(63)$			0.058*** (0.010)			0.026** (0.013)
$D_{imt} * age(64)$			0.077*** (0.011)			0.050*** (0.014)
$D_{imt} * age(65)$			0.080*** (0.011)			0.053*** (0.014)
1st generation immigrant		0.022** (0.009)	0.022** (0.009)		0.021** (0.013)	0.020* (0.011)
2nd generation immigrant		0.006 (0.011)	0.006 (0.011)		0.036*** (0.013)	0.036*** (0.013)
Kidsdummy		0.032*** (0.006)	0.032*** (0.006)		0.029*** (0.008)	0.028*** (0.008)
married		0.015** (0.006)	0.014** (0.006)		-0.052*** (0.007)	-0.052*** (0.007)
Age dummies						
61		-0.018*** (0.002)	-0.019*** (0.002)		-0.025*** (0.003)	-0.026*** (0.003)
62		-0.052*** (0.003)	-0.058*** (0.004)		-0.061*** (0.004)	-0.065*** (0.005)
63		-0.101*** (0.004)	-0.114*** (0.005)		-0.114*** (0.006)	-0.121*** (0.007)
64		-0.184*** (0.005)	-0.203*** (0.006)		-0.197*** (0.007)	-0.212*** (0.008)
65		-0.398*** (0.006)	-0.423*** (0.007)		-0.396*** (0.007)	-0.415*** (0.009)
α	0.939*** (0.035)	0.929*** (0.034)	0.930*** (0.034)	0.937*** (0.008)	0.973*** (0.051)	0.972*** (0.051)
Controls	NO	YES	YES	NO	YES	YES
Muncipality FE	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES
Adj. R^2	10.7%	15.1%	15.2%	8.0%	12.6%	12.6%
Civil cervants	15,721	15,721	15,721	9,740	9,740	9,740

*Table 19 Clustered standard errors at the individual level between parentheses. *** denotes significance at the 1% level, ** denotes significance at the 5% level, and * denotes significance at the 10% level. Age 60 is the reference category in the above regression.*

	Older civil servants (60+): Intensive and extensive margin combined					
	Male			**Female**		
D_{imt}	1.697*	1.655*	-4.628***	2.754**	2.534**	0.048
	(0.962)	(0.929)	(1.442)	(1.113)	(1.068)	(1.641)
$D_{imt} * age(61)$			0.845			-0.368
			(0.949)			(1.011)
$D_{imt} * age(62)$			4.711***			1.229
			(1.349)			(1.504)
$D_{imt} * age(63)$			9.021***			2.849
			(1.574)			(1.782)
$D_{imt} * age(64)$			12.207***			6.342***
			(1.705)			(1.908)
$D_{imt} * age(65)$			13.180***			8.308***
			(1.653)			(1.851)
1st generation immigrant		5.049***	4.999***		7.976***	7.942***
		(1.352)	(1.353)		(1.589)	(1.589)
2nd generation immigrant		0.500	0.471		6.853***	6.819***
		(1.685)	(1.683)		(1.859)	(1.859)
Kidsdummy		5.758***	5.709***		2.858**	2.828**
		(0.890)	(0.890)		(1.210)	(1.209)
married		2.977***	2.957***		-14.805***	-14.826***
		(0.974)	(0.974)		(1.030)	(1.030)
Age dummies						
61		-3.188***	-3.335***		-3.759***	-3.664***
		(0.297)	(0.345)		(0.338)	(0.411)
62		-8.997***	-9.926***		-8.952***	-9.248***
		(0.484)	(0.567)		(0.554)	(0.673)
63		-17.042***	-19.088***		-15.967***	-16.733***
		(0.651)	(0.775)		(0.748)	(0.924)
64		-29.906***	-33.036***		-26.860***	-28.796***
		(0.801)	(0.951)		(0.913)	(1.131)
65		-61.440***	-65.466***		-52.003***	-55.030***
		(0.877)	(1.031)		(0.994)	(1.209)
α	140.100***	137.710***	137.912***	112.451***	122.961***	122.728***
	(5.622)	(5.487)	(5.480)	(7.696)	(7.274)	(7.277)
Controls	NO	YES	YES	NO	YES	YES
Municipality FE	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES
Adj. R^2	10.3%	15.0%	15.1%	6.7%	12.0%	12.1%
Civil servants	15,721	15,721	15,721	9,740	9,740	9,740

Table 20 Clustered standard errors at the individual level between parentheses. *** denotes significance at the 1% level, ** denotes significance at the 5% level, and * denotes significance at the 10% level. Age 60 is the reference category in the above regression.

	Age group (18-30)	
	Log (young civil servants)	% of young civil servants
D_{mt}	0.060	0.156
	(0.073)	(0.319)
Municipality FE	YES	YES
Time FE	YES	YES
Adj. R^2	92.7%	71.5%
Number of observations	2,688	2,688

Table 21The effect of adopting a GRP on the number of younger workers hired. Clustered standard errors at the municipality level between parentheses. *** denotes significance at the 1% level, ** denotes significance at the 5% level, and * denotes significance at the 10% level.

	Age group (18-30)	
D_{imt}	-0.002	-0.002
	(0.002)	(0.002)
Municipality FE	YES	YES
Time FE	YES	YES
Controls	NO	YES
Adj. R^2	14.6%	15.3%
Number of civil servants	10,322	10,322

Table 22 Wage growth for young civil servants. Clustered standard errors at the individual level between parentheses. *** denotes significance at the 1% level, ** denotes significance at the 5% level, and * denotes significance at the 10% level.

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