Bank of Finland Research Discussion Papers
15 • 2018

Janne Tukiainen – Tuomas Takalo – Topi Hulkkonen

Relative age effects in political selection

Bank of Finland
Research

Bank of Finland Research Discussion Papers
Editor-in-Chief Esa Jokivuolle

Bank of Finland Research Discussion Paper 15/2018
8 August 2018

Janne Tukiainen – Tuomas Takalo – Topi Hulkkonen
Relative age effects in political selection

ISBN 978-952-323-238-9, online
ISSN 1456-6184, online

Bank of Finland
Research Unit

PO Box 160
FIN-00101 Helsinki

Phone: +358 9 1831

Email: research@bof.fi
Website: www.suomenpankki.fi/en/research/research-unit/

Relative Age Effects in Political Selection*

Janne Tukiainen
London School of Economics and Political Science and
VATT Institute for Economic Research

Tuomas Takalo
Bank of Finland and VATT Institute for Economic Research

Topi Hulkkonen
StattFinn Ltd and University of Helsinki

July 9, 2018

Abstract

We exploit a regression discontinuity design to provide causal evidence of the relative age effect (RAE) on a long-run adult age outcome: Political selection. We find strong evidence of the RAE in politics in Finland. However, the effect is heterogeneous: We find that male candidates born early in the calendar year have a significantly higher probability of getting elected to the parliament but no similar RAE applies to female candidates nor to municipal elections. Moreover, this effect only takes place in the most competitive parliamentary districts and is present only for some parties. We also find that in all the groups where the RAE does not exist, early-born candidates are under-represented suggesting attrition of talent in the candidate placement. Overall, our results show that seemingly artificial cutoffs imposed by the government have persistent consequences even on the selection to the highest positions of power within a society.

Keywords: Political selection, political competition, gender differences, regression discontinuity design, relative age effect.

JEL codes: C21, D72, J13, J16, J24

*Corresponding author: Janne Tukiainen: Department of Government, London School of Economics and Political Science; Houghton Street, London WC2A 2AE, UK, and VATT Institute for Economic research; Arkadiankatu 7, Helsinki, FI-00101; janne.tukiainen@vatt.fi, Tel +358295519451. Tuomas Takalo: Bank of Finland, P.O. Box 160, FI-00101, Helsinki, Finland; Tuomas.takalo@bof.fi. Topi Hulkkonen: StattFinn Ltd, Metsänneidonkuja 12, 02130 Espoo, Finland. topi.hulkkonen@helsinki.fi. We thank Toke Aidt (the editor) and two anonymous referees for valuable comments. We also thank Sebastian Barfort, Torun Dewan, Marja-Liisa Halko Kristiina Huttunen, Martti Kaila, Klaus Kultti, Johanna Mollestrom, Lucas Novaes, Ville Seppälä, Marko Terviö, Roope Uusitalo, Hannu Vartiainen, Stephane Wolton and seminar participants at the 7th Annual EPSA Conference, London School of Economics, the 34th Summer Seminar of the Finnish Economists, and VATT Institute for Economic Research for useful comments and discussions.

1. Introduction

The relative age effect (RAE) refers to the possible advantage that children get when being relatively old in their cohort, that is, children born early in the calendar year perform better that those born later. The existence of an RAE in various professional sports and educational performance is well documented (see, *e.g.*, Musch and Grondin, 2001, Bedard and Duhey, 2006, Böheim and Lackner, 2012, Fredriksson and Öckert, 2014, and Fumarco and Rossi, 2018). The academic and policy interest here arises for four primary reasons. First, there is a concern that artificial rules imposed by the society may create persistent inequality and, second, result in losing irreversibly potential talent among the relatively young in many areas of human life. Third, the existence of an RAE should make a difference for decisions that parent take in family planning and raising children. For example, parents may be making uniformed decisions in enrolling their children to school earlier than obligatory or in waiving the possibility of seeking over-age permissions when warranted. Finally, understanding the mechanisms behind RAE offers a window into understanding early-life human capital accumulation.

Despite the extent of empirical analysis of the RAE, it has remained a possibility that the RAE could be driven by unobserved heterogeneity, for example, season of birth effects due to, *e.g.*, biological, climatic, or environmental factors (Musch and Grondin, 2001). Nor it is clear to what extent the RAE exists beyond education and sports, and to what extent the RAE prevails in the long-run outcomes. Furthermore, the literature has largely focused on estimating the average RAE, paying much less attention to potential heterogeneity in the RAE. For example, there may be important gender differences in the prevalence of an RAE is sports (*e.g.*, Helsen *et al.*, 2005, Vincent and Glamser, 2006, and Nakata and Sakamoto, 2012), but it is not clear whether such gender differences in the RAE exist in other areas of human life. Similarly, a competitive environment has been understood to be a key ingredient for the emergence of an

RAE in sports (see, *e.g.*, Musch and Grondin, 2001, and Addona and Yates, 2010) but it is not clear whether this insight carries elsewhere.

In this paper, we provide evidence from the Finnish politics of an RAE on long-run political outcomes and show that the RAE in politics is not caused by unobserved heterogeneity, but rather by the factors that give a performance advantage to those of the oldest of a cohort. More specifically, the closer is the exact date of the birth of a January-born candidate to the New Year, the larger is his probability to become elected in parliamentary elections. We also find strong evidence that the RAE only applies to males in competitive political environments. In particular, we find no evidence of the RAE among female politicians nor in local municipal elections where competition is much weaker than on the nation-wide parliamentary elections, or even in those parliamentary districts that are less competitive. Moreover, no RAE appears to be present among the politicians of the Centre Party, one of the three main parties in Finland, which is known for its centralized candidate selection process.

Our results on candidate selection show that in all the groups where the RAE does not exist, early-born candidates are under-represented compared to late-born candidates. In contrast, in groups where we find the RAE, the density of candidates develops smoothly over the end-of-the-year cutoff. This suggests that the attrition of (early-born) talent in the candidate placement in some groups is at least one possible reason for the lack of the RAE.

Politics in Finland provides a useful environment to study both gender- and competition-specific RAEs. Finland was the first country in Europe to introduce women's suffrage in 1907 and female representation in politics has been since then high by international standards. For example, in 2015 parliamentary elections, roughly 40% of candidates and successfully elected candidates were female. Moreover, we use data on parliamentary elections from a period where there still were substantial differences in the level of political competition between parliamentary districts.

Our comparative evidence from the Finnish politicians supports Muller and Page's (2015) seminal findings of the existence of an RAE in the US congress (another highly competitive environment). Going beyond Muller and Page (2015), we find that gender, the intensity of electoral competition, and party differences matter for the emergence of an RAE in political selection. Our results suggest that those males who have benefited from RAEs during early-life in school seem to perform better, and thus, political selection in Finland is at least to some extent meritocratic. Therefore, we contribute to understanding political selection (see, *e.g.*, Caselli and Moreno, 2004, and Poutvaara and Takalo, 2007, for theoretical foundations, and Galasso and Nannicini, 2011, Kotakorpi and Poutvaara, 2011, Folke *et al.*, 2016, and Dal Bo *et al.* 2017 among others for empirical evidence). On the other hand, our result has a less encouraging implication: We seem to be losing irreversibly potential talent among the late born in the political arena due to the artificial division of children into different age groups.

Our results showing heterogeneity in the RAE in politics in terms of competition and gender provide a new angle to the extensive literature of gender differences in competitiveness (see Niederle and Vesterlund, 2011, and Niederle, 2016, surveys): If females shy away from mixed-sex competition and if the emergence of the RAE is linked to competitive pressure, we should observe the RAE more visibly in males in more competitive mix-sex environments such as competitive elections. This hypothesis linking the RAE to the gender-competition nexus, together with the laboratory evidence by Niederle *et al*. (2013) that a quota-style affirmative action might reduce the gender gap in competitiveness, predict that encouraging female representation in politics via quotas could result in the emergence of the RAE among the female politicians, too.

Our findings also shed light on the mechanisms underlying the emergence of the RAE. In particular, the heterogeneity in the RAE with respect to gender and intensity of competition supports psychological and biological theories as the main mechanism, but fits less well with

the resource-based theories of the RAE. As a result, the findings help to design appropriate policy response to the RAE.

In the next section we survey the previous literature documenting the existence of the RA, various theories proposed to explain this phenomenon, and motivate why we might to expect to see heterogeneity in the RAE. We describe our data and institutional background in Section 3. Then, in Section 4, we proceed to our empirical investigation of the RAE among the Finnish politicians. We conclude in Section 5.

2. Previous Literature

2.1 Evidence of the RAE

There is a large, multidisciplinary literature documenting the existence of an RAE in educational performance and sports. There is also some evidence that the effect is causal and not driven by season of birth effects. For example, there is cross-country variation in the school and youth sport admission cut-off dates which has been exploited in identification (*e.g.*, Munch and Hay, 1999, and Bedard and Duhey, 2006). While this evidence is quite convincing, there is still possibility that the cut-off date and relative performance variation may be partially driven by the same factors. For example, climatic factors partially explain school and sport season and cut-off variation around the world (*e.g.*, for historical reasons school entry takes place after the harvesting period, *i.e.*, in August-October in the Northern Hemisphere, and in March-May in the Southern Hemisphere, and this is reflected in the school cut-off dates) and it could still be possible that similar climatic factors (*e.g.,* exposure to sun light at a critical development stage) contribute to the relative performance gap.

Another straightforward way to provide causal evidence is to exploit variation over time in the cut-off dates. For example, since 1980s there has been international effort to harmonize cut-off dates for youth football to the 1st of January. Musch and Hay (1999) and Helsen *et al.*

(2000) exploit this shift in Australian and Belgian youth soccer cut-off dates, respectively, and show that performance advantage of those born early in the previous regime vanishes in the new regime whereas those born early in the new regime gain a performance advantage.

A third way to provide causal evidence on the existence of the RAE is to resort to regression discontinuity design (RDD). For example, Barnsley and Thompson (1988), Ponzo and Scoppa (2014) and Crawford *et al.* (2014) provide evidence for the existence of a performance gap between those born one month before and one after the cut-off date in ice-hockey and education. We also perform a RDD where we use data around the cut-off date. Unlike the above studies, we optimize our estimation window instead of resorting to arbitrary windows and use state-of-the-art inference (Calonico *et al.*, 2014, and 2016a).

Beyond sports and education, there is relative paucity of studies of the long-run RAE that allow for a causal interpretation. Fredrikson and Öckert (2014) and Landersøn *et al.* (2017) use the RDD approach to study the effect of school starting age on long-run labor market outcomes and youth crime, respectively. In the only prior study concerning the RAE in politics, Muller and Page (2015) document the evidence for the existence of a bias in the birth rates for US congress representatives, favoring those where the eldest in their cohort at school. We complement their study by using RDD to estimate the gender- and competition-specific RAE in the Finnish parliamentary and municipal elections.

2.2 Theories for the Emergence of the RAE

The arguments for why relative age matters can be loosely grouped in two categories. First, the RAE can emerge because the more advanced in a cohort get more resources in their youth than the less advanced. For example, more advanced students and players in team sports may get more attention and advice from teachers and coaches. In schools, they may be allocated more responsibilities, *e.g.*, they may act as auxiliary teachers or represent the class in various

school committees. In team sports, they may get more easily selected in elite teams where coaches and other training facilities are better or they may get more playing time in more important positions (*e.g.*, central midfield) which are more conducive for future development. This discrimination then amplifies the initial ability differences that may have been entirely due to relative age, rendering the differences persistent.

Another class of explanations for the emergence of the RAE is based on psychology and human biology (see, *e.g.*, Musch and Grondin, 2001). For example, being better than peers strengthen children's self-confidence, self-esteem, and locus of control *per se*. Encouragement and attention by teachers and coaches strengthen further these attributes. Similarly, additional responsibilities in school and playing in more important positions in team sports (and being, *e.g.,* a captain of the team) should also boost self-esteem, self-confidence, and locus of control. This should affect positively motivation and determination to perform well, yielding those children further success. This amplification mechanism works in the reverse direction, too, *i.e.*, performing weaker than peers dilutes self-confidence, self-esteem, and locus of control, diluting motivation and determination, and so on. As a result, small differences in ability due to relative age are amplified over time to large, persistent differences in performance and outcomes.

It is likely that both mechanisms are relevant for the emergence of the RAE, but it would be useful to know whether one of them is more important than the other. It is however empirically challenging to tell apart the effects of the theories because the emergence from the same sources. Our contribution to this literature is that causal evidence of the RAE and heterogeneity in the RAE should at least provide some speculative indication of the underlying mechanism.

2.3 Hypothesis Development

It has been noted that the RAE is more prevalent in more competitive environments in sports (see, *e.g.*, Musch and Grondin, 2001, and Addona and Yates, 2010). The more popular the sport in a country or a region, the more intense is the competition for the elite teams or national teams, and the stronger is the RAE. It is hence possible that the RAE in politics would also be related to the intensity of political competition. We may think political parties as behaving like sport teams and selecting candidates based on their perceived success in elections and channel more resources to their top candidates. Candidates (expected) success could be linked to some psychological traits (*e.g.*, self-esteem, confidence and locus of control) that have been impacted by the RAE. The more important and competitive the election, the more the candidate selection matters for the parties and voters. We can hence hypothesize that to the extent the RAE in politics exists, it is more pronounced in more competitive political environments.

The existence of gender differences in the RAE in sports, especially in football (soccer), are also extensively studied. Although the evidence (see, *e.g.*, Helsen *et al.* 2005, Vincent and Glamser, 2006, Nakata and Samamoto, 2012, and Kirkendall, 2014) is somewhat inconclusive, the presence of the RAE in female athletes appears to be smaller than in male athletes.[1] There is also some evidence of the gender-specific RAE in other areas than sports. Landersø *et al.* (2017), for example, find that higher relative school starting age reduces the probability of committing a crime at a young age and that the effect is significantly stronger for boys than girls. Thus, if there is a gender gap in the prevalence of the RAE, and if the emergence of the RAE is linked to the intensity of competition, we might observe the RAE also in politics more

[1] Evidence of the existence of the RAE from the studies focusing on female football players (rather than on gender differences) is also somewhat ambiguous (see, *e.g.*, Delorme *et al.* 2010, and Romann and Fuchslocher, 2011), suggesting potential gender differences.

visibly in men in more competitive political environments. However, differences in the RAE between men and women found in the previous literature are, for example, explained by gender-specific pace of maturation and physical requirements of different sports, which cannot rationalize the emergence of a gender gap in the RAE in politics.

An explanation for heterogeneity in the RAE in politics in terms of competition and gender could arise from the evidence showing that men are more competitive than women (see Niederle and Vesterlund, 2011, and Niederle, 2016, for surveys of the evidence). Gender differences in response to competition has been reported in the laboratory experiments both at the extensive margin (entering into competition, see, *e.g.*, Niederle and Vesterlund, 2007) and at the intensive margin (exerting effort while in a competition, see, *e.g.*, Gneezy *et al.*, 2003). The gender gap in competitiveness appears to be stronger in mixed-sex competition than in single-sex competition or in self-competition (see, e.g., Gneezy *et al.*, 2003, Niederle *et al.*, 2013, and Apicella *et al.*, 2017). The gender gap seems to emerge at an early age (see, e.g., Gneezy and Rustichini, 2004, and Glätzle-Rützler and Sutter, 2014), and to exist in diverse societies (see, e.g., Gneezy *et al.*, 2009, Apicella and Dreber, 2015, and Zhang, 2018). Gender differences in competitiveness have also been documented outside the laboratories (see, *e.g.*, Buser *et al*. 2014, Reuben *et al.*, 2015, and Zhang, 2018).

In sum, although the evidence does not necessarily suggest that the gender gap in competitiveness is large, or invariantly present, the existence of such a gap appears to be a relatively robust observation. We can hence assume a gender difference in political competitiveness, especially given the mixed-sex nature of electoral competition. Such a gender gap in political competiveness would predict a gender gap in political representation and, if competition is conducive for the emergence of the RAE, it would also suggest a gender gap in the RAE in competitive political environments.

A related explanation for heterogeneity in the RAE in politics in terms of competition and gender (but not for the gender gap in political representation) is that voters value competitive characteristics more in male politicians than female politicians. Political parties maximizing their electoral success should take such voter preferences into account already in candidate selection. Unfortunately, our analysis cannot distinguish whether candidates' or voters' preferences for competition matter more in politics. However, we find no gender differences on what candidate characteristics predict personal votes in the local elections sample that contains rich information on the candidates (results not reported).

It is also conceivable that the RAE might vary across political parties. For example, Berggren *et al*. (2017) show that politicians on the right are on average better looking than politicians on the left, and suggested as an explanation that beautiful people are more likely to perceive the world as just place, and adopt hence conservative values. Similarly, we may think that if those born early perform better or are treated better in their youth than their relatively younger peers, they will also begin to treat the world as a more just place, and adopt more likely conservative values. We could thus observe the RAE more visibly among the politicians of the right-wing parties than of the left-wing parties.

Alternatively, since party organization matters for candidate selection, it could also matter for the emergence of the RAE in politics. We will hence compare the candidates of the Centre Party of Finland to the candidates of other parties since the Centre Party has more centralized candidate selection and nomination procedures than the other parties (Meriläinen and Tukiainen, 2018). A salient division in the Finnish politics also arises from distinctive agrarian roots of the Centre Party, whereas the other main parties are nowadays more urban.

3. Data and Institutional Background

3.1 The Finnish Education System

Since experiences at school should be the main mechanism in explaining the potential existence of an RAE in politics, we review the Finnish education system here briefly. The compulsory basic education in Finland consists of nine years of comprehensive school, which begins during the calendar year a child turns seven.

There are no tuition fees at any stage of education and, in addition, in comprehensive school all the materials, transportation and lunch are free as well. Virtually all children in Finland complete basic education. For instance, according to the Finnish National Board of Education, only 0.1% of a cohort do not graduate from comprehensive school. At the end of ninth grade, each student who has passed all subjects receives a basic education certificate, which contains a numerical or verbal assessment in each subject. The certificate is used the main criteria in the selection process to the upper secondary schools where, according to the Finnish National Board of Education, roughly 90% of students continue after completing the compulsory basic education. Anyone who has completed an upper secondary school is eligible to apply to a university. Depending on the subject and university, students are chosen through an entrance exam and based on their matriculation examination.

A few features make the Finnish education system conducive for the emergence of the RAE in other areas of human life. First, because of the schools starting rule, at the beginning of the first grade of the basic education, the oldest of a cohort can be almost one year older than the youngest of the cohort. Second, retention during basic education is uncommon. For instance, according to the Finnish National Board of Education, only 0.5 % of students were held back in comprehensive school annually during the years 2000-2007. This should guarantee that most adults have spent the same number of years in comprehensive school. Third, postponing school start or earlier enrollments to school are relatively rare. Only around 2% percent of students in

each cohort have delayed the start of school between the years 1995-1999 (Kaila, 2017). Fourth, compulsory education extends to a relatively old age in Finland, so the initial large differences in the relative age have time to accumulate. Finally, according to the Finnish National Institute for Health and Welfare, almost all babies (99.6%) in Finland are born in hospitals where their date of birth is carefully documented.

3.2 The Finnish Political Institutions and Data

We have data from two types of general elections for the representatives for the Finnish democratic institutions.[2] *Municipal elections* are held to elect the municipal councilors. Although the number of municipalities has significantly reduced over the recent decades, at the beginning of 2016 there were still 313 municipalities in Finland and the median size was only roughly 6000 inhabitants. The larger the municipality the larger the number of councilors elected. However, the relationship between the municipality size and the elected councilors is concave, implying that competition for seats is more intense in larger municipalities. Voters of a municipal election consist of adult European Union citizens whose home address is in the municipality. Being a councilor of a municipality is not a paid job but the councilors only get small honorariums.

In the nation-wide *parliamentary elections*, the 200 members of the Finnish parliament are elected. The electorate consists of roughly 4.5 million adult Finnish citizens, divided into 13 electoral districts. Being a member of the parliament is a full-time job with a relatively high salary.

Both elections are dominated by three large parties from the political left, center and right: The Social Democratic Party, the Centre Party of Finland, and the National Coalition Party,

[2] Besides these two elections the Finns participate for the elections for members of the European parliament and the election for the President of the Finland.

respectively. In total eight parties get seats in the parliament and these same are the eight largest parties in the local elections.

Female representation both at the candidate and elected official level is high by the international standards although the majority of candidates and elected officials are males. Both municipal and parliamentary elections are held every four years, but not on the same year. Both elections use the open list proportional representation system using the D'Hondt seat allocation method. Voters have to place a preference vote for an individual candidate. This system creates incentives to cultivate a personal vote and induces competition both within and between parties (Carey and Shugart 1995) making it a plausible case for the RAE to arise.

We have access to a candidate level election data for 1996-2012 municipal elections and 1999-2007 parliamentary elections. These data are from the Finnish Ministry of Justice. During this period there was still substantial variation across parliamentary districts in political competition when measured, for example, by population per seat. Subsequent reform erased these regional differences.

We describe these data in Table 1. There is a similar quite high about 40% share of female candidates in both types of elections. Also the age distribution of candidates is fairly similar in both elections. The parliamentary elections seem to be much more competitive in terms of the number of candidates, the number of votes and especially the much lower share of elected, even conditional on the smaller set of candidates.

Table 1. Descriptive statistics on candidates.

Variable	Obs	Mean	Std. Dev.	Min	Max
Municipal elections					
Votes	198,120	61	149	0	11815
Elected	198,121	0.286	0.452	0	1
Female	198,121	0.387	0.487	0	1
Age	198,120	46.7	12.6	18	95
Parliamentary elections					
Votes	6,026	1368	2386	3	60563
Elected	6,026	0.100	0.299	0	1
Female	6,026	0.389	0.488	0	1
Age	6,026	46.1	12.8	18	87

4. Empirical Strategy and Results

4.1 Identification Strategy and Implementation

To evaluate whether or not an RAE exist in politics and whether or not the effect has a causal interpretation, we employ RDD. We compare the electoral performance of candidates that are of the same absolute age, and born in the same season, but were of different relative age among their cohort, *e.g.*, when in school and in other children and youth activities using the 1st of January cut-off date. More specifically, we ask whether a candidate born on the 1st January of any given year has a higher probability to get elected (and to run for office) than a candidate born on the 31st of December of the previous year. These candidates have a 1 *day* absolute age difference but a 1 *year* relative age difference. Moreover, we study whether the the effect on the success probability of a January-born candidate becomes smaller the later he or she is born in a calendar year. We evaluate the different types of elections (municipal, parliamentary) separately, and also conduct the gender, party and competition analysis using separate samples.

In RDD, we compare two candidates with different relative age but the same absolute age and same season of birth. We estimate regression functions of the form

$$(1) \qquad Y_{it} = \alpha + \beta \bullet 1\{v_{it} > 0\} + f(v_{it}) + \varepsilon_{it},$$

where Y_{it} is the outcome of interest, in particular, whether the candidate gets elected. The forcing variable v_{it} measures the distance from the cut-off located at the turn of the calendar year. To make the forcing variable equidistant on both sides of the cut-off, January 1 and December 31 get values of 0.5 and -0.5, respectively, and the other dates are assigned values accordingly. We also account for leap years.

In the right hand side of equation (1), $1\{v_{it} > 0\}$ is an indicator function for being relatively old (born on the right side of the cut-off), and β is the coefficient of interest. If $f(v_{it})$ is approximately correctly specified within a bandwidth, and there is no precise manipulation of the forcing variable (*i.e.*, the density is smooth at the threshold), the other covariates should evolve smoothly at the boundary, and thus, β will be the causal estimate of the RAE. In this context, it is very likely that the treatment assignment is as-good-as-random close to the threshold, because parents cannot perfectly control the exact date of when giving their birth even if they attempted to do so. As is standard in RDD, imprecise manipulation of the birth date does not hinder identification. For example, even if some selected parents would aim to give birth early in the year, we would be able to identify the causal effect of interest, because they do not always succeed in that.

As suggested, *e.g.*, by Gelman and Imbens (2014), we execute the design using low-order local polynomial specifications. Our implementation follows closely suggestions of Calonico *et al.* (2014 and 2016a). We employ the Mean Squared Error (MSE) optimal bandwidths provided by Calonico *et al.* (2016b) that improve on the existing MSE-optimal bandwidths by

Imbens and Kalyanaraman (2012) (columns (1)-(4) of Tables 2 and 3) and Calonico *et al.* (2014), and also their Coverage Error Rate (CER) optimal bandwidths (column (5) of Tables 2 and 3). We also verify the robustness to alternative range of bandwidths (columns (1) and (2) in Tables 2 and 3). We conduct the RDD both with (somewhat outdated, see Hyytinen *et al.* 2017, Calonico *et al.* 2014 and 2016a) conventional local linear approach (columns (1) and (2) of Tables 2 and 3), but also with the more recent approach of bias correction and robust inference proposed by Calonico *et al.* (2014 and 2016a) (columns (3)-(5) of Tables and 3, referred to as the CCT-correction). We also report results where we fix the main and bias bandwidths to be the same following the advice in Calonico *et al.* (2016a) and Hyytinen *et al.* (2017) (column (4) of Tables 2 and 3). All local regressions use the standard triangular kernel. We use local linear specification in the conventional approach, and in the CCT-correction we use local linear for the main effect estimation and local quadratic for the bias estimation.

Note that the conventional local linear MSE-optimal coefficient is the optimal choice for the point estimate. However, for statistical inference, the confidence intervals based on the bias-corrected coefficient and associated robust inference by Calonico *et al.* (2014) are the most reliable due to their superior coverage properties. Nonetheless, we report in each column the respective point estimate and standard error, but it would be useful to look at the point estimate in column (2) and the confidence interval in column (3) for the most reliable overall picture.

We cluster both the bandwidth selection and the statistical inference at the forcing variable level, that is, one day is one cluster. This clustering addresses two issues. First, same candidate can run many times creating the issue of within-candidate residual correlation. As the birth-date does not change, clustering at the forcing variable level addresses this issue. Second, the forcing variable is a discrete daily based measure in which case Lee and Card (2008) recommend clustering at the forcing variable level. Our results are more precise if we do not cluster (not reported).

Typically RDD would identify an average treatment effect (ATE) at the thresholds. This local effect happens to be precisely the RAE of interest for us in the sense of relating to maximum relative age difference possible in this institution. One caveat is that if there is selection that children have been pushed to school earlier or later than their calendar year would indicate, we are identifying an intent-to-treat effect (ITT). An ITT is likely to be a lower bound of an ATE in this case due to contamination. However, in Finland the calendar year assignment to school cohorts is almost invariantly followed, and thus, in our case an ITT is likely to be very close to an ATE. Dee and Sievertsen (2015) show using real school starting age data from Denmark that the ITT and ATE are in practice identical.

4.2 RDD Main Results

In Figures 1a-b we show the results graphically for the parliamentary elections for all candidates.[3] Figure 1a is a global regression using all the data and 4th order polynomial specification (as is default in the rdplot STATA package), and Figure 1b is the local linear specification within the MSE-optimal bandwidth. The vertical axis shows the success probability and the horizontal axis describes the distance to the New Year cut-off (the 0-point) in days. Based on these figures, those born early in the year seem to have a higher success probability in elections. In other words, the RAE appears to exist in parliamentary politics.

[3] Figures are plotted with the rdplot command in STATA by Calonico *et al.* (2015). For the bin sizes, we use the option that mimics variance of the data rather the one that mimics the regression fit of the data.

Figure 1a. RAE for parliamentary election candidates, global RDD.

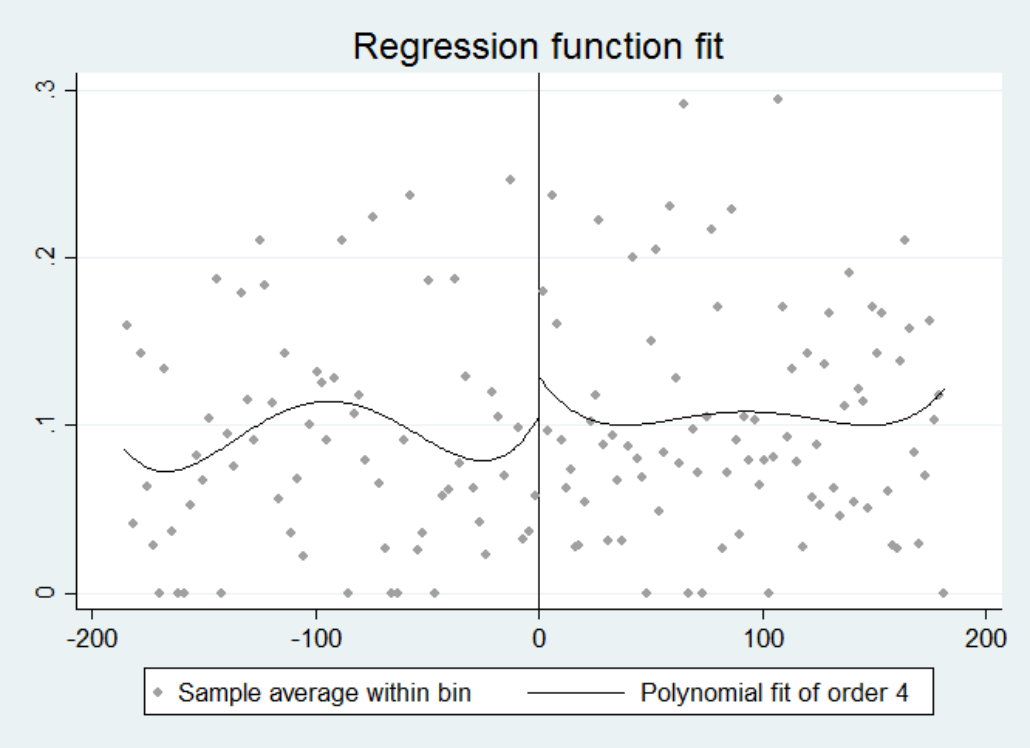


Figure 1b. RAE for parliamentary election candidates, local RDD.

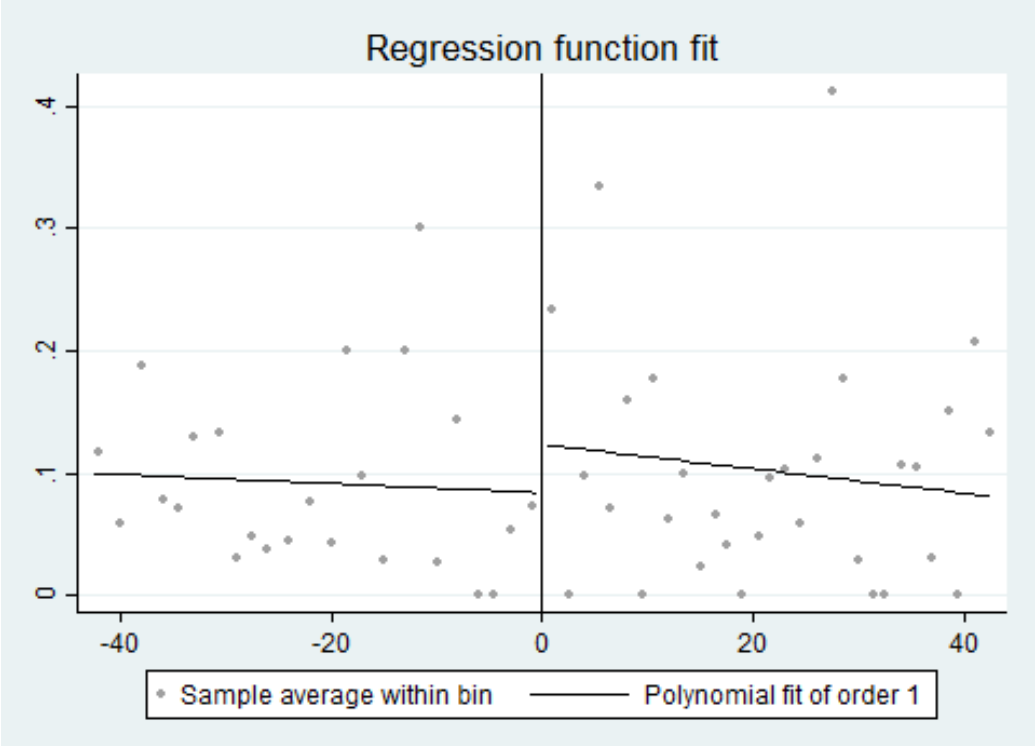


Table 2 displays the regression results for parliamentary elections. The coefficient for relative age is positive in all the reported regressions and statistically significant in three out of five specifications (one at 1%, one at 5% and one at 10% level). The effect is also very large in magnitude: The (smallest) MSE-optimal estimate (column (2)) implies that being born in January 1st instead of December 31st increase the probability of getting elected to the parliament by 6.9 percentage points (conditional on running for the parliament). This almost doubles the baseline probability given that in the data, 600 candidates are elected (200 per elections) and we have a total of 6026 candidate-election observations (see Table 1). The more flexible the specification (narrower bandwidth or higher the degree of polynomial) the larger the effect, showing that when we put more weight to observations where the relative age difference is the largest, we also get larger effects as expected. Overall, the regression results and the graphical results clearly document the existence of the RAE, and suggest a causal interpretation.

Table 2. RAE for parliamentary election candidates.

	(1)	(2)	(3)	(4)	(5)
Estimate	0.166***	0.069	0.088	0.148**	0.107*
95% CI	[0.041;0.290]	[-0.029;0.166]	[-0.022;0.198]	[0.020;0.275]	[-0.009;0.223]
Method	Convent. local lin.	Convent. local lin.	CCT-correction	CCT-correction	CCT-correction
Bandwidth selector	MSE*0.5	MSE	MSE	MSE	CER
Bandwidth(s)	22	43	43/75	43/43	32/75
Effective N	750	1423	1423	1423	1065

Notes: * Denotes statistical significance at 10% level, ** at 5% level and * at 1% level. For the CCT-correction, we report both the main bandwidth and the bias bandwidth. Both the bandwidth selection and statistical inference is clustered at the level of the forcing variable.

In Table 3, we analyze RAE for local elections. We find no evidence of an RAE in that overall sample and the confidence intervals are quite narrow. Depending on the specification, we can rule out effects larger than between about 2-5 percentage points, which are quite small effects given that baseline probabilities of getting elected in local elections are quite high

(almost 30%, see Table 1). This null-result is robust across the various specifications. A possible candidate for explaining the difference between local and national elections is the intensity of competition. We turn to this and other types of heterogeneity in the effect in the next section.

Table 3. RAE for local election candidates.

	(1)	(2)	(3)	(4)	(5)
Estimate	0.017	0.001	-0.001	0.009	0.001
95% CI	[-0.013;0.047]	[-0.021;0.024]	[-0.027;0.026]	[-0.022;0.040]	[-0.027;0.030]
Method	Convent. local lin.	Convent. local lin.	CCT-correction	CCT-correction	CCT-correction
Bandwidth selector	MSE*0.5	MSE	MSE	MSE	CER
Bandwidth(s)	24	47	47/78	47/47	35/78
Effective N	24733	48231	48231	48231	35739

Notes: * Denotes statistical significance at 10% level, ** at 5% level and * at 1% level. For the CCT-correction, we report both the main bandwidth and the bias bandwidth. Both the bandwidth selection and statistical inference is clustered at the level of the forcing variable.

4.3 RDD Heterogeneity Results

We analyze the heterogeneity of the effects in three dimensions, degree of competition, gender, and political party.

Fist, we run the RDD separately on candidate samples with high or low competition. We measure competition for office at the parliamentary district level simply by calculating the population per available seat. This simple measure is attractive as it likely captures competition in the selection process for both candidacy and getting elected, and accounts for both between and within party competition.[4] This measure varies between about 24,000 and 28,000 inhabitants per available seat. We split the sample so that about half of the allocated seats are in both samples. Moreover, the high competition sample contains 7 out the 8 largest cities in

[4] Typical measures of political competition (see, *e.g.*, Galasso and Nannicini 2011 and Cox *et al*. 2018) focus on between party electoral competition, and thus, do not provide a comprehensive picture of how competitive is the entire process of political selection.

Finland (and the 4 largest). As highly educated and otherwise more skilled citizens are concentrated on cities, this is likely to further intensify the competition in that sample.

Second, we run the RDD separately on female and male candidate samples. This division based on gender is straightforward.

Third, we divide the candidate sample along the party differences. There are two natural divisions in the Finnish context. The first division is between left- and right-wing parties. Similar mechanisms that lead candidates on the right be better looking (see Berggren *et al*., 2017) could lead relatively more right-wing candidates born early in the year. However, we find no difference between the Social Democratic and the National Coalitional Party with both exhibiting almost identical RAE in magnitude (see Table A1 in the Online Appendix). In contrast, we compare the Centre Party of Finland to the other parties. As explained in Section 2.3, the Centre Party has idiosyncratic agrarian roots, and more centralized candidate selection and nomination procedures than the other parties (Meriläinen and Tukiainen, 2018).

The heterogeneity results for the parliamentary elections are presented in Table 4. The specification corresponds to one in column (3) of Table 2 (results are robust to alternative specifications). The results are striking: We find large and statistically significant (at 1% level) effects for the high competition and male samples, and non-significant negative coefficients for the low competition and female samples. The results for males are also statistically significantly (at 5% level) different from the female results as are the high completion results from the low competition ones (at 1% level) (so not only different from zero). These results provide strong evidence of the existence of an RAE being dependent on political competition and gender.

Moreover, we find some evidence of heterogeneity across the parties. The coefficient for the Centre Party is negative and non-significant, whereas the coefficient for the other parties is positive and significant at 10% level. However, the difference between these two estimates is not statistically significant mainly due to the imprecise Centre Party estimate for which the

sample is small. A speculative interpretation is that a decentralized candidate placement favors those advantaged by early-year birth.

Table 4. Heterogeneity in RAE for parliamentary election candidates.

	(1)	(2)	(3)	(4)	(5)	(6)
Estimate	0.240***	-0.081	0.184***	-0.042	-0.126	0.119*
95% CI	[0.092;0.378]	[-0.212;0.051]	[0.056;0.312]	[-0.190;0.106]	[-0.539;0.287]	[-0.002;0.240]
Method	CCT-correction	CCT-correction	CCT-correction	CCT-correction	CCT-correction	CCT-correction
Bandwidth selector	MSE	MSE	MSE	MSE	MSE	MSE
Bandwidth(s)	35/64	65/96	35/67	70/108	61/88	40/69
Effective N	596	999	699	891	211	1172
Sample	High competition	Low competition	Male	Female	Centre party	Other parties

Notes: * Denotes statistical significance at 10% level, ** at 5% level and * at 1% level. For the CCT-correction, we report both the main bandwidth and the bias bandwidth. Both the bandwidth selection and statistical inference is clustered at the level of the forcing variable.

To understand further the heterogeneity in the RAE we repeated the analysis for local elections. In the case of local elections, high competition is defined as municipalities with population larger than the 75th percentile of 34,388. In Table 5, the coefficients in all the subsamples indicate quite precisely (with the exception on the smaller Centre Party subsample which is more imprecise) estimated zero effect. Given the parliamentary election results the absence of a competition effect in local elections is not surprising, as the level of competition even in the most competitive municipality (about 6,650 inhabitants per available seat) is much lower than in the parliamentary district with the least competition.

Table 5. Heterogeneity in RAE for local election candidates.

	(1)	(2)	(3)	(4)	(5)	(6)
Estimate	0.003	-0.001	-0.009	0.015	0.049	-0.006
95% CI	[-0.037;0.044]	[-0.027;0.025]	[-0.050;0.032]	[-0.013;0.043]	[-0.011;0.110]	[-0.033;0.020]
Method	CCT-correction	CCT-correction	CCT-correction	CCT-correction	CCT-correction	CCT-correction
Bandwidth selector	MSE	MSE	MSE	MSE	MSE	MSE
Bandwidth(s)	54/82	74/113	48/75	65/104	36/67	68/110
Effective N	14016	57033	30082	26062	8034	54530
Sample	High competition	Low competition	Male	Female	Centre party	Other parties

Notes: * Denotes statistical significance at 10% level, ** at 5% level and * at 1% level. For the CCT-correction, we report both the main bandwidth and the bias bandwidth. Both the bandwidth selection and statistical inference is clustered at the level of the forcing variable.

Finally, we split the parliamentary election samples further to analyze how competition, gender and party interact. These results are reported in Tables A2 and A3 in the Online Appendix. The results indicate further that the RAE may be more nuanced that what is commonly thought: We find evidence of an RAE only in the case of males that are competing for parliamentary seats in the most competitive parliamentary districts, but we find no evidence otherwise. For example, the effect is not present for males in low competition districts nor for females in high competition districts. Moreover, the RAE fails to exists among the Centre Party candidates, not even among males in the high competition environments.

4.4 RDD Results on Selection for Candidacy

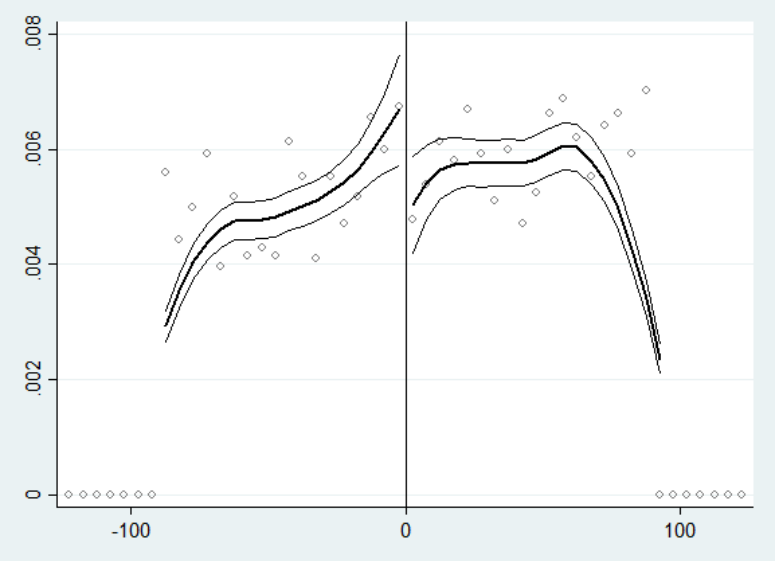
To understand to what extent the RAE is present in candidate selection stage we analyze the RAE on candidacy. Here we do not observe the set of all potential candidates, but only the actual candidates. Thus, we conduct McCrary (2008) density estimation. The object here is not to seek for manipulation that would invalidate the design, but rather to estimate a real effect if interest, that is, the RAE on becoming a candidate in parliamentary elections.

We focus the analysis on the parliamentary candidates to see if the candidate selection patterns are informative on the mechanisms for why we observe RAE only in some

parliamentary candidate samples in Table 4. These results are presented in Figures 2a-2d and Table 6.

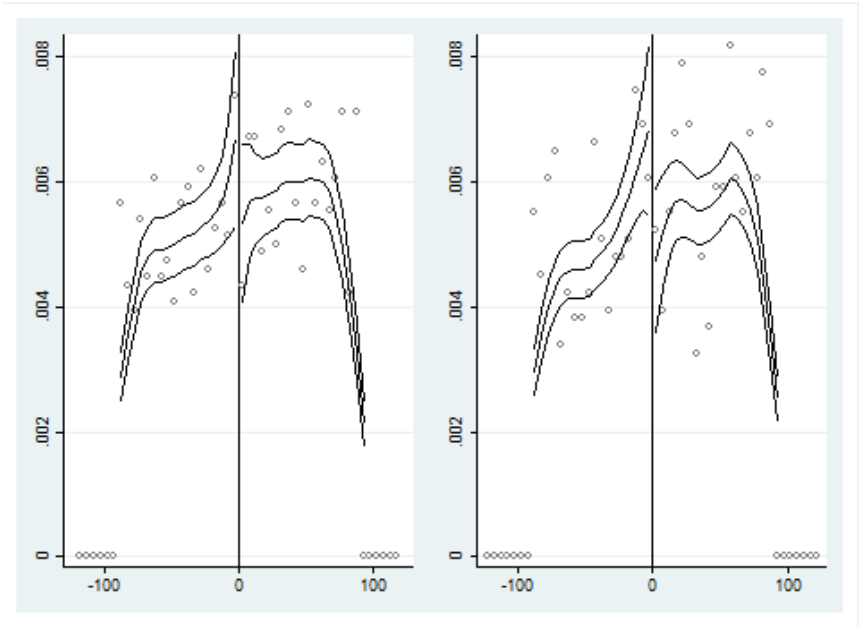
The results indicate the presence of an RAE in selection into candidacy. In particular, the relatively old candidates are under-represented in the party lists (Figure 2a and column (1) of Table 6). Moreover, again the effect is heterogeneous: Figures 2b-2d and columns (2)-(7) of Table 6 indicate that under-representation, if exists at all, is smaller for the groups that are characterized by the RAE in electoral success. Especially large is the difference between women and men (Figure 2c and columns (2) and (3) of Table 6), although the difference between the estimates is significant only at 10% level. Nonetheless, this evidence is consistent with the hypothesis that (relatively talented) women shy away from competition, especially in competitive mixed-sex environments. The results also suggest that behavior in the candidate selection stage may at least partly explain the RAEs in selection for the office in elections.

Figure 2a. McCrary (2008) test for all parliamentary candidates.



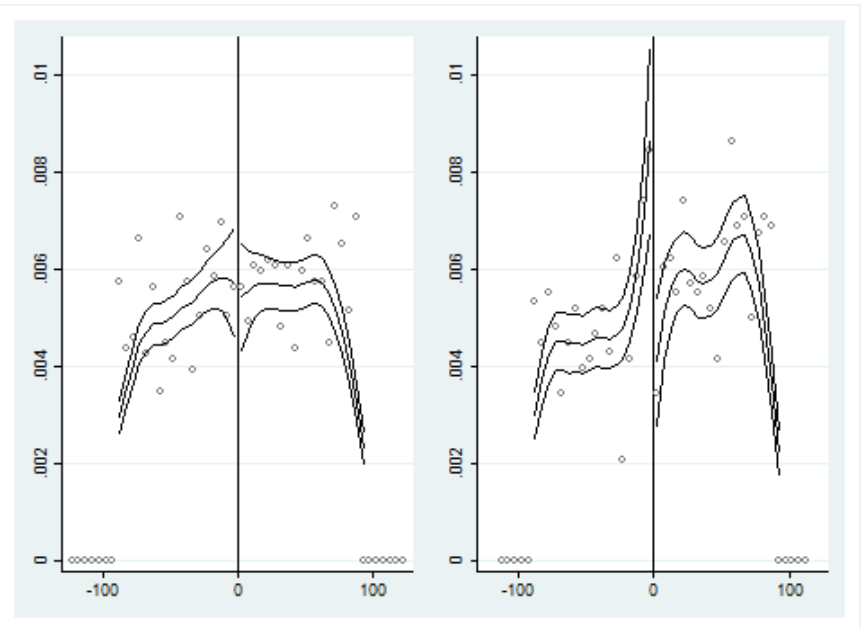
Notes: Sample includes all parliamentary candidates within a 3 month bandwidth. x-axis indicates days and y-axis the density.

Figure 2b. McCrary (2008) tests by competition for parliamentary candidates.



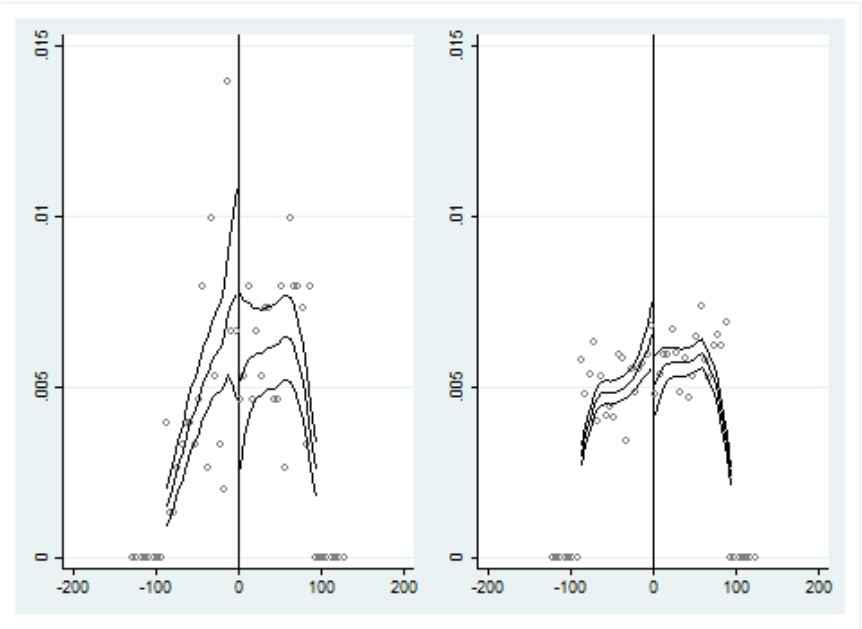
Notes: The left-hand (right-hand) graph include all parliamentary candidates within a 3 month bandwidth in high-competition (low-competition) districts. x-axis indicates days and y-axis the density.

Figure 2c. McCrary (2008) tests by gender for parliamentary candidates.



Notes: The left-hand (right-hand) graph includes all male (female) parliamentary candidates within a 3 month bandwidth. x-axis indicates days and y-axis the density.

Figure 2d. McCrary (2008) tests by party for parliamentary candidates.



Notes: The left-hand (right-hand) graph includes all Centre Party (other parties') parliamentary candidates within a 3 month bandwidth. x-axis indicates days and y-axis the density.

Table 6. Estimates of discontinuity of density at the cutoff.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	All	Male	Female	High Comp	Low Comp	Centre	Other
Estimate	-0.366***	-0.046	-0.951***	-0.339	-0.469**	-0.464	-0.321***
s.e.	0.135	0.175	0.259	0.197	0.193	0.38	0.126

Notes: * Denotes statistical significance at 10% level, ** at 5% level and * at 1% level. The estimate is in log of differences in density. The data involves all or indicated subsamples of parliamentary candidates within a 3 month bandwidth on either size of the cutoff. On these samples, we use the user-written DcDensity command in STATA that implements the McCrary (2008) density test.

4.5 RDD Robustness and Validity Tests

For the sake of brevity, we report the robustness and validity checks only for the parliamentary election analysis, because that is the only sample where we claim to have found

a positive effect. Similar analysis for the local elections gives no reasons to doubt the validity and robustness of the zero effects in that sample (not reported).

Hyytinen *et al.* (2017) argue that the placebo cutoff tests are particularly useful for specification testing (as opposed to validity testing). Therefore, to test the appropriateness of applied specifications, in Figures 3a-3d, we artificially move the cut-off to placebo locations by the amount of days denoted in the x-axis, and report the coefficient and the associated 95% confidence interval estimated for each placebo location. We use here the specification in column (3) of Table 2 and all the specifications used in Table 4.

If our estimation specification is flexible enough (and not too flexible) and the design is valid, zero effect should be within the 95% confidence interval in (about) 95% of the placebo locations. Overall, the figures are fairly comforting, even if not always perfect. In all figures, most of the placebo estimates are insignificant indicating that the specification (CCT-correction with clustered bandwidth selection and inference) is appropriate.

Figure 3a. Placebo cut-offs analysis, CCT-correction, all parliamentary candidates.

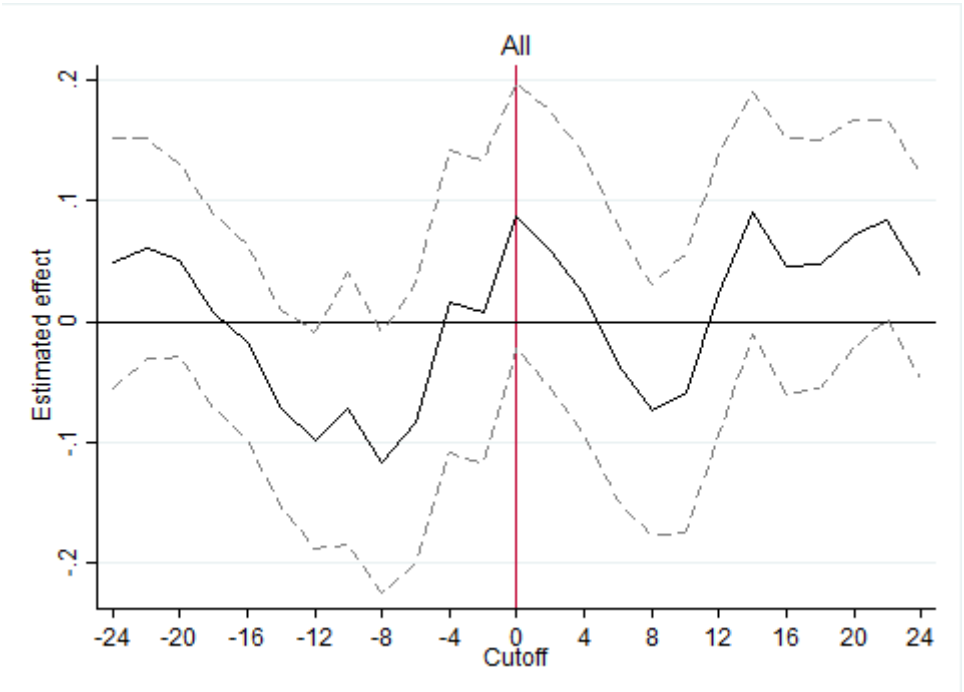


Figure 3b. Placebo cut-offs analysis, CCT-correction, parliamentary candidates by competition.

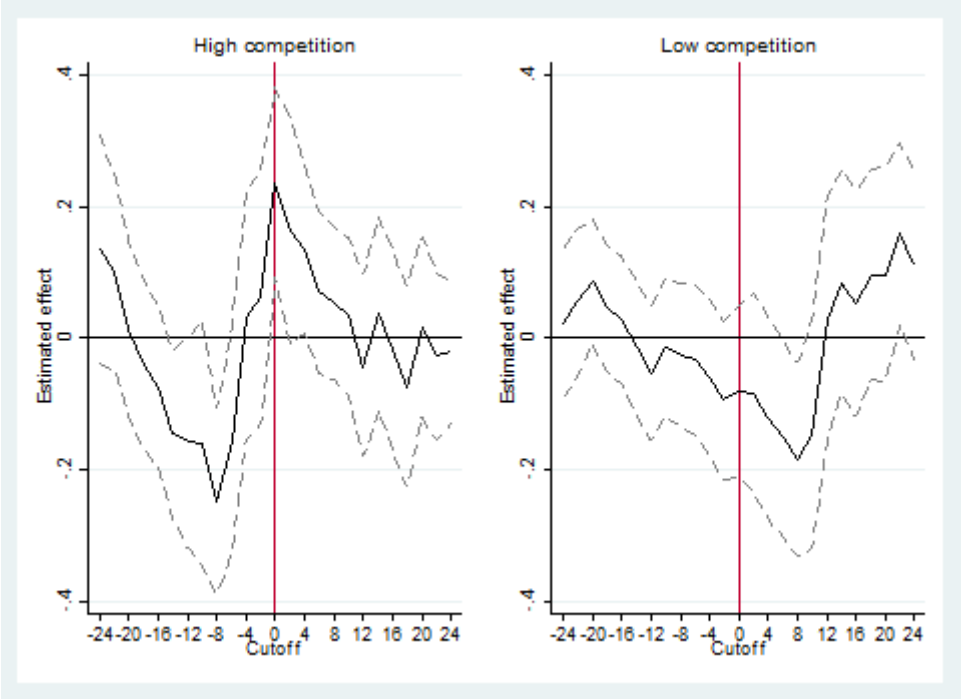


Figure 3c. Placebo cut-offs analysis, CCT-correction, parliamentary candidates by gender.

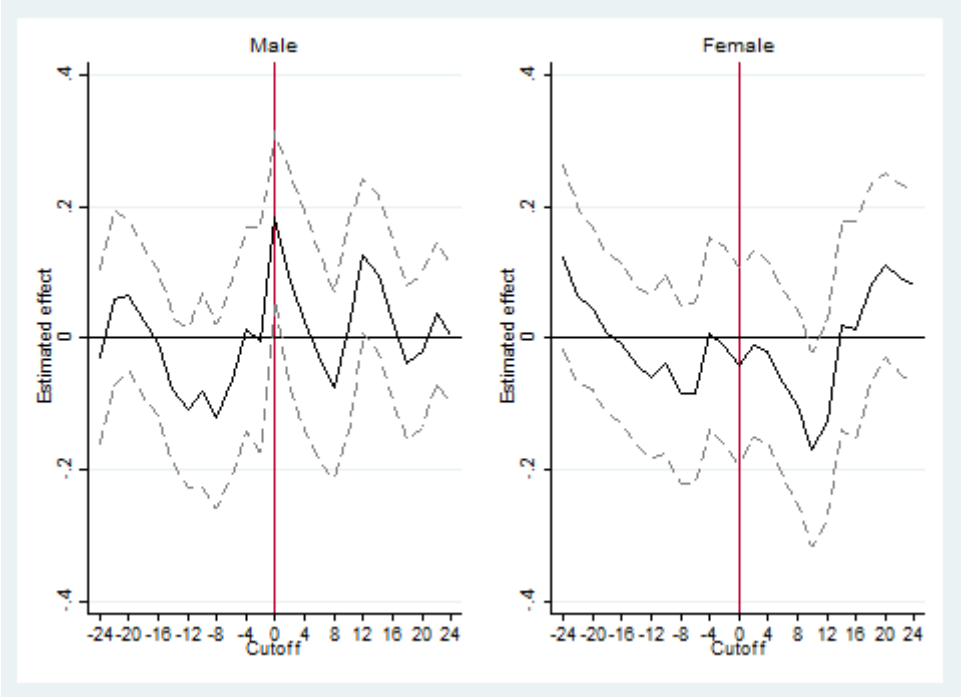
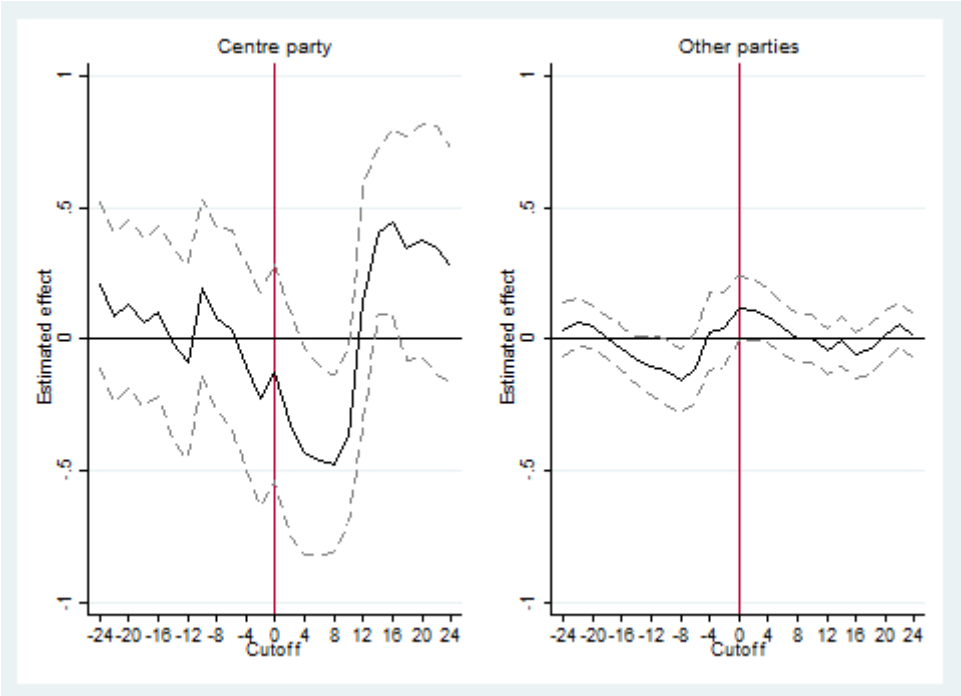


Figure 3d. Placebo cut-offs analysis, CCT-correction, parliamentary candidates by party.



In Figures 4a-4d, we report robustness analysis across a range of bandwidths. Again, the figures use the specification in column (3) of Table 2 and all the specifications used in Table 4. We report the coefficient and the associated 95% confidence interval for each bandwidth denoted in the x-axis (main bandwidth below, bias bandwidth above). Qualitatively, the results are robust. Moreover, in the cases where we observe the RAE, the effects are larger in magnitude the smaller the bandwidth. This observation supports our findings, because increasing bandwidth implies including observations which are relatively younger.

Figure 4a. Results across a range of bandwidths, CCT-correction, all parliamentary candidates.

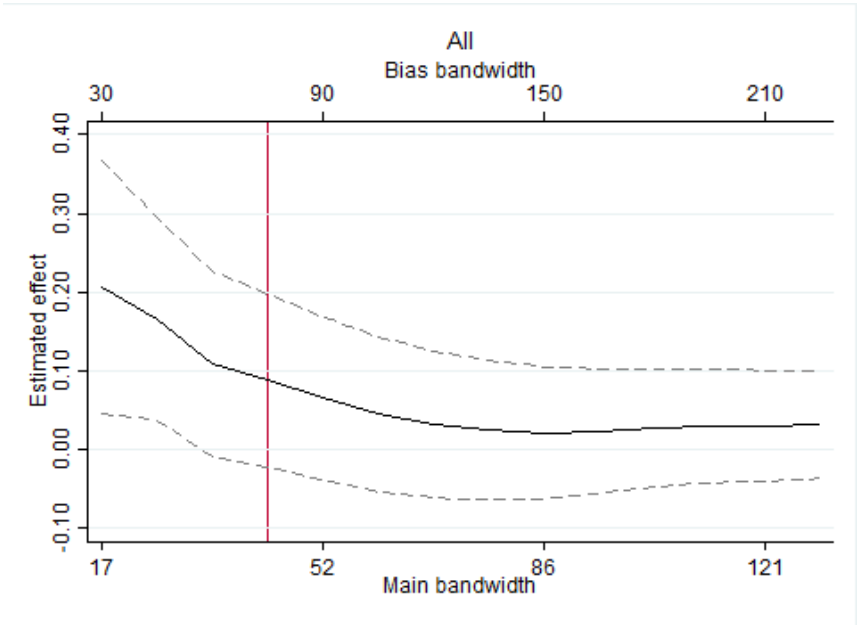


Figure 4b. Results across a range of bandwidths, CCT-correction, parliamentary candidates by competition.

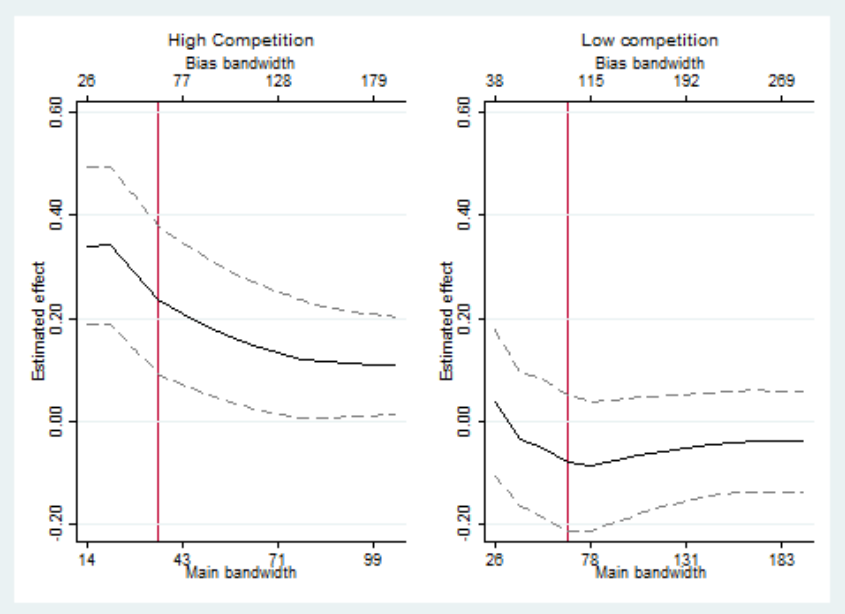


Figure 4c. Results across a range of bandwidths, CCT-correction, parliamentary candidates by gender.

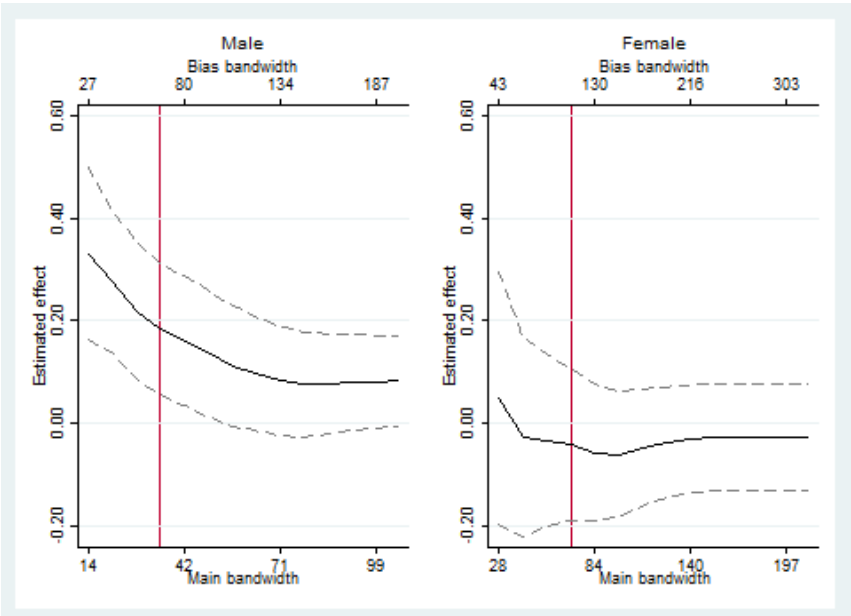
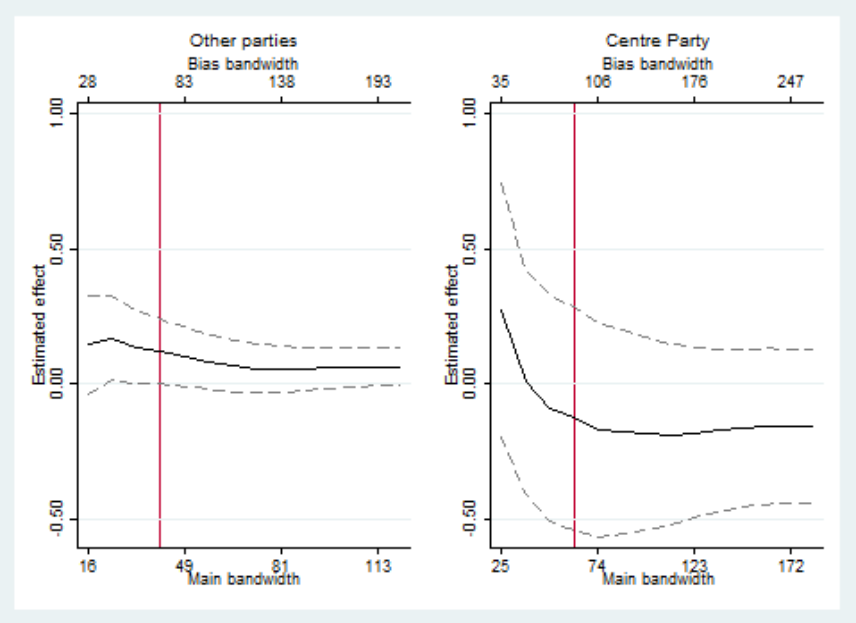


Figure 4d. Results across a range of bandwidths, CCT-correction, parliamentary candidates by party.



A common validity test for RDD is the covariate balance test, an indirect way of testing the key assumption of smooth development of potential outcomes over the threshold. Testing for covariate balance is, however, tricky in the case of an RAE, because we have no pre-treatment variables. Since the RAE in politics is likely to be driven by early-life events, *e.g.*, experiences in school, politicians' own adult-age characteristics can only be used to analyze the actual effects, not to test for balance. Unfortunately, we have no access to characteristics of parliamentary candidates' parents, which could have been used as placebo outcomes. However, we think that the design is valid, because birth date cannot be perfectly manipulated. Moreover, we can conduct a relevant placebo test to show that the absolute age of candidates balances. The results (shown in the Table A4 of the Online Appendix) using specification (3) from Tables 2 and 3. The effects are not statistically significant (at 5% level) for the entire sample nor for any of the subsamples.

5. Conclusions

We study whether the RAE can be given a causal interpretation and whether and how it varies with gender, the intensity of competition, and political party by using Finnish data from politics. Our results suggest that the RAE in politics is not driven by unobserved heterogeneity nor seasonal effects but is created by the artificial division of people into different age groups. We find that the RAE is only a concern for male politicians in competitive political environments. We also document that the lack of the RAE in female politicians, in municipal elections, and among the politicians of the Centre Party are driven by the under-representation of early-born candidates.

Our findings regarding gender and competition corroborate the previous literature on the RAE in sports suggesting gender differences in the RAE, and conduciveness of competitive pressure for the emergence of the RAE. However, our findings suggest that the documented gender gap in the RAE in sports might not be driven solely by the different pace of maturation of boys and girls and role of physical requirements in female and male sports as speculated in the literature.

Rather, we think that gender differences in the RAE could arise from gender differences in preferences for and responses to competition. There is substantial evidence (see surveys by Niederle and Vesterlund, 2011, and Niederle, 2016) showing that women shy away from competition whereas men embrace it. Moreover, men typically perform better in more competitive environments. The gender gap in competitiveness also seems to higher in mixed-sex competition such as politics. Finally, the adverse effects of performing badly in competitive environments seem to be larger for men than women. For example, Eliason and Storre (2009) report large negative health effects for men due to job loss but these effects are absent for women.

Our results combined with the laboratory evidence from Niederle *et al*. (2013) allow for speculation that institutional reforms (*e.g*., quota-style affirmative actions) aiming at reducing the gender gap in political representation, or more generally, in competitiveness might also reduce the gender gap in the RAE.

Our findings can also be seen to provide suggestive evidence that the RAE is driven by the human capital accumulation resulting from in particular the males benefiting from being able to successfully compete with their peers from early on in life. To fight against such persistent inequalities created by the artificial rules imposed by the society, educational systems could consider remedies to the RAE adopted by some advanced sport leagues and teams, such as bio-banding, *i.e*., grouping young based on attributes associated with growth and maturation, rather than on chronological age (see, *e.g*., Cumming *et al*., 2017). At least, teachers of young children should begin to pay careful attention to their students' birth dates, especially when evaluating student performance. [5]

References

Addona, V. and Yates, P. A. (2010) A Closer Look at the Relative Age Effect in the National Hockey League. *Journal of Quantitative Analysis in Sports* 6, Iss. 4, Article 9.

Angrist, J. D., and Krueger, A. B. (1992) The Effect of Age at School Entry on Educational Attainment: An Application of Instrumental Variables with Moments from Two Samples. *Journal of the American Statistical Association* 87, 328-336.

Apicella, C. L., and Dreber, A. (2015) Sex Differences in Competitiveness: Hunter Gatherer Women and Girls Compete Less in Gender-Neutral and Male-Centric Tasks. *Adaptive Human Behavior and Physiology* 1, 247-269.

[5] A related remedy could be to present information about student age properly to teachers. For example, Mann and van Ginneken (2017) show that age-ordered shirt numbering could eliminate selection bias associated to the RAE in youth football.

Apicella, C. L., Dreber, A., and Mollestrom, J. (2017) No Gender Difference in Willingness to Compete when Competing against Self. *American Economic Review* 107, 136-140.

Barnsley, R. H., and Thompson, A. H. (1988) Birthdate and Success in Minor Hockey: The Key to the NHL. *Canadian Journal of Behavioural Science* 20, 167-176.

Bedard, K., and Dhuey, E. (2006) The Persistence of Early Childhood Maturity: International Evidence of Long-Run Age Effects. *Quarterly Journal of Economics* 121, 1437-1472.

Berggren, N., Jordahl, H., and Poutvaara, P. (2017) The Right Look: Conservative Politicians Look Better and Voters Reward It. *Journal of Public Economics* 146, 79-86.

Buser, T., Niederle, M., and Oosterbeek, H. (2014) Gender, Competitiveness and Career Choices. *Quarterly Journal of Economics* 129, 1409-1447.

Böheim, E., and Lackner, M. (2012) Returns to Education in Professional Football. *Economics Letters* 114, 326-328.

Calonico, S., Cattaneo, M. and Titiunik, R. 2014. Robust Nonparametric Confidence Intervals for Regression-Discontinuity Designs. *Econometrica* 82, 2295–326.

Calonico, S., Cattaneo, M. and Titiunik, R. 2015. Optimal Data-Driven Regression Discontinuity Plots. *Journal of the American Statistical Association* 110, 1753–69.

Calonico, S., Cattaneo, M. and Farrell, M. 2016a. On the Effect of Bias Estimation on Coverage Accuracy in Nonparametric Inference. Forthcoming in *Journal of the American Statistical Association*.

Calonico, S., Cattaneo, M., Farrell, M. and Titiunik, R. (2016b) rdrobust: Software for Regressions Discontinuity Designs. Forthcoming in *Stata Journal*.

Carey, J. and Shugart, M. (1995). Incentives to Cultivate a Personal Vote: A Rank Ordering of Electoral Formulas. *Electoral Studies* 14, 417-439.

Caselli, F. and Morelli, M. (2004) Bad Politicians. *Journal of Public Economics* 88, 759–782.

Crawford, C., Dearden, L., and Greaves, E. (2014) The Drivers of Month-of-Birth Differences in Children's Cognitive and Non-cognitive Skills. *Journal of the Royal Statistical Society A* 177, 829–860.

Cox, G. W., Diva, J. H., and Smith, D. M. (2018) Measuring the Competitiveness of Elections. Mimeo.

Cumming, S. P., Lloyd, R. S., Olivier, J. L., Eisenmann, J. C., and Malina, R. M. (2017) Bio-banding in Sport: Applications to Competition, Talent Identification, and Strength and Conditioning of Young Athletes. *Strength and Conditioning Journal* 39, 34-47.

Dal Bó, E., Finan, F., Folke, O., Persson, T. and Rickne, J. (2017) Who Becomes a Politician? *Quarterly Journal of Economics* 132, 1877-1914.

Delorme, N., Boiché, J., and Raspaud, M. (2010). Relative Age Effect in Female Sport: A Diachronic Examination of Soccer Players. *Scandinavian Journal of Medicine and Science in Sports* 20, 509-515.

Dee, T., and Sievertsen, H. (2015) The Gift of Time? School Starting Age and Mental Health. NBER Working Paper 21610.

Eliason, M., and Storre, D. (2009) Job Loss is Bad for your Health – Swedish Evidence on Cause-Specific Hospitalization Following Involuntary Job Loss. *Social Science & Medicine* 68, 1396-1406.

Gelman, A., and Imbens, G. (2014) Why Higher Order Polynomials Should not be Used in Regression Discontinuity Designs. NBER Working Paper 20405.

Galasso, V., and Nannicini, T. (2011) Competing on Good Politicians. *American Political Science Review* 105, 79–99.

Glätzle-Rützler, D., and Sutter, M. (2014) Gender Differences in the Willingness to Compete Emerge Early in Life and Persist. *Management Science* 61, 2339–23354.

Gneezy, U., Leonard, K., and List, J. (2009) Gender Differences in Competition: Evidence from a Matrilinear and a Patriarchal Society. *Econometrica* 77, 1637–1664.

Gneezy, U., Niederle, M., and Rustichini, A. (2003) Performance in Competitive Environments: Gender Differences. *Quarterly Journal of Economics* 118, 1049-1074.

Gneezy, U., and Rustichini, A. (2004) Gender and Competition at a Young Age. *American Economic Review* 94, 377–381.

Folke, O., Persson, T., and Rickne, J. (2016) The Primary Effect: Preference Votes and Political Promotions. *American Political Science Review* 110, 559-578.

Fredriksson, P., and Öckert, B. (2014) Life-cycle Effects of Age at School Start. *Economic Journal* 124, 977-1004.

Fumarco, L., and Rossi, G. (2018) Relative Age Effect on Labor Market Outcomes for High Skilled Workers – Evidence from Soccer. Forthcoming in *European Sport Management Quarterly*.

Helsen, W. F., Starkes, J. L., and Van Winckel, J. (2000) Effect of a Change in Selection Year on Success in Male Soccer Players. *American Journal of Human Biology* 12, 729- 735.

Helsen, W. F., Van Winckel, J., and Williams, A. M. (2005) The Relative Age Effect in Youth Soccer Across Europe. *Journal of Sports Science* 23, 629-636.

Hyytinen, A., Meriläinen, J., Saarimaa, T., Toivanen O, and Tukiainen J. (2017). When Does Regression Discontinuity Design Work? Evidence from Random Election Outcomes. Forthcoming in *Quantitative Economics*.

Kaila, M. (2017) *The Effects of Relative School Starting Age on Educational Outcomes in Finland*. University of Helsinki, Faculty of Social Sciences, Economics Master's Thesis, February 2017.

Kirkendall, D. T. (2014) The Relative Age Effect Has No Influence in the Match Outcome in Youth Soccer. *Journal of Sport and Health Science* 3, 273-278.

Kotakorpi, K. and Poutvaara, P. (2011) Pay for Politicians and Candidate Selection: An Empirical Analysis. *Journal of Public Economics* 95, 877-885.

Landersø, R., Nielsen, H. S., and Simonsen, M. (2017) School Starting Age and the Crime-age Profile. *Economic Journal* 127, 1096-1118.

Lee, D. S. and Card, D. (2008) Regression Discontinuity Inference with Specification Error. *Journal of Econometrics* 142, 655–674.

Mann, D. L., and van Ginneken, P. J. M. A. (2017) Age-ordered Shirt Numbering Reduces the Selection Bias Associated with the Relative Age Effect. *Journal of Sports Sciences* 35, 784-790.

McCrary, J. (2008) Manipulation of the Running Variable in the Regression Discontinuity Design: A Density Test. *Journal of Econometrics* 142, 698-714.

Meriläinen, J. and Tukiainen, J. (2018) Rank Effects in Political Promotions. Forthcoming in *Public Choice*.

Muller, D. and Page, L. (2015) Born Leaders: Political Selection and the Relative Age Effect in the US Congress. *Journal of Royal Statistical Society A* 179, 809-829.

Musch, J., and Grondin, S. (2001) Unequal Competition as an Impediment to Personal Development: A Review of the Relative Age Effect in Sport. *Development Review* 21, 147-167.

Musch, J., and Hay, R. (1999) The Relative Age Effect in Soccer: Cross-Cultural Evidence for a Systematic Distribution Against Children Born Late in the Competition Year. *Sociology of Sport Journal* 16, 54-64.

Nakata, H., and Sakamoto, K. (2012) Sex Differences in Relative Age Effects among Japanese Athletes. *Perceptual and Motor Skills* 115, 179-186.

Niederle, M. (2016) Gender. In John Kagel and Alvin E. Roth (eds.) *Handbook of Experimental Economics*, 2nd edition, 481-553. Princeton University Press: Princeton, N. J.

Niederle, M., Segal, C., and Vesterlund, L. (2013) How Costly is Diversity? Affirmative Action in Light of Gender Differences in Competitiveness. *Management Science 59*, 1-16. "

Niederle, M., and Vesterlund, L. (2007) Do Women Shy Away from Competition? Do Men Compete Too Much? *Quarterly Journal of Economics* 122, 1067-1101.

Niederle, M., and Vesterlund, L. (2011) Gender and Competition. *Annual Review of Economics* 3, 601-630.

Ponzo, M., and Scoppa, V. (2014) The Long-Lasting Effects of School Entry Age: Evidence from Italian Students. *Journal of Policy Modeling* 36, 578-599.

Poutvaara, P. and Takalo, T. (2007) Candidate Quality. *International Tax and Public Finance* 14, 7-27.

Reuben, E., Sapienza, P. and Zingales, L. (2015) Taste for Competition and the Gender Gap Among the Young Business Professionals. IZA Discussion Paper No. 9446.

Romann, M., and Fuchslocher, J. (2011). Influence of the Selection Level, Age and Playing Position on Relative Age Effects in Swiss Women's Soccer. *Talent Development and Excellence* 3, 239-247

Vincent, J., and Glamser, F.D. (2006). Gender Differences in the Relative Age Effect Among the US Olympic Development Program Youth Soccer Players. *Journal of Sports Sciences* 24, 405–13.

Zhang, Y.J. (2018) Culture, Institutions, and the Gender Gap in Competitive Inclination: Evidence from the Communist Experiment in China. Forthcoming in *Economic Journal*.

Online Appendix

Table A1: RDD by party.

	Centre Party	Social Democratic Party	National Coalitional Party
Estimate	-0.126	0.172	0.164
95% CI	[-0.539;0.287]	[-0.212;0.557]	[-0.055;0.383]
Method	CCT-correction	CCT-correction	CCT-correction
Bandwidth selector	MSE	MSE	MSE
Bandwidth(s)	61/88	62/98	67/113
N	211	208	208

Notes: * Denotes statistical significance at 10% level, ** at 5% level and * at 1% level. For the CCT-correction, we report both the main bandwidth and the bias bandwidth. Both the bandwidth selection and statistical inference is clustered at the level of the forcing variable.

Table A2: RDD, two-way interactions and heterogeneous RAE.

Panel A: By competition and gender				
	(1)	(2)	(3)	(4)
Estimate	0.422***	0.025	-0.042	-0.149*
95% CI	[0.282;0.562]	[-0.187;0.236]	[-0.218;0.134]	[-0.316;0.019]
Method	CCT-correction	CCT-correction	CCT-correction	CCT-correction
Bandwidth selector	MSE	MSE	MSE	MSE
Bandwidth(s)	28/55	68/108	56/84	73/111
N	271	476	547	420
Sample	High comp & male	High comp & female	Low comp & male	Low comp & female
Panel B: By competition and party				
	(5)	(6)	(7)	(8)
Estimate	-0.365	0.290***	-0.103	-0.056
95% CI	[-0.824;0.094]	[0.133;0.445]	[-0.632;0.426]	[-0.171;0.060]
Method	CCT-correction	CCT-correction	CCT-correction	CCT-correction
Bandwidth selector	MSE	MSE	MSE	MSE
Bandwidth(s)	50/75	32/54	88/120	45/74
N	76	495	158	602
Sample	High comp & Centre P.	High comp & other	Low comp & Centre P.	Low comp & other
Panel C: By party and gender				
	(9)	(10)	(11)	(12)
Estimate	-0.164	-0.334**	0.227***	0.001
95% CI	[-0.694;0.366]	[-0.649;-0.020]	[0.102;0.352]	[-0.180;0.182]
Method	CCT-correction	CCT-correction	CCT-correction	CCT-correction
Bandwidth selector	MSE	MSE	MSE	MSE
Bandwidth(s)	72/114	51/74	31/61	64/95
N	147	81	583	724
Sample	Centre Party & male	Centre Party & female	Other parties & male	Other parties & female

Notes: * Denotes statistical significance at 10% level, ** at 5% level and * at 1% level. For the CCT-correction, we report both the main bandwidth and the bias bandwidth. Both the bandwidth selection and statistical inference is clustered at the level of the forcing variable.

.

Table A3: RDD, three-way interactions and heterogeneous RAE.

	Panel A: High competition			
	(1)	(2)	(3)	(4)
Estimate	0.056	-0.463*	0.425***	0.093
95% CI	[-0.279;0.392]	[-1.01;0.081]	[0.281;0.569]	[-0.175;0.361]
Method	CCT-correction	CCT-correction	CCT-correction	CCT-correction
Bandwidth selector	MSE	MSE	MSE	MSE
Bandwidth(s)	40/76	46/62	28/53	59/93
N	31	36	256	373
Sample	Centre Party & male	Centre Party & female	Other parties & male	Other parties & female
	Panel B: Low competition			
	(5)	(6)	(7)	(8)
Estimate	-0.244	-0.227	0.004	-0.135
95% CI	[-0.845;0.358]	[-0.595;0.141]	[-0.117;0.125]	[-0.338;0.068]
Method	CCT-correction	CCT-correction	CCT-correction	CCT-correction
Bandwidth selector	MSE	MSE	MSE	MSE
Bandwidth(s)	80/116	73/118	38/68	80/114
N	91	51	329	394
Sample	Centre Party & male	Centre Party & female	Other parties & male	Other parties & female

Notes: * Denotes statistical significance at 10% level, ** at 5% level and * at 1% level. For the CCT-correction, we report both the main bandwidth and the bias bandwidth. Both the bandwidth selection and statistical inference is clustered at the level of the forcing variable.

Table A4: RDD, covariate balance on absolute age.

	(1)	(2)	(3)	
Estimate	0.55	3.95	-3.11	
95% CI	[-2.68;3.80]	[-1.15;9.06]	[-6.98;0.75]	
Method	CCT-correction	CCT-correction	CCT-correction	
Bandwidth selector	MSE	MSE	MSE	
Bandwidth(s)	49/75	61/93	40/70	
Effective N	1577	1035	627	
Sample	All	High competition	Low competition	
	(4)	(5)	(6)	(7)
Estimate	-0.79	-0.39	5.02*	0.20
95% CI	[-5.06;3.47]	[-3.96;3.19]	[-0.824;10.87]	[-3.38;3.77]
Method	CCT-correction	CCT-correction	CCT-correction	CCT-correction
Bandwidth selector	MSE	MSE	MSE	MSE
Bandwidth(s)	41/70	55/91	68/112	50/76
Effective N	847	684	241	1436
Sample	Male	Female	Centre party	Other parties

Notes: * Denotes statistical significance at 10% level, ** at 5% level and * at 1% level. For the CCT-correction, we report both the main bandwidth and the bias bandwidth. Both the bandwidth selection and statistical inference is clustered at the level of the forcing variable.

Bank of Finland Research Discussion Papers 2018

ISSN 1456-6184, online

1/2018 Matthijs Lof – Jos van Bommel
Asymmetric information and the distribution of trading volume
ISBN 978-952-323-206-8, online

2/2018 Marcella Lucchetta – Michele Moretto – Bruno M. Parigi
Systematic risk, bank moral hazard, and bailouts
ISBN 978-952-323-209-9, online

3/2018 Ernesto Pasten – Raphael Schoenle – Michael Weber
Price rigidities and the granular origins of aggregate fluctuations
ISBN 978-952-323-211-2, online

4/2018 Jinill Kim – Francisco Ruge-Murcia
Extreme events and optimal monetary policy
ISBN 978-952-323-212-9, online

5/2018 Seppo Honkapohja – Kaushik Mitra
Price level targeting with evolving credibility
ISBN 978-952-323-213-6, online

6/2018 Guido Ascari – Anna Florio – Alessandro Gobbi
High trend inflation and passive monetary detours
ISBN 978-952-323-218-1, online

7/2018 Gonçalo Faria – Fabio Verona
The equity risk premium and the low frequency of the term spread
ISBN 978-952-323-219-8, online

8/2018 Mikael Juselius – Előd Takáts
The enduring link between demography and inflation
ISBN 978-952-323-220-4, online

9/2018 Jonathan Benchimol – Lahcen Bounader
Optimal monetary policy under bounded rationality
ISBN 978-952-323-222-8, online

10/2018 Mathias Drehmann – Mikael Juselius – Anton Korinek
Going with the flows. New borrowing, debt service and the transmission of credit booms
ISBN 978-952-323-224-2, online

11/2018 Kim Ristolainen
Getting better? The effect of the single supervisory mechanism on banks' loan loss reporting and loan loss reserves
ISBN 978-952-323-231-0, online

12/2018 Juho Anttila
Measuring the effects of conventional and unconventional monetary policy in the euro area
ISBN 978-952-323-232-7, online

13/2018 Esa Jokivuolle – Radu Tunaru – Davide Vioto
Testing the systemic risk differences in banks
ISBN 978-952-323-234-1, online

14/2018 Christiane Baumeister – James D. Hamilton
Inference in structural vector auto regressions when the identifying assumptions are not fully believed: Re-evaluating the role of monetary policy in economic fluctuations
ISBN 978-952-323-235-8, online

15/2018 Janne Tukiainen – Tuomas Takalo – Topi Hulkkonen
Relative age effects in political selection
ISBN 978-952-323-238-9, online