VATT Working Papers 94

Gender Specific Relative Age Effects in Politics and Football

Janne Tukiainen

Tuomas Takalo

Topi Hulkkonen

VATT INSTITUTE FOR ECONOMIC RESEARCH

VATT WORKING PAPERS

94

Gender Specific Relative Age Effects in Politics and Football

Janne Tukiainen
Tuomas Takalo
Topi Hulkkonen

Valtion taloudellinen tutkimuskeskus
VATT Institute for Economic Research
Helsinki 2017

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, P.O. Box 1279, FI-00101, janne.tukiainen@vatt.fi

Tuomas Takalo, Bank of Finland, P.O. Box 160, FI-00101, and VATT Institute for Economic Research, Arkadiankatu 7, P.O. Box 1279, FI-00101, tuomas.takalo@bof.fi

Topi Hulkkonen, StatFinn Ltd, Metsänneidonkuja 12, FI-02130, and University of Helsinki, P.O. Box 33, FI-00014, topi.hulkkonen@helsinki.fi

We thank Sebastian Barfort, Torun Dewan, Kristiina Huttunen, Martti Kaila, Mika Kortelainen, Klaus Kultti, 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.

ISBN 978-952-274-201-8 (PDF)

ISSN 1798-0291 (PDF)

Valtion taloudellinen tutkimuskeskus
VATT Institute for Economic Research
Arkadiankatu 7, 00100 Helsinki, Finland

Helsinki, August 2017

Gender Specific Relative Age Effects in Politics and Football

VATT Institute for Economic Research
VATT Working Papers 94/2017

Janne Tukiainen – Tuomas Takalo – Topi Hulkkonen

Abstract

The existence of a relative age effect (RAE) is well documented, i.e., those born early in the calendar year perform better at school and sports. We exploit a change in a selection period in youth football and regression discontinuity design in political selection to parliament in Finland to provide causal evidence of the RAE on long-run outcomes: The RAE is not driven by inherent advantages of an early year birth but rather by factors that favor those that are the oldest of a cohort irrespective of the calendar year. Thus, it is not limited to sports but has persistent consequences even on the selection to the highest positions of power within a society. Strikingly, we find strong evidence that the RAE only applies to males in competitive political environments.

Key words: Gender differences, political selection, relative age effect

JEL classes: C21, D72, J13, Z22

1. Introduction

The relative age effect (RAE) refers to the possible advantage that children get when being relatively old in their cohort. 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, 2015). 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 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, it has been noted that there may be important gender differences in the prevalence of an RAE is team sports (*e.g.*, Helsen *et al.*, 2005, Vincent and Glamser, 2006, and Nakata and Sakamoto, 2012) but the evidence is somewhat inconclusive, and 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 team sports (see, *e.g.*, Musch and Grondin, 2001) but it is not clear whether this insight carries elsewhere.

In this paper, we provide evidence of an RAE on long-run outcomes in politics and football (soccer), and that the RAE in neither politics nor in football is caused by unobserved heterogeneity, but rather by the factors that give a performance advantage to those of the oldest of a cohort. We also find strong evidence that the RAE only applies to males in competitive political environments, being absent from female politicians (and from young female football players) and, also absent in less competitive political environments, even in the case of males. In particular, we do not find evidence of the RAE among female politicians nor in local municipal elections where competition is much weaker that on the nation-wide parliamentary elections.

We provide comparative evidence from politics in Finland that corroborates Muller and Page's (2015) seminal findings of the existence of an RAE in the US politics. Going beyond Muller and Page (2015), we find that gender and the intensity of electoral competition matters for the emergence of an RAE in political selection. Our results suggest that those males who have benefited from RAE 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, the result has a less positive implication: We seem to be losing potential talent among the late born in the political arena due to artificial rules imposed by the society on the school starting age.

Our leading evidence comes from the Finnish politicians, which provides a useful environment to study gender-specific relative age effects. 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. We use regression discontinuity design (RDD) to show that the RAE is driven by those that are born close to the beginning of a calendar year. 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. As briefly reviewed in the next section, the literature on the RAE in sports and education is large and spreading across many fields of science. But, to the best of our knowledge, there are no previous studies that would consider how the RAE in politics varies with gender and competitive environment.

We augment our conclusions by the evidence from the Finnish football players. There we can exploit an age-limit change in 1987 that shifted the admission year threshold by four months. We show how football players born in the early of an admission year are overrepresented in the professional adult football league, irrespective of the calendar year. The shift in the admission date resulted in a drop in the representation of those that are born early in the previous admission regime and corresponding increase in the representation of those that are born early in a calendar year under the new, calendar year-based admission regime. While our analysis of the Finnish football focuses on causal inference using data on male players, we also provide some tentative evidence of the gender differences in the RAE in the Finnish football that support our results from the Finnish politicians.

Our findings shed some 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 RAE and various theories proposed to explain this phenomenon. We describe our data and institutional background in Section 3. The empirical strategy and estimation results for football players are presented in Section 4. Then, in Section 5, we proceed to the main contribution of our paper, to our empirical investigation of the RAE among the Finnish politicians. We conclude in Section 6.

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 professional 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. Munch 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. In this paper we exploit the same shift in the admission date in the Finnish football that occurred in 1987 in Finland.

A third way to provide causal evidence on the existence of the RAE is resort to 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. For politics, we perform a RDD where 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).

The existence of gender differences in the RAE in sports, especially in football, are also extensively studied. Overall, the presence of the RAE in female football appears to be smaller than in male football, but the evidence is somewhat inconclusive (see, *e.g.*, Helsen *et al.* 2005, Vincent and Glamser, 2006, Nakata and Samamoto, 2012, and Kirkendal, 2014)[1] As the female football is relatively popular and high quality in Finland[2], we are able to make an preliminary investigation to the gender differences in the existence of the RAE in the Finnish football.

[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.

[2] For example, the share of registered female players to all football players was above 20% in 2013. In contrast to the Finland men's national team, the women's national team has qualified several times in the European Championship and World Cup final tournaments.

Beyond sports and education, there is relative paucity of studies of the RAE that allow for a causal interpretation and the study of gender differences in other areas of human life. 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 effects of the RAE in the Finnish parliament and municipal elections. Because female candidates are relatively prevalent in Finland, we also can study the gender differences in the existence of the RAE in politics.

Fredrikson and Öckert (2014) and Landersøn *et al.* (2016) use the RDD approach to study the effect of school starting age on long-run labor market outcomes and youth crime, respectively. They also consider gender differences. Landersø *et al.* (2016) 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. Fredrikson and Öckert (2014) find little positive long-run effects on labor market outcomes except in case of women's prime age employment.[3]

[3] Fredrikson and Öckert (2014) find a stronger gender gap in favor of girls when they study the effect of school starting age on educational attainment. However, Fredrikson and Öckert (2014) also show that boys born just before (after) the school entry cut-off are more likely to start their school late (early) than girls, which makes the true relative school starting age much smaller for boys than girls around the cut-off.

2.2 Theories for the Emergence of the RAE

There are various explanations for the emergence of the RAE. First, it has been noted that the RAE is more prevalent in more competitive environments in sports (see, *e.g.*, Musch and Grondin, 2001). The more popular is the sport in a country or a region, the more intense the competition for the elite teams or national teams and the stronger is the RAE. We provide evidence that competition is also conducive for the emergence of an RAE in politics.

The arguments for why relative age matters can be loosely grouped in two categories. First, there is an argument that the RAE emerges because the more advanced in a cohort get more resources in their youth than the less advanced. For example, more advanced students and football players 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 football, 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-esteem, self-confidence, and locus of control (i.e., belief in the ability to control own destiny) 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 football (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. Importantly, this amplification mechanism works in the reverse direction, too, i.e., performing weaker than peers dilutes self-confidence, self-esteem, 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 very challenging to tell apart the effects of the theories because the emergence from the same sources. Our contribution to this literature is that differences in the existence of the RAE in terms of gender and competitive environment should provide at least some speculative evidence about the underlying mechanism.

3. Data and Institutional Background

3.1 The Finnish Education System

Since experiences at school are the main mechanism in explaining the existence of 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 Football Players

Roughly corresponding to, for example, the English Premier League and Women's Super League, *Veikkausliiga*, the Finnish Football League, (the league is named according to its main sponsor, Veikkaus, the Finnish National Betting Agency) and *Naisten Liiga* ("Women's League") were established in 1990 and 2006 to take care of the highest level of men's and women's football, respectively. Before establishment of these separate organizations taking care of the highest level football competition, the top leagues were called *Mestaruussarja* ("Championship series"). *Ykkönen* ("Division one") and *Kakkonen* ("Division two") are the second and third highest level of the Finnish football for both males and females. Kakkonen is spit to three different groups so there are more teams in Kakkonen than in the two highest leagues together.

Football in the three highest leagues are considered to be competitive and at least semi-professional. Veikkausliiga is operated by an independent organization, the Finnish Football League Association. Naisten Liiga, Ykkönen and Kakkonen are operated under the Football Association of Finland, whereas lower leagues are organized locally. Only in Veikkausliiga, most players are full professionals (albeit the average earning is low by the European standards). In Naisten Liiga, Ykkönen and Kakkonen, as well as in the Mestaruussarja in the past, most players are semi-professionals. Because the earning potential even in Veikkausliiga is low, the very top Finnish players seek entry to the main professional leagues abroad.

The organization of the youth football is the roughly similar for boys and girls. There are thousands of teams that compete against each other in regional competitions and various cups. The best players are selected to youth national teams, starting from age 14 for boys and slightly later for girls.

We manually collected data of the players of Veikkausliiga from the start of the league in 1990 until 2014 from the webpages of the Finnish Football League Association.[4] Excluding foreign players and counting each player playing multiple seasons only once, this resulted in 1463 players who have appeared in Veikkausliiga at least in one season.

To make a tentative investigation of the gender differences in the Finnish football, we also collected data for players who appeared in Nasten liiga, Ykkönen and Kakkonen (both for women and men) in the year 2013 from *Jalkapallokirja 2013* (Soininen, 2013), which is an annual statistical yearbook of the Football Association of Finland. This was augmented by

[4] http://www.veikkausliiga.com/veikkausliiga/veikkausliigan-tilastohistoria, last accessed June 8, 2017.

collecting data on players who appeared in youth national teams in the spring of 2013 (for boys) and the spring of 2014 (for girls) from the webpages of the Football Association of Finland.[5] This resulted in additional 1631 adult player observations (550 women and 1081 men) and 262 youth player observations (122 girls and 140 boys).

3.3 Politicians

We have data from two types of general elections for the representatives for the Finnish democratic institutions.[6] *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. 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 selected by the proportional D'Hondt method. 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.

[5] Data for boys was retrieved from https://www.palloliitto.fi/maajoukkueet/pojat in June, 2013 for all national youth teams from the youngest, under-15 years old (U15) team to the oldest, U20 team. Data for girls was retrieved from https://www.palloliitto.fi/maajoukkueet/tytot in June 2014, for U17-U20 teams (player data for girls' U15 and U16 teams was not displayed because youth national teams for girls typically start competitive games slightly later than boys).

[6] 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.

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, where 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. 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: Football Players

As an introduction to our study of the emergence of the RAE among the Finnish politicians, we present evidence of the RAE among the Finnish football players. The purpose of this section is twofold. First, since the literature on the RAE in football is large, we can compare whether the RAE in football in Finland is similar to the one prevailing in other countries or not. If it is, we are more confident that our new results concerning politicians are not caused by some characteristic unique to Finland. Second, in the case of football, we can use the reform concerning the age group cut-off date to study the causal effect of relative age: Before 1987, the cut-off date was the 1st of August but from 1987 onwards, the cut-off date has been the 1st of January.

While the reform would facilitate difference-in-differences -style regressions, its effect is easiest and most transparent to observe from simple descriptive monthly counts. We do not report the actual regressions but it suffices to say that discussed effects are also statistically significant at standard levels. To take into account the change in the cut-off date, we split our sample of football players into three groups according to the birth-year of a player, as shown in Table 2. The first group consists of those born in 1972 or earlier. We assume that those players were old enough in 1987 that the change in the cut-off had no impact on their performance.[7] Similarly, we assume that those born in 1982 and after were young enough that the change in the cut-off had no impact on their performance. Those players, constituting group 3, were 5 years old or younger in 1987.[8] Finally, our second group of players comprises of those who are born between 1973-1981. They were exposed to both regimes in

[7] For example, among the youngest players in this group is the former Ajax, Barcelona, and Liverpool player Jari Litmanen, who is born 20 February 1971. We assume that he was old enough in 1987 so that the fact that he suddenly became among the oldest players of his cohort did not contribute to his rise to global fame.

[8] For example, virtually all currently active players belong to this group.

their youth over several years and, as a result, received offsetting experience of their relative average.[9]

In sum, we expect that in the old selection regime (group 1), players born in autumn and summer are over- and underrepresented, respectively, in youth national teams.[10] Were the RAE to have long-run effects, the same over- and underrepresentation should also show up in Veikkausliiga. If the RAE has a causal interpretation, this over and under representation should vanish in the new selection regime (group 3) where players born at the beginning and the end of the year should in turn be over- and underrepresented respectively. In contrast, among group 2 players, who were exposed to both regimes, the RAE might be present at both cut-offs, if at all.

In Table 2, we report the calendar month counts of the players that played in Veikkausliiga at least for one season between years 1990-2014. As explained in Section 3.2, players that played for many seasons are counted only once, and foreign players are excluded, which results in 1463 players. Table 2 is divided into three columns based on the above explanation how the reform affected them. We have 390, 435 and 638 players in group (column) 1, 2 and 3, respectively. The horizontal lines represent the age group cut-offs.

Table 2 presents strong evidence of an RAE as months below (above) cut-offs are overrepresented (underrepresented). Importantly, this holds despite the actual cut-off changing with respect to the calendar year ruling out seasonal effects. In the middle column there appears to be a jump at both the cut-offs.

---

[9] For example, one of the older players in this group is the former Liverpool and Bayer Leverkusen defender Sami Hyypiä who is born 7 October 1973. He was 13 years old when he suddenly changed of being one of the oldest of his cohort to being one of the youngest. We assume that players like him were under the influence of both regimes for enough many years so that their relative age effects are ”contaminated”.

[10] Unless otherwise stated, seasons of the year refer to the ones prevailing in the Northern Hemishpere.

Table 2. Male *Veikkausliiga* players, seasons 1990-2014, counts.

Month	Born <73 Before	73-81 During	Born >81 After
1	29	42	61
2	24	35	61
3	44	45	80
4	34	44	69
5	21	35	60
6	29	33	59
7	25	26	49
8	38	53	42
9	39	37	46
10	30	21	39
11	35	36	36
12	42	28	36
Total	390	435	638

There is clear seasonal variation in the birth rates in Finland. For example, March is most common birth month due to the so-called midsummer babies. This may bias the counts, for example, those born in March are over-represented in all three regimes according to Table 2. Therefore, we present the results controlling for the monthly variation in birth rates in Table 3. The pattern documented in Table 2 continues to exist (curiously, also the overrepresentation of March in all regimes continues to exists).

Table 3. Male *Veikkausliiga* players, seasons 1990-2014, relative to births in the entire Finnish population, shares.

	Born <73	73-81	Born >81
Month	Before	During	After
1	-0.009	0.014	0.016
2	-0.004	0.001	0.026
3	0.021	0.011	0.036
4	0.006	0.012	0.028
5	-0.028	-0.008	0.012
6	-0.010	-0.010	0.008
7	-0.008	-0.027	0.000
8	0.024	0.041	-0.004
9	0.035	0.005	-0.002
10	0.005	-0.031	-0.016
11	0.016	0.007	-0.008
12	0.035	-0.014	-0.007

In Table 4, we report results concerning the gender differences in the Finnish football. As mentioned in Section 3.2, we have comparable data for both genders only for year 2013. This has the advantage that there are no longer any pre-reform players (those born 1972 or earlier) in our data of adult players and none of the youth national team players in our data have experience of the old system (the oldest of them were three years at the regime shift).

In the two left hand columns of Table 4, we report the results for the three highest leagues for both adult men and women. In the two right hand columns, we use data for boys' and girls' youth national teams. We report shares of the month within the column and the total count. For example, for boys this implies that in there are 22 players (122*0.1803) born in January and only 2 in December that have been representing Finland in a youth national team.

There are two main lessons. First, the RAE is fairly similar for adult male and female players and present for both. Note, however, that our data here does not separate group 2 (born 1973-1981) and group 3 (born 1982 or later) players. This should bias both the RAE and observed gender differences downwards, since male players are on average older than female players and, as a result, there are more men who started to play football under the old cut-off system. Second, the RAE is by far the largest for boys and almost absent for girls. This quite striking difference should, however, interpreted cautiously due to fairly low number of observations of youth players, even given that the difference is significant statistically.

Table 4. Gender differences in football, shares, no pre-reform players.

	3 highest leagues		Youth national teams	
Month	Men	Women	Boys	Girls
1	10.27	11.09	18.03	7.86
2	7.68	8.36	18.85	10.71
3	11.47	8	11.48	12.14
4	9.9	11.09	15.57	12.86
5	8.88	10.18	9.84	6.43
6	8.88	6.36	4.92	14.29
7	6.94	7.27	3.28	7.86
8	6.94	10.36	4.92	4.29
9	8.6	8	4.92	7.14
10	7.22	7.27	4.1	8.57
11	6.75	5.45	2.46	2.86
12	6.48	6.55	1.64	5
Count	1081	550	122	140

Overall, the RAE in football in Finland is similar to the one prevailing in other countries, suggesting that our new results concerning the RAE among politicians presented in the next section might also generalize to other countries with similar school system and political institutions.

5. Empirical Strategy and Results: Politicians

5.1 Identification Strategy and Implementation

To evaluate whether or not 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 1^{st} 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 31^{st} 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 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 primary effect. 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. 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.

As advised in recent work (*e.g.* Gelman and Imbens 2014), we will execute the design using low-order local polynomial specifications. Our implementation follows closely recent 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) in Tables 5-8) and Calonico *et al.* (2014), and also their Coverage Error Rate (CER) optimal bandwidths (column (5) in Tables 5-8). We also verify the robustness to alternative range of bandwidths (columns (1)-(2) in Tables 5-8 and Figure 6). We conduct the RDD both with (somewhat outdated, see Hyytinen *et al.* 2016, Calonico *et al.* 2014 and 2016a) conventional local linear approach (columns (1)-(2) in Tables 5-8), but also with the more recent approach of bias correction and robust inference suggested by Calonico *et al.* (2014 and 2016a) (columns (3)-(5) in Tables 5-8, 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.* (2016) (column (4) in Tables 5-8). 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.

Again following this recent literature, we report in Tables 5-8 the conventional local linear MSE-optimal coefficient (because that is optimal choice for the point estimate), but for statistical inference, we report confidence intervals based on the bias-corrected coefficient and associated robust inference by Calonico *et al.* (2014) due to its superior coverage properties. This implies that 95% confidence intervals are *not* centered around the reported MSE-optimal coefficients in the bias-corrected columns, but rather around the (non-reported) bias-corrected estimate.

Typically this design 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 ATE in this case due to contamination. However, it is very rare in Finland not to follow the calendar year assignment to school cohorts, and thus, in our case ITT is likely to be very close to ATE. Dee and Sievertsen (2015) show using real school starting age data from Denmark that the ITT and ATE are in practice identical.

5.2 RDD Results

In Figures 1a-b) we show the results graphically for the parliamentary elections for all candidates.[11] 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. It is evident from the figures that those born early in the year have a higher success probability in elections. In other words, the RAE appears to exist in politics.

[11] 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.

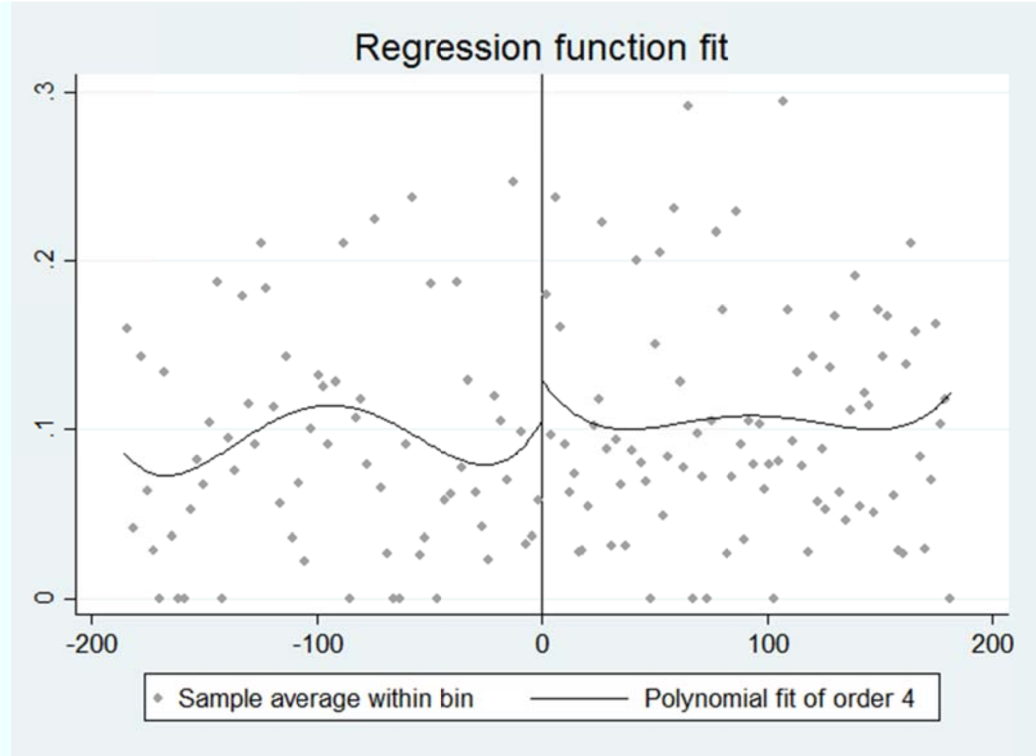


Figure 1b. RAE for parliamentary election candidates, local RDD.

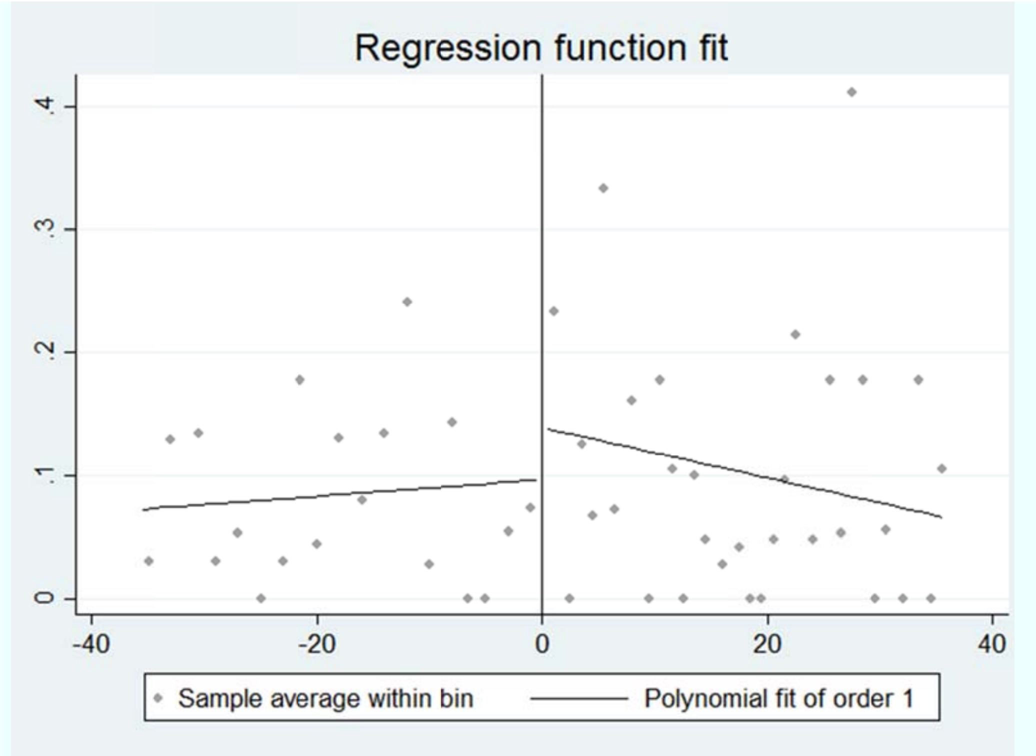


Table 5 displays the regression results. The coefficient for relative age is positive and statistically significant in all the reported regressions. Both the regression results and graphical results clearly document the existence of the RAE, and suggest a causal interpretation. The effect is also very large: The MSE-optimal estimate implies that being born in January 1st instead of December 31st increase the probability of getting elected to the parliament by 8.3 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.

Table 5. RAE for parliamentary election candidates.

	(1)	(2)	(3)	(4)	(5)
Estimate	0.172***	0.083**	0.083**	0.083***	0.158***
95% CI	[0.055;0.289]	[0.003;0.164]	[0.012;0.188]	[0.061;0.269]	[0.067;0.307]
Method	Convent. local lin.	Convent. local lin.	CCT-correction	CCT-correction	CCT-correction
Bandwidth selector	MSE*0.5	MSE	MSE	MSE	CER
Bandwidth(s)	17	36	36/70	36/36	23/70
Effective N	629	1192	1192	1192	786

Next, we turn to gender specific effects. We run the RDD separately on the samples of male or female candidates. The results for the males are presented in Figures 2a and 2b and Table 6 and for females in Figures 3a and 3b and Table 3. The results are striking: We find robust, very large and statistically significant effects for males and robust non-significant negative coefficients for females. Importantly, the results for males are also statistically significantly different from the female results (so not only from zero). These results provide strong evidence that of the existence of an RAE in the case of male politicians but no RAE in the case of female politicians.

Figure 2a. RAE for male parliamentary election candidates, global RDD.

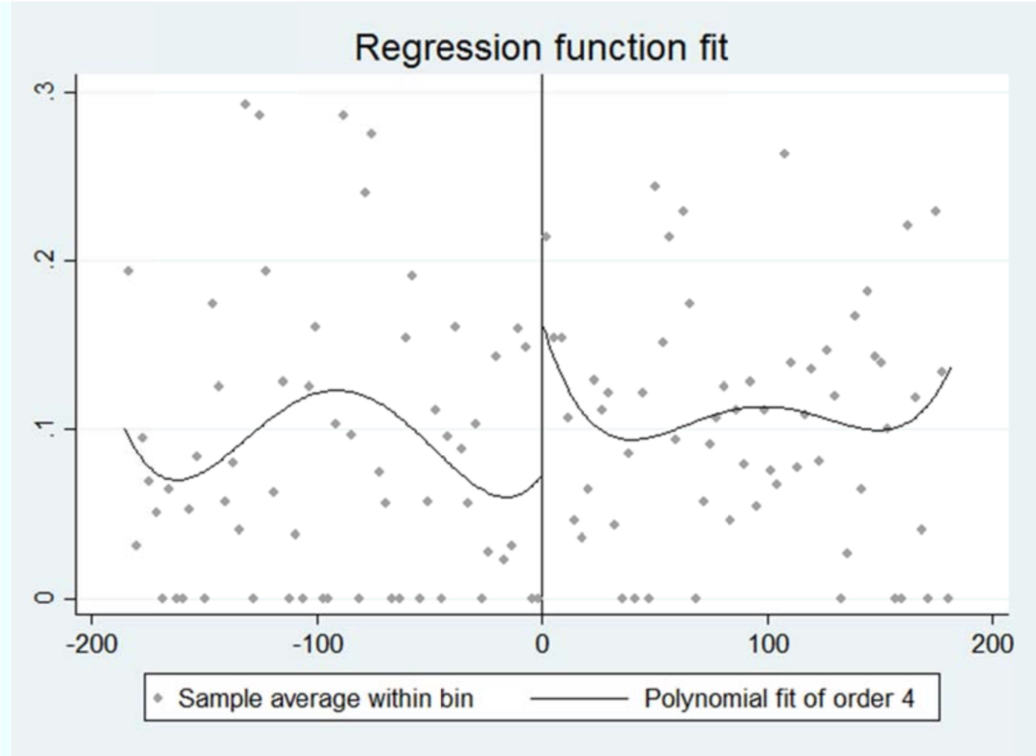


Figure 2b. RAE for male parliamentary election candidates, local RDD.

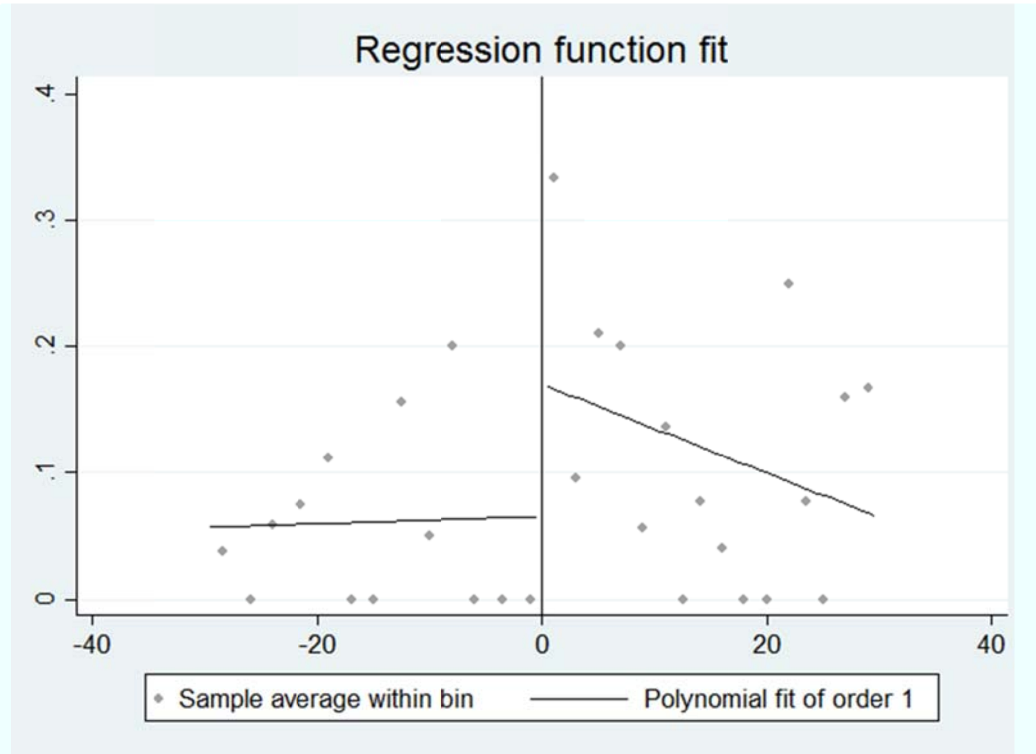


Table 6. RAE for male parliamentary election candidates.

	(1)	(2)	(3)	(4)	(5)
Estimate	0.295***	0.181***	0.181***	0.181***	0.256***
95% CI	[0.150;0.439]	[0.060;0.303]	[0.090;0.319]	[0.164;0.464]	[0.136;0.396]
Method	Convent. local lin.	Convent. local lin.	CCT-correction	CCT-correction	CCT-correction
Bandwidth selector	MSE*0.5	MSE	MSE	MSE	CER
Bandwidth(s)	15	30	30/62	30/30	20/62
N	305	621	621	621	410

Figure 3a. RAE for female parliamentary election candidates, global RDD.

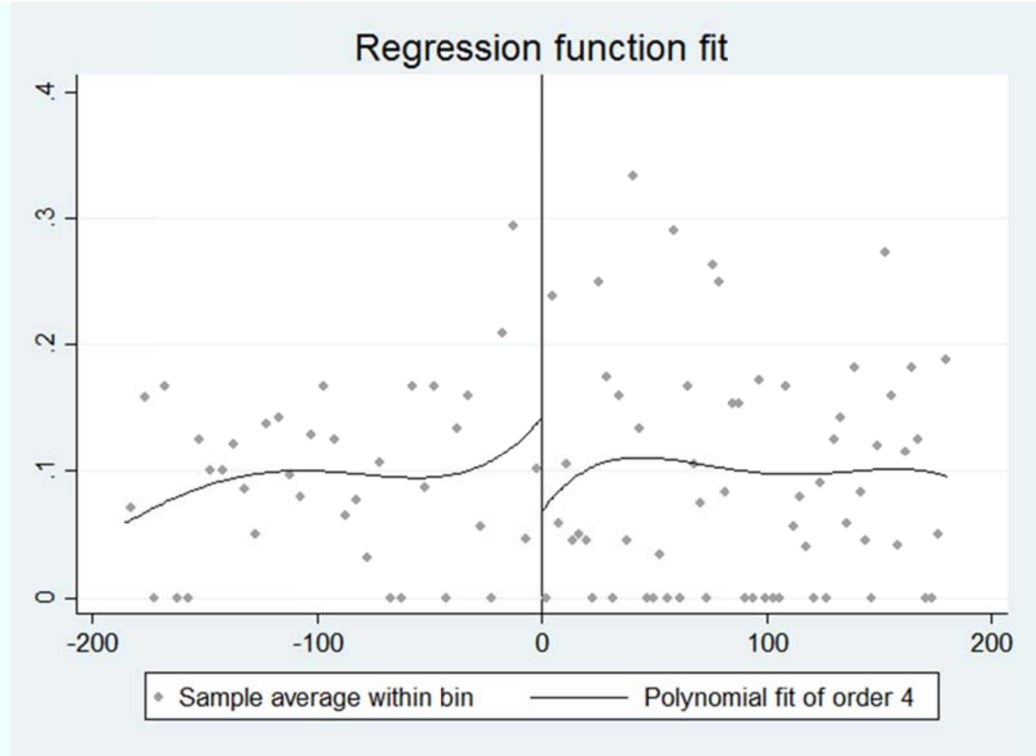


Figure 3b. RAE for female parliamentary election candidates, local RDD.

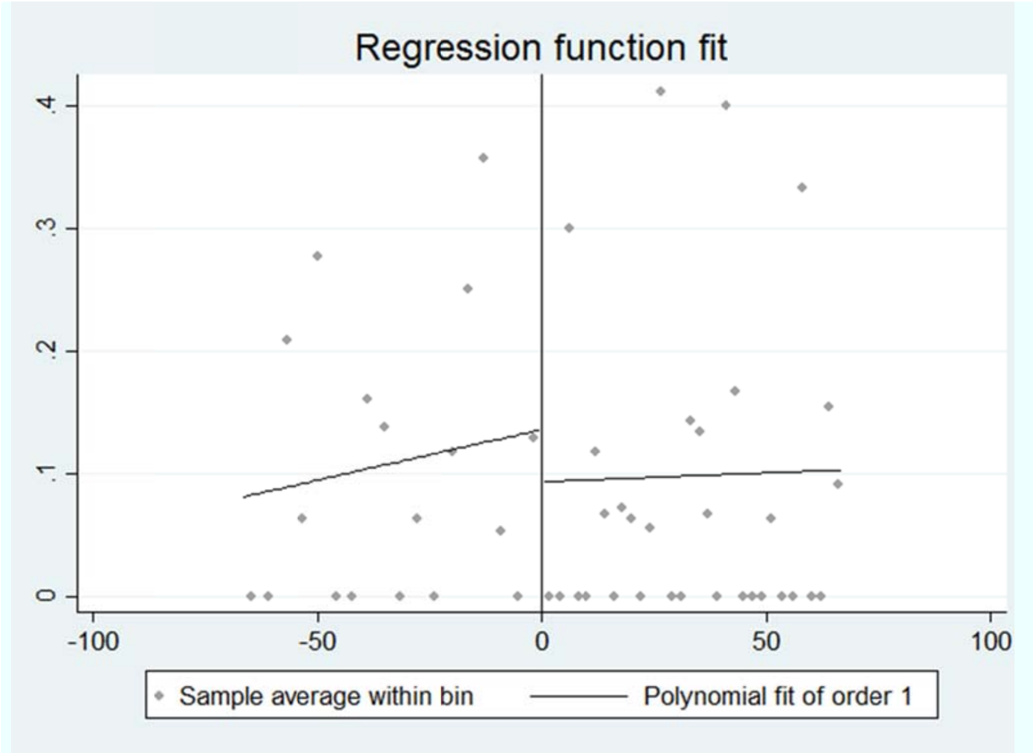


Table 7. RAE for female parliamentary election candidates.

	(1)	(2)	(3)	(4)	(5)
Estimate	-0.013	-0.038	-0.038	-0.038	-0.041
95% CI	[-0.135;0.109]	[-0.126;0.049]	[-0.132;0.063]	[-0.148;0.089]	[-0.145;0.067]
Method	Convent. local lin.	Convent. local lin.	CCT-correction	CCT-correction	CCT-correction
Bandwidth selector	MSE*0.5	MSE	MSE	MSE	CER
Bandwidth(s)	33	67	67/101	67/67	45/101
N	442	845	845	845	575

To understand whether RAE depends on the extent on competition, we repeated the analysis for males in local elections. We find no evidence of an RAE in that sample and confidence intervals are quite narrow, at least relative to the effect magnitude for the males in parliamentary elections. We report only the results for males but also the female sample and the whole sample indicate quite precisely estimated zero effect. The results in Table 8 show that the RAE may be more nuanced that what is commonly thought: We find evidence of an

RAE in case of males competing for top political positions, but we find no evidence otherwise.

Figure 4a. RAE for male municipality election candidates, global RDD.

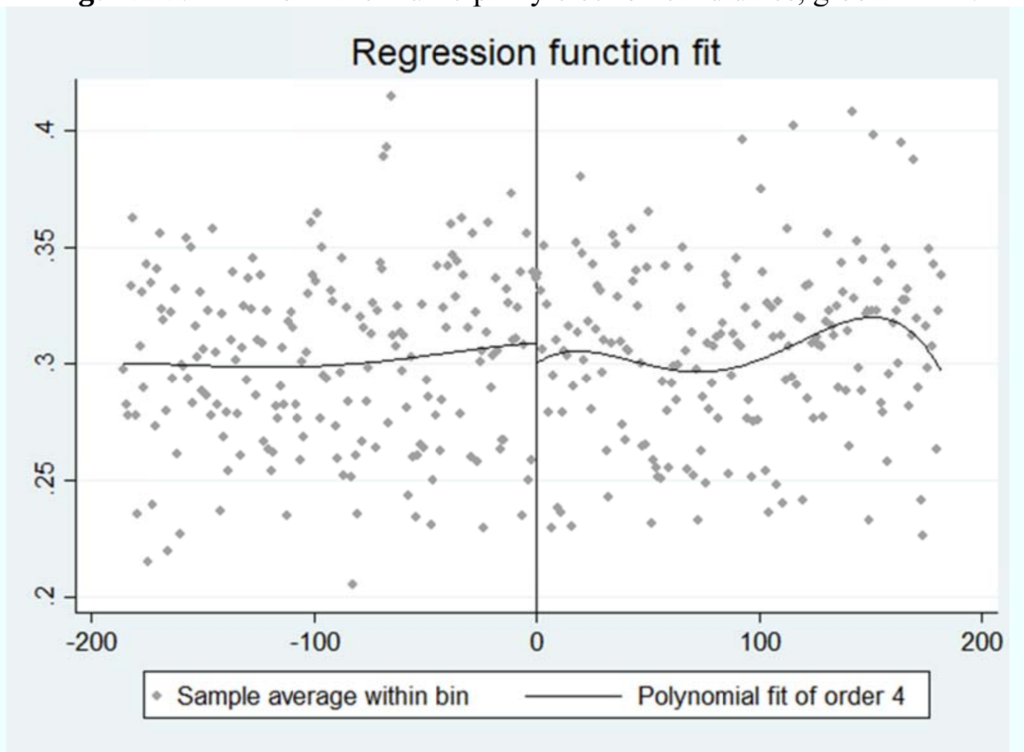


Figure 4b. RAE for male municipality election candidates, local RDD.

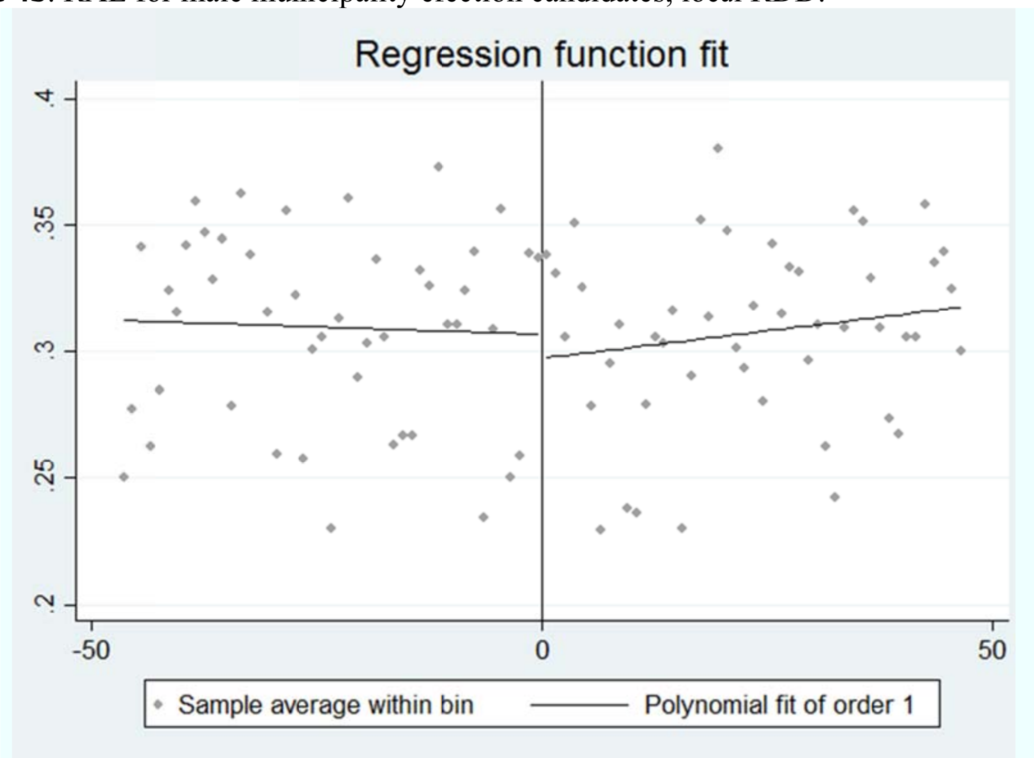


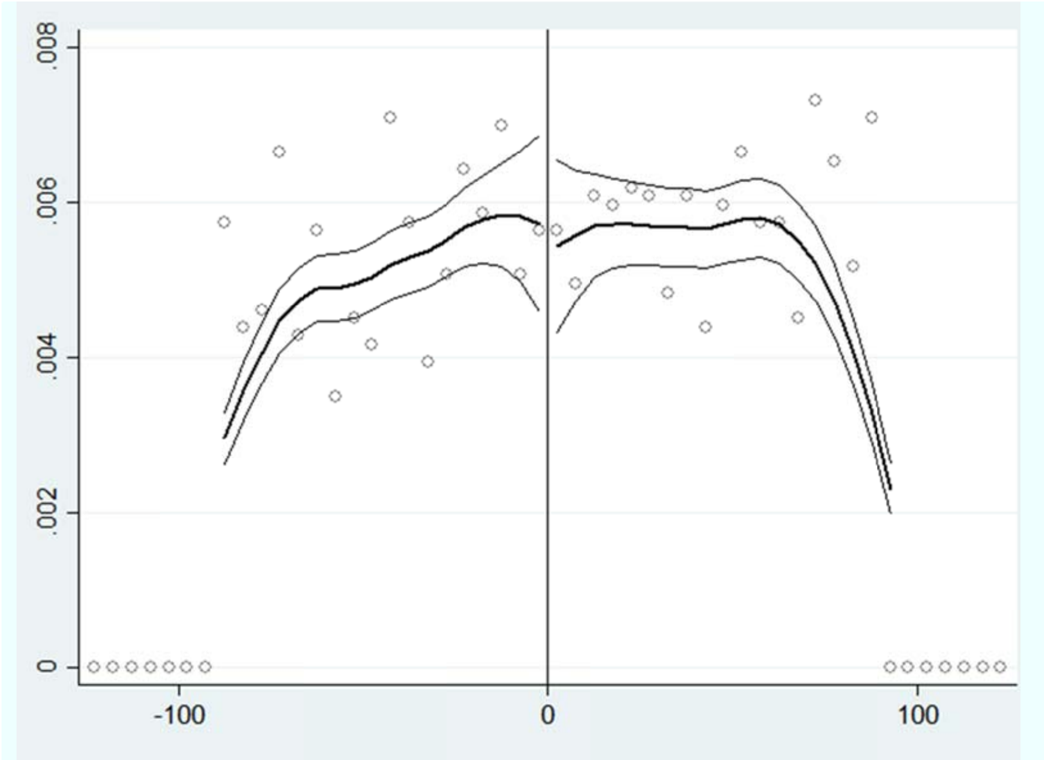
Table 8. RAE for male municipality election candidates.

	(1)	(2)	(3)	(4)	(5)
Estimate	0.00274	-0.00589	-0.00589	-0.00589	-0.0027
95% CI	[-0.0475;0.0529]	[-0.0400;0.0282]	[-0.0355;0.0199]	[-0.0383;0.0305]	[-0.0362;0.0296]
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	47/73	47/47	26/73
N	15126	29479	29479	29479	16360

5.3 RDD Robustness and Validity Tests

For the sake of brevity, we report the robustness and validity checks only for the sample of males in parliamentary elections, because that is the only sample where we claim to have found a positive effect. We begin with the analysis of running for candidacy. Here we do not observe the set of all potential candidates, but only the actual candidates. Thus, we conduct McCrary (2008) density estimation. Note that 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. The results are presented in Figure 5. The coefficient of the jump is not statistically significant meaning that there is no evidence of such an effect.

Figure 5. McCrary (2008) test for male candidates in parliamentary elections.



In Figures 6a and 6b, we artificially move the cut-off to placebo locations and report the coefficient and the associated 95% confidence interval for each placebo location. Figure 6a is based on the specification in Table 6 column (2) and Figure 6b on Table 6 column (3). If our estimation specification is flexible enough and the design is valid, we should observe a statistically significant effect (almost) only in the real cutoff location at zero. Overall, the figures are fairly comforting, even if not perfect. In both figures, the real estimate in larger than any of the placebo ones and most of the placebo estimates are insignificant. However, there are some placebo estimates that are (barely) significant in both figures. On the other hand, we run 24 placebo regressions in both figures, and thus, it is not very unlikely simply due to multiple testing that 2-3 estimates out of these 24 would be significant at 5% level.

Figure 6a. Placebo cut-offs analysis, conventional local linear.

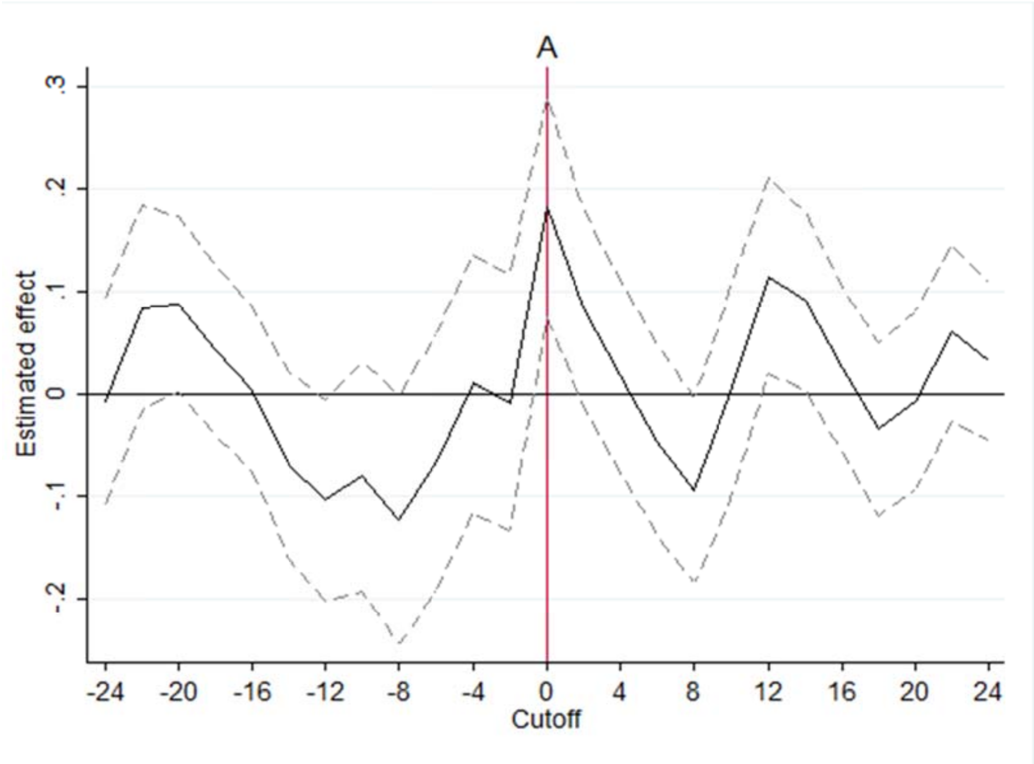
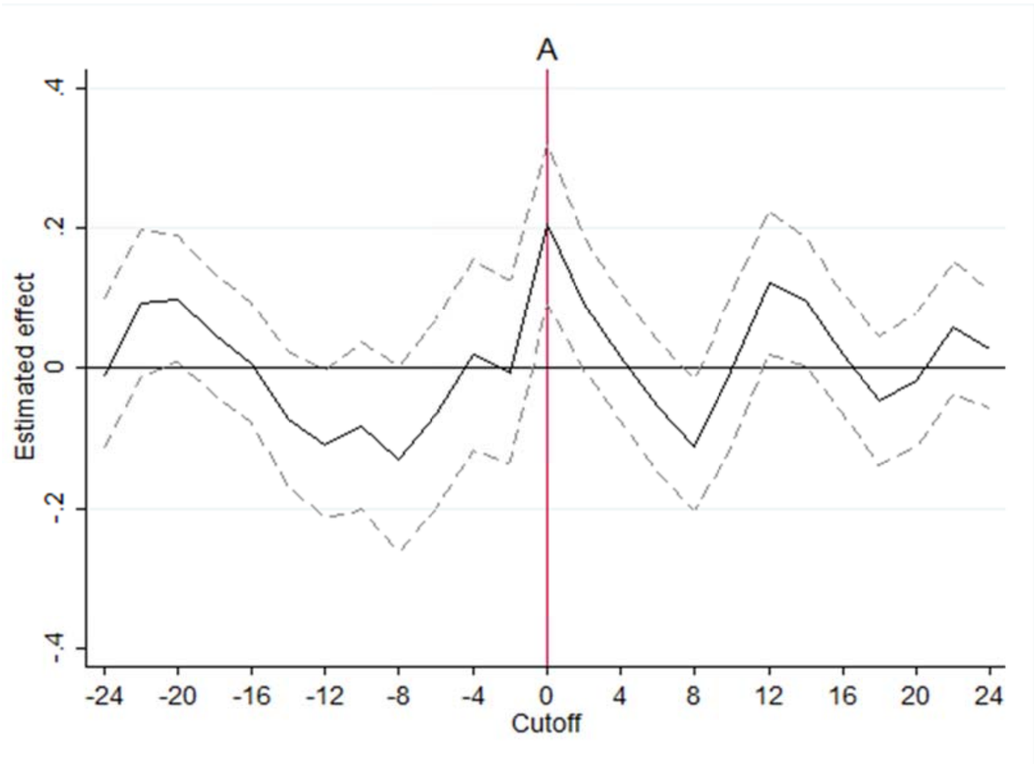


Figure 6b. Placebo cut-offs analysis, CCT-correction.



In Figures 7a and 7b, we report robustness analysis across a range of bandwidths. Again, Figure 7a is based on the specification in Table 6 column (2) and Figure 7b on Table 6 column (3). We report the coefficient and the associated 95% confidence interval for each bandwidth denoted in the x-axis. Qualitatively, the results are robust. More interestingly, and perfectly in line with theory, the result are larger in magnitude the smaller the bandwidth. This makes perfect sense, because increasing bandwidth implies including observations which are relatively younger.

Figure 7a. Results for male parliamentary candidates across a range of bandwidths, conventional local linear.

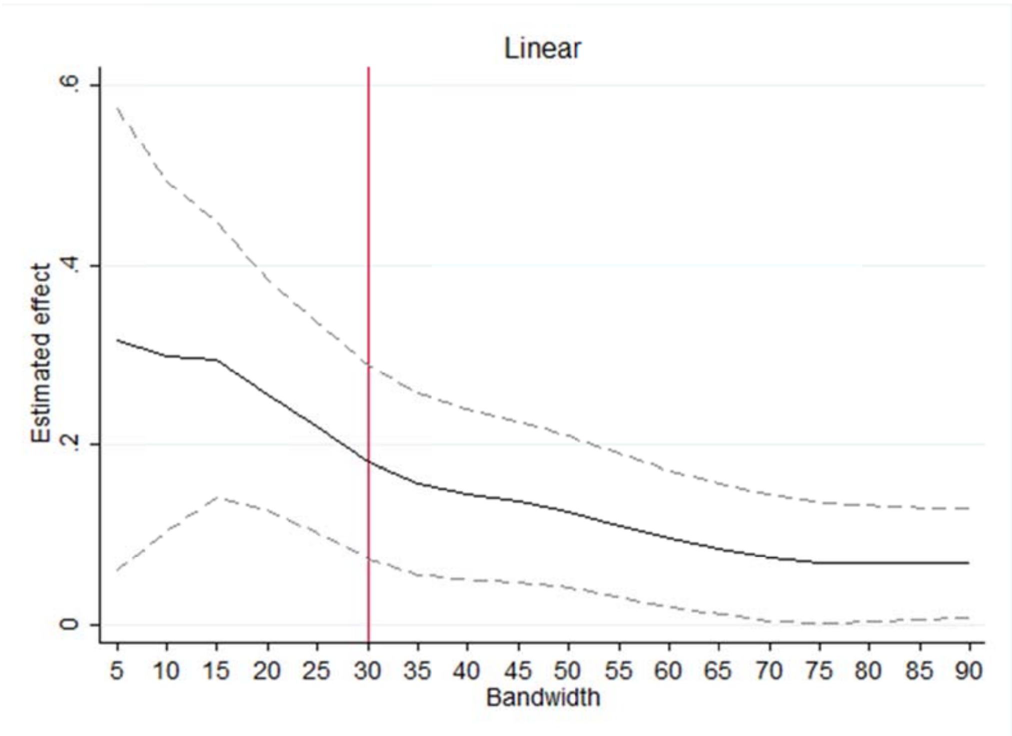
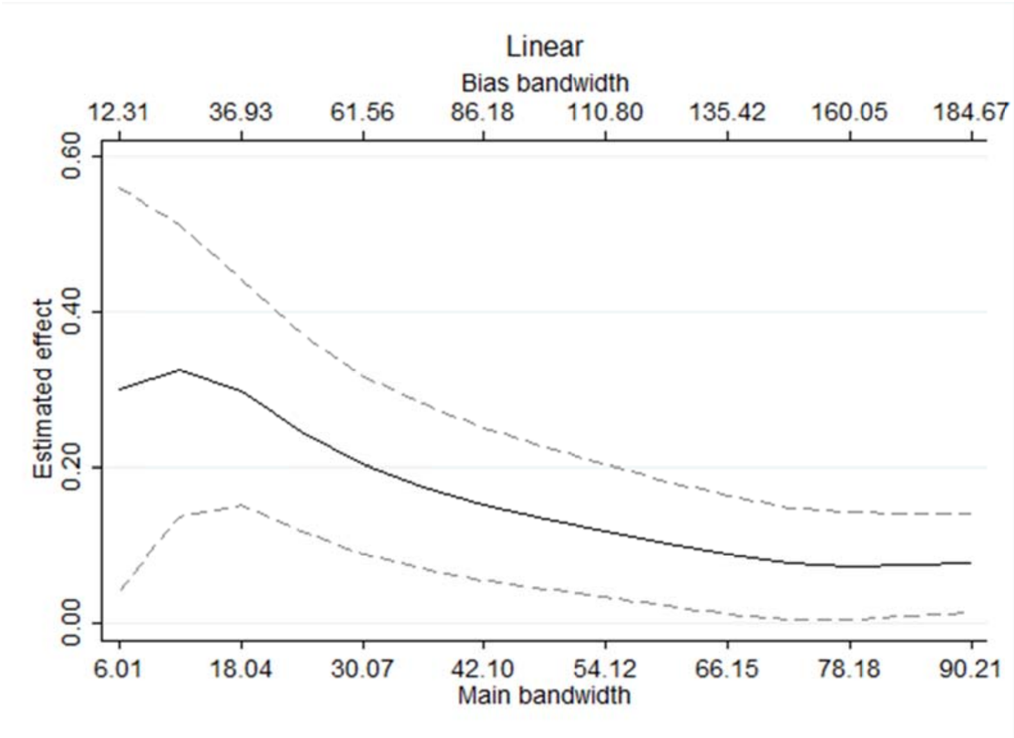


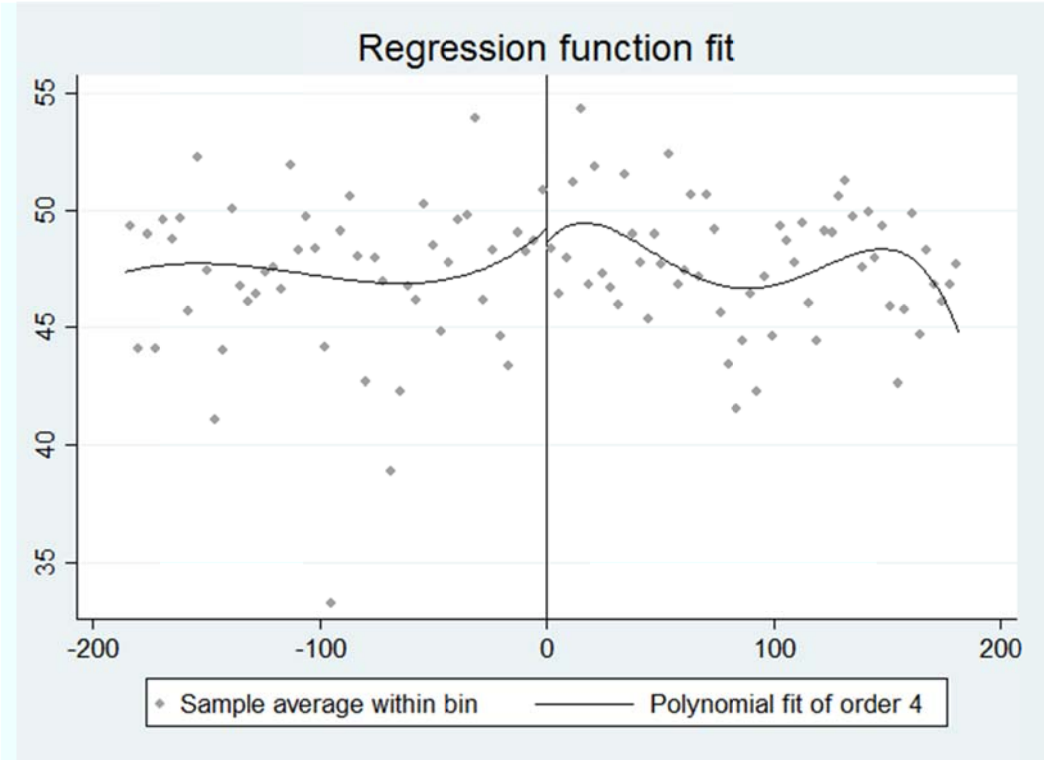
Figure 7b. Results for male parliamentary candidates across a range of bandwidths, CCT-correction.



One of the important validity tests for RDD is the covariate balance test. This is an indirect test of the key assumption that potential outcomes develop smoothly over the threshold. Testing for covariate balance is tricky in the case of an RAE, because we have no pre-treatment variables. It is likely that the RAE in politics is driven by early-life events, *e.g.*, experiences in school. Thus, politicians' own adult-age characteristics can only be used to analyze the actual effects, not to test for balance. We do not have access to characteristics of parliamentary candidates' parents, which could have been used as placebo outcomes. However, it seems clear that the design is valid, because birth date cannot be perfectly manipulated. Moreover, we can conduct one very relevant placebo test to show that the absolute age of the male candidates balances. We report this in Figure 8. There is no apparent jump at the threshold. This is verified by regressions. All specifications in the style of (1)-(5)

in the previous tables, show non-significant coefficient close to zero. For example, specification (3) shows MSE-optimal coefficient of -0.020 with a robust CI of [-4.65;3.79].

Figure 8. Covariate balance for absolute age for male parliamentary candidates, global RDD.



6. Conclusions

We study whether the RAE can be given a causal interpretation and how it varies with gender and the intensity of competition by using Finnish data from politics and football. Our results suggest that the RAE in politics and football is not driven by unobserved heterogeneity nor seasonal effects but is created by the artificial division of people into the different age groups. We find that the RAE is only a concern for males in competitive political environments. We also find strong evidence of the RAE in the Finnish football save for young female players. These findings suggest that the documented gender differences in RAE in sports are not driven solely by the different role of physical requirements in male and female 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. Famously, Niederle and Vesterlund (2007) and the subsequent literature shows that women shy away from competition whereas men embrace it. Moreover, men typically perform better in competitive environments. 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. In light of this literature, our results 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.

References

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.

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.

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(6), 2295–326.

Calonico, S., Cattaneo, M. and Titiunik, R. 2015. Optimal Data-Driven Regression Discontinuity Plots. *Journal of the American Statistical Association* 110(512), 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.

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

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.

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. (2015) Relative Age Effect on Labor Market Outcomes for High Skilled Workers – Evidence from Soccer. Working Papers in Management, Birkbeck, Department of Management, BWPMA, 1501, 1-50.

Helsen, W. F., Baker, J., Michiels, S., Schorer, J., Van Winckel, J., and Williams, A. M. (2012) The Relative Age Effect in European Professional Soccer: Did Ten Years of Research Make any Difference? *Journal of Sports Science* 30, 1665-1671.

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.

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.

Kirkendal, 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. (2016) School Starting Age and the Crime-age Profile. Forthcoming in *Economic Journal*.

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

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 115, 179-186. *Perceptual and Motor Skills* 115, 179-186.

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

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.

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

Soininen, H. (2013) *Jalkapallokirja 2013*. The Football Association of Finland.

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.