

Finnish 2019 parliamentary election prediction *

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This paper introduces a synthesizing prediction model for Finnish 2019 parliamentary election. First, the paper introduces different prediction models and their appliance in the field of election prediction. Following that, the paper presents the Finnish party system and the initial party standings for 2019 election. In the data section, Finnish election data with additional independent variables are introduced. After that different models are evaluated and we are going to find polling, government membership and last election vote shares to be the best predictors of future elections by comparing root mean squared errors of different models. Finally, ex-ante predictions of 2019 election are presented. With the data at hand, we predict Kokoomus-party to win the 2019 election.

Keywords: Finnish election, election prediction, synthesizing model, structural model, poll aggregation

Introduction

Election forecasting has had a very important role in public (political) and academic life. A well conducted pre-election survey, for an example, can steer a campaign in a new direction, it informs the public of the possible outcomes. At the same time, in the academic community, forecasting can provide an environment for learning, building new theories, and methods of measurement, etc. (Lewis-Beck 2005)

Lewis-Beck categorizes scientific approaches to election forecast into three categories: structuralists (using fundamentals), aggregators (polling), synthesizers and judges, and they are all specific in the way they apply the theoretical knowledge, the time frame, and the data collected. Synthesizing models are a key approach, as they offer a theory of the vote through the structuralist (e.g. economic growth) aspect, and dynamism through the aggregator aspect (polls) (Lewis-Beck and Stegmaier 2014).

While Lewis-Beck stresses the importance of structuralist approach (Lewis-Beck 2005) as the underlining and the crucial one, there are critics to this approach, such as Van der Eijk, who explains the election as an aggregate of individual choices and behaviours, and doubts the necessity of a strong political theory in the background to improve the results of a forecast (Eijk 2005).

Lewis-Beck recommends that given the opportunity to choose, a researcher should always aim to combine (“synthesize”) both aggregating and structural models, as it presents a much higher reduction in prediction error, keeps the dynamism of the aggregators’ models. He names the 4-6-month period prior to the election to be the optimal amount of time for the synthesizer model to work. (Lewis-Beck and Dassonneville 2015) There are though much discussion about choosing the right lead time for using polling as a variable in the prediction models (see e.g. Selb and Munzert (2016)).

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The Finnish Political and Party System

Finnish political system has been classified as semi-presidential system, but after constitutional reform of 2000 the parliament has been given more constitutional rights, cabinet formation is in the responsibility of party negotiations, and the president is almost completely excluded from domestic politics (Raunio 2011).

Finnish parliament consists of 200 seats and each seat tied to a specific voting district (Jääskeläinen 2002). Parliamentary voting districts have seats according to their adult population (Jääskeläinen 2002). There is no additional voting threshold required to meet to get a seat in the parliament.

Finland has four set of elections: parliamentary, presidential, communal and European Union. Parliamentary elections take place every 4 years as do communal, presidential elections every 6 years and EU elections every 5 years (Jääskeläinen 2002). There is also a plan for new regional elections to take place in late 2018 (Valtioneuvosto 2017b).

Finnish political system has been experiencing disengagement of the public as turnout has been falling and party memberships have been declining for decades. Regarding the voting behavior, traditional class voting had lost its dominance in 1970's and new cleavages have emerged along urban and rural divisions. Otherwise, the Finnish electorate has become more uncertain and unpredictable. The share of voters deciding during election campaigning who to vote for has increased to over half of the electorate (Wiberg 2006). At the same time party identification has decreased so that less than half of the voters identify to any party (Borg 2008).

The Finnish governments have been since 1975 almost exclusively oversized majority coalitions. It has been more or less the rule, according to Raunio (2011) that cabinets have included two of the three main parties, the Social Democrats, the National Coalition and the Center Party. In the current constitution, large governments have an easy position to push through legislation, if they can solve intra governmental conflicts, but the lack of transparency in decision-making of coalition governments can distract voters. Governments being often ideologically incoherent, the opposition has been often left fragmented (Raunio 2011).

In the Finnish multiparty system, there are three traditional major parties: Social Democratic Party (SDP), National Coalition (Kokoomus) and the Center Party (Keskusta), one traditional minor party: the Swedish People's Party (RKP). Both the Finns Party (PS) and Christian Democrats (KD) have roots in the 1950's (Terry 2014a; Sundberg 2015). The Finns Party was established on the ruins of the former Rural Party in 1995 (Sundberg 2015). Similarly, the Left Alliance has roots in the mid-20th century and the party was founded after the dissolution of the Finnish People's Democratic League (SKDL) in the year of 1990 (Terry 2014b). The youngest party holding a seat in the parliament without any ideological predecessors is the Green League (Vihreät) founded in 1987 (although the party had two representatives in the parliament in 1983 before the registration) (Vihreät 2017). The most recently established parties without any representatives in the national level are the Pirate Party, the Feminist Party and the Liberal Party (formerly known as the Whiskey Party). Table 1 shows the vote shares of current parties (and their predecessors) possessing a seat in the parliament from 1975 to 2015 (data obtained from Suomen virallinen tilasto (SVT) (n.d.)).

The 2019 Election Scenario

The 2019 Finnish parliamentary election has a very intriguing initial setting. No party is leading comfortably in the polls, and the situation in the party field is wide open for future coalitions. It remains to be seen whether the communal election results of spring 2017 reflect the popular opinion for the national election. Also, the upcoming presidential election in 2018 can have an effect on the party positions for the general election in 2019. Next, we are going to have a look at

Table 1: Finnish national election results 1975-2015

	election	KESK	KOK	PS	SDP	VIHR	VAS	RKP	KD	Muut
1	2015	21.1	18.2	17.7	16.5	8.5	7.1	4.9	3.5	2.5
2	2011	15.8	20.4	19.1	19.1	7.3	8.1	4.3	4.0	2.0
3	2007	23.1	22.3	4.1	21.4	8.5	8.8	4.6	4.9	2.4
4	2003	24.7	18.6	1.6	24.5	8.0	9.9	4.6	5.3	2.8
5	1999	22.4	21.0	1.0	22.9	7.3	10.9	5.1	4.2	5.3
6	1995	19.8	17.9	1.3	28.3	6.5	11.2	5.1	3.0	6.9
7	1991	24.8	19.3	4.8	22.1	6.8	10.1	5.5	3.1	3.5
8	1987	17.6	23.1	6.3	24.1	4.0	9.4	5.3	2.6	7.5
9	1983	17.6	22.1	9.7	26.7		13.5	4.6	3.0	2.8
10	1979	17.3	21.7	4.6	23.9		17.9	4.2	4.8	5.7
11	1975	17.6	18.4	3.6	24.9		18.9	4.7	3.3	8.7
12	1972	16.4	17.6	9.2	25.8		17.0	5.1	2.5	6.4

the individual party settings.

Most notably, the upcoming parliamentary election will be a contest for hearing old supporters of the Finns Party, as the party split into two separate fractions in the summer of 2017. The split of the Finns Party happened after the Finns Party convention, where conservative anti-immigration hardliner Jussi Halla-aho was elected as the new chairman of the party. Halla-aho was able to beat Sampo Terho. Terho enjoyed the support of the former party establishment and was the favourite of the outgoing leader Timo Soini, who led the party since 1997. At the convention establishment candidates were not able to secure any positions in the new party leadership. This event triggered a brief government crisis in Finland as the prime minister Juha Sipilä (Keskusta) and the minister of finance Petteri Orpo (Kokoomus) declared in a joint press conference that co-operation with the Finns Party is no longer possible. Before prime minister Sipilä was to hand out the letter of resignation to the president, a majority of the Finns Party's parliamentary group members, including Timo Soini and Sampo Terho, stormed out of the Finns Party headquarters declaring to have resigned from the party, and seeking to remain in the government. The resigned representatives of the Finns Party declared that they had formed a new parliamentary group named as "Sininen Tulevaisuus" (the Blue Future). The crisis was resolved by replacing the Finns Party by the Blue Future in the government, without the need to exchange any minister positions, ie. Timo Soini was able to continue as the minister of foreign affairs. (Rosendahl and Forsell 2017)

By choosing Halla-aho as their new leader the Finns Party has joined the ranks of other alt-right parties of Western Europe making immigration policy as its main focus, also leaving many key policy questions unanswered (Ahponen 2017). The Blue Future's position on many matters is still unclear. The biggest question concerns their views of the European Union and deepening of European integration which can contain a prospect for a renewed governmental crisis, if the group disagrees with the rest of the government parties.

The Finns Party is probably the biggest question mark for the next election, as it has lost more than half of its support since 2015. Now, as the party has been split into two, the polls have been showing different figures for the two fractions, but the combined support of the two parties has been stable (Pohjanpalo 2017; Tikkala 2017). The weak party support was also manifested in the communal elections as the Finns Party decreased its vote share from the previous communal election by 3.5% (Yle 2017). One possible reason for the decreasing support of the Finns Party has been the incapability to meet the expectations of their voters, who are more economically deprived than

the voters of other government parties, by supporting cuts on governmental spending (Ahponen 2017). Moreover, it will be difficult to say how the Finns Party's decision to nominate Laura Huhtasaari (see more Niilola (2017)), a controversial figure, for the upcoming presidential election will play out.

For the Green League (Vihreät), the communal election marked a significant victory, as they expanded their support in many major cities. The elevated election result is due to successful opposition politics, as the Greens have been the most vocal opposers of education cuts (Teivainen 2016). Now the polls are showing the Greens approaching prime minister Sipilä's party (Pohjanpalo 2017). Eventually it is difficult to say where the upperbound of the Greens support resides. The newly elected party chairman Touko Aalto declared soon after his nomination that his goal is to grow the Green League to be the prime minister party. Recently Aalto has been receiving negative media attention related to personal affairs (Ikävalko 2017). The new party leader's favourability in national election is yet untested, but now there seems to be an actual possibility to make Vihreät one of the major parties of Finland. The party has also been preparing for the 2018 presidential election by nominating Pekka Haavisto as their candidate (Tolkki 2017). Haavisto is the most plausible contender for the incumbent president Sauli Niinistö (Kokoomus). Haavisto ran for president in 2012, but lost to Niinistö in the second round. It remains unlikely that Niinistö would be defeated, as only three incumbent presidents have ever lost an election, but by getting on the second round may provide an additional boost for the Greens' electoral prospects in 2019.

The Social Democratic Party of Finland (SDP) is the largest opposition party, but the party has been losing electoral support since 2003. The two thirds of the party's members are retired, thus the average age of the party member is 61.5 years (Virkkunen 2017). Regardless of the demographics, in recent polling SDP has been seen as the main contender of Kokoomus (Pohjanpalo 2017). The reason for SDP's current recovery might be just the fact that it has been in the opposition, being not responsible for unpopular reforms.

Kokoomus (the National Coalition Party) was declared as the largest party of Finland after winning the communal elections of 2017, even though the party lost 1.2% of its vote in comparison to the previous communal election (Yle 2017). Since the election Kokoomus been able to increase its support in the polls and the party is considered to be the favourite for winning the 2019 election. The party has been able to retain its support even though enjoying consecutive terms in the government. Although, there has been major changes of leadership within the party as sitting party chairman and financial minister Alexander Stubb was ousted in the summer of 2016 by Petteri Orpo, who then also took the minister position (MTV Uutiset 2016). The party's support has been unaffected by the lack of delivery or by its advocated austerity measures. It remains to be seen whether the patience of Kokoomus supporters will last, as the party has not been able to provide its key goals to privatize health care, nor reforms to family leave (Yle 2016).

The Center Party (Keskusta) experienced a defeat in the past communal election. The party has been losing support since 2015. The reason for decreased support might be that the party has not been able to meet the demanding economic goals it had set for the government in 2015, specifically, employment numbers are lagging behind the targets, and the government has not been able to stop national debt from growing (Rosendahl 2017). Similarly, major reforms regarding health care and regional governance have been stalled and are lagging behind schedule. Also, the party's transportation minister pushed for unpopular privatization of Finnish highways (the plan was eventually rejected, see Hartikainen (2017)). There is a chance that some economic goals will be met, as the Finnish economy is showing signs of higher GDP growth than expected earlier this year (Milne 2017). Keskusta is in a difficult situation as it will either try to push for the reforms before the elections which can have negative effects on the party support, or it will fail to fulfill its own goals, which in the eyes of the public, is considered as a failure as well.

The Left Alliance (Vasemmistoliitto) is confident in contending the Finns Party as the 5th largest party of the Finnish parliament. Vasemmistoliitto received a positive result in the communal election stopping the downward trend of their party support. Much credit for the result can be given to Li Andersson who was chosen to lead the party in 2016. She was able to beat the sitting finance minister Petteri Orpo and former Green League party leader Ville Niinistö in their home municipality Turku in terms of personal votes (Yle 2017).

The Swedish People's Party (RKP) and Christian Democrats (KD) have been somewhat sidelined, as neither party no longer sits in the government. Both parties were able to increase their vote shares in the communal election (Yle 2017) and both parties are aiming to get more than 4% of the vote in the national election.

Data and Methods

In this section, the main research questions of the paper are introduced, in addition to describing data collection and model construction.

Research Questions

In this paper, one seeks to develop structural prediction model for Finnish parliamentary elections and answer the following research questions:

1. What is the most accurate model to predict Finnish parliamentary elections for the past 20 years of elections?
2. What predictions can structural model provide for the upcoming 2019 parliamentary election?

Data Collection

This study uses a completely unique data set which contains election results of major Finnish parties in the parliamentary elections from 1975 to 2015 as a dependent variable, the data regarding election results was obtained from Statistics Finland (Suomen virallinen tilasto (SVT) n.d.). Independent variables include continuous variables of yearly average of unemployment at the year of election (obtained from The World Bank (n.d.)), polling variables, previous election result, average of last three elections per party and their swing version (meaning an absolute change to previous observation).

Data set also contains multiple dummy variables which depict a historic support of the party (major, medium, minor). For instance, RKP (the Swedish People's Party) is identified as a minor party receiving stable 4-5% support in the elections (see Table 2), Vihreät (the Green League) is perceived as medium party enjoying 4-8% support and Keskusta (The Center Party) has had support of 15-24% support 1995-2015. Other dummy variables contain information regarding party's position in the parliament (in the government vs. in the opposition, having a prime minister or not, see Tables 3,4). The information regarding previous government and prime ministers of Finland was collected from (Valtioneuvosto 2017a). Two interaction variables were designed to combine party's position in the government (being in the government or having a prime minister) with unemployment/previous election vote share.

The most recent polling data about 2011, 2015 and 2019 elections was collected from Finnish and English Wikipedia articles on Finnish parliamentary elections (Wikipedia n.d.[a]; Wikipedia n.d.[b]; Wikipedia n.d.[c]). The oldest polls available (starting in 1994) were collected from the National Broadcaster's (Yle) site, which reports monthly polls of *Taloustutkimus* polling company

Table 2: Party summary statistics

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
KESK	12	19.859	3.259	15.760	17.537	22.577	24.825
KOK	12	20.041	1.955	17.589	18.327	21.770	23.132
PS	12	6.900	6.030	0.986	3.088	9.294	19.053
SDP	12	23.346	3.246	16.510	21.953	25.091	28.251
VIHR	8	7.109	1.445	4.027	6.744	8.121	8.526
VAS	12	11.898	3.989	7.132	9.246	14.346	18.892
RKP	12	4.828	0.397	4.229	4.600	5.126	5.484
KD	12	3.680	0.941	2.530	3.016	4.322	5.337
Muut	12	4.708	2.323	2.010	2.679	6.567	8.699

Table 3: Government status, by party 1975-2017

	KD	KESK	KOK	Muut	PS	RKP	SDP	VAS	VIHR
Not in government	9	5	5	10	10	3	4	7	5
In government	3	7	7	2	2	9	8	5	4

Table 4: Number of terms prime minister seat controlled by party 1975-2017

	KD	KESK	KOK	Muut	PS	RKP	SDP	VAS	VIHR
No PM party	12	8	10	12	12	12	7	12	9
PM party	0	4	2	0	0	0	5	0	0

(see Kinnunen (2017)). To overcome the lack of polling data for election years 1975-1991, I used a linear model to predict, how the polls could have been using existing polling from 1994 onwards as a training set. The polls were predicted by using previous and upcoming election results with a party dummy variable. Party dummy was added to create some noise in the data, so that polls do not always be closing the upcoming election's voteshare.

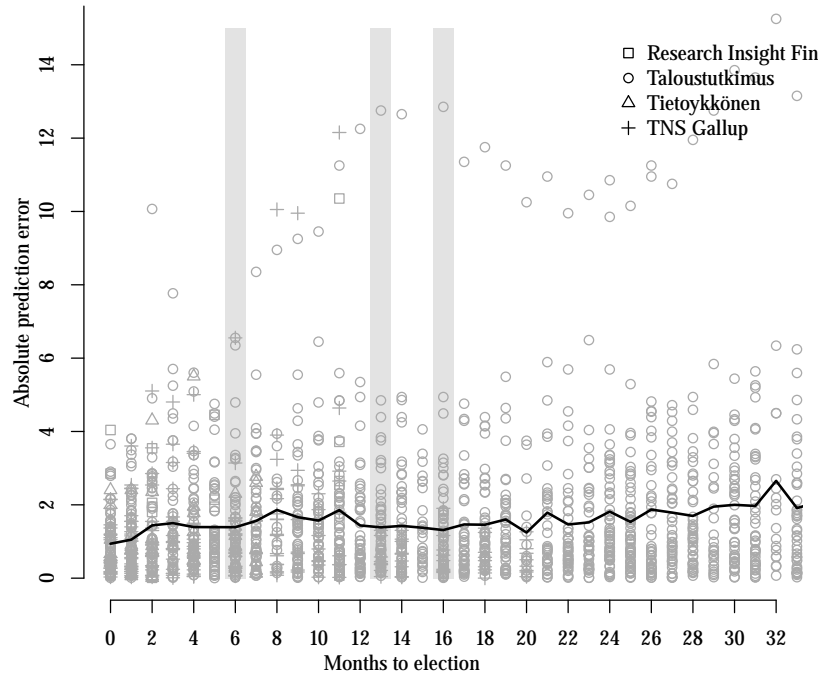
$$Polls_{t_1-t_2} = a + \beta_0 Voteshare + \beta_1 Lastelection + \beta_2 Party + \epsilon$$

Also, the benefit of estimating polls this way was that one can predict different values for different polling time frames.

The next step after the data collection was to choose polling time frames. This means that one inspects the accuracy of polling by comparing the actual voting day results with polls conducted in certain time periods before the election. This way we can calculate historical average error of polls for each month prior to election. The data for calculating the historical polling errors consists of only real polling numbers for elections 1995-2015. In Figure 1, one can see these polling errors by each party in each poll. Expectedly, polls conducted zero months before the election (1-30 days) were the most accurate ones. Polling errors were also small: 6 (210-240 days), 13 (390-420 days) and 16 (480-510 days) months prior the election¹. All mentioned time frames were chosen to be a part of the final prediction data set.

¹Polling error for 20 months before election contained only two polls, so it was excluded from selected time frames.

Figure 1: Historical average polling error



After selecting appropriate time frames, I calculated average polls for those time frames for each election. Now, one can inspect visually how polling averages were connected to election results by each party for each election (this time all of the election years are included). In Figure 2, one notices that deviations from the actual voting results become smaller as election date approached.

Model Construction

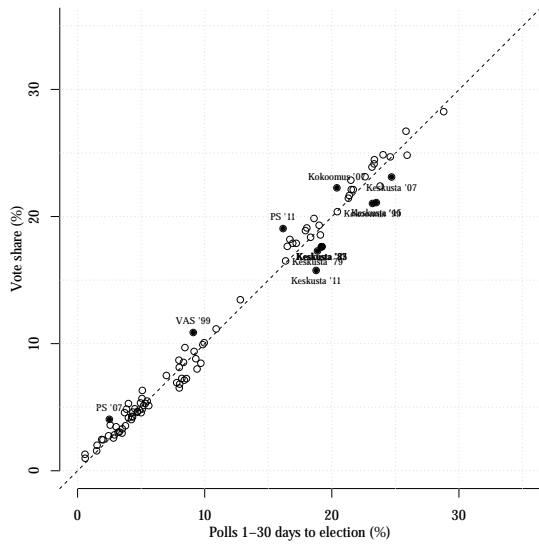
To create a prediction model that suits our purpose, it would not be predictive enough to use polls 1-30 days before the election day, as it is so close to the election day, even though this has the highest fit to actual voting results (*adjusted R²* 0.985). Therefore, it was chosen to use the second highest fit of polling, which is 6 months prior the election.

Captured variance of model fits decreases steadily as there is more time to election day. The main difference between the models is that in the most fitted model the constant is no longer statistically significant, as it is with other models. Also, the coefficients of the polling variables range between models from 0.910 to 0.986. The different polling time frame variable models are compared in Table 5.

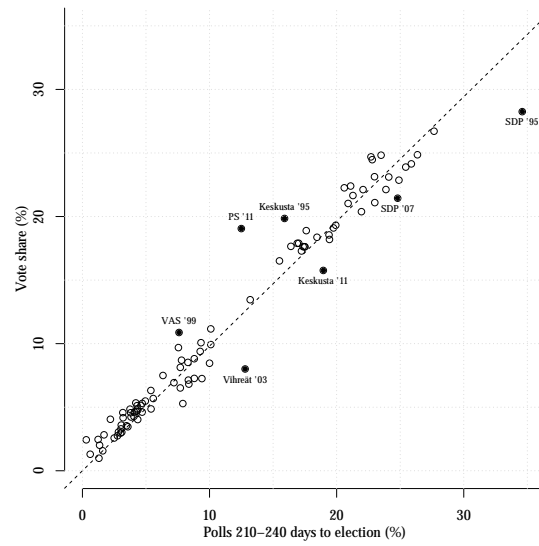
After determining the polling variable, the model selection was done atheoretically by calculating *adjusted R²* for all possible independent variable combinations. Then the best models with one to four variables were chosen. The base model (one variable model) consisted of `Polls_210_240` variable explaining the dependent variable. The model produced a good fit and had a high (0.963) *adjusted R²*. The second model also had the polling variable and in addition `PM X Unemp` variable, which is an interaction variable of prime minister dummy and change of unemployment rate. Both variables were statistically significant and they produced 0.001 improvement in *adjusted R²* to

Figure 2: Pre-election polls in comparison to actual vote shares

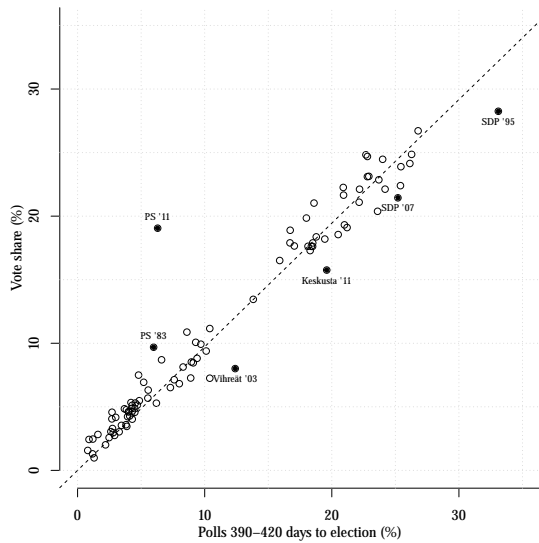
(a) 1-30 days before election



(b) 210-240 days before election



(c) 390-420 days before election



(d) 480-510 days before election

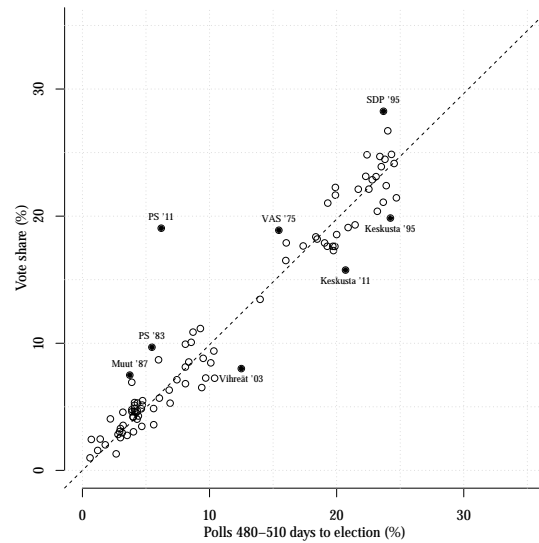


Table 5: Single variable poll models with full data 1975-2015

	<i>Dependent variable:</i>			
	Vote share (in percentages)			
	(1)	(2)	(3)	(4)
Polls 1-30	0.986*** (0.013)			
Polls 210-240		0.933*** (0.019)		
Polls 390-420			0.910*** (0.023)	
Polls 480-510				0.943*** (0.028)
Constant	0.221 (0.178)	0.840*** (0.268)	1.108*** (0.322)	0.777** (0.389)
Observations	95	95	95	95
R ²	0.985	0.963	0.946	0.926
Adjusted R ²	0.985	0.963	0.945	0.925
Residual Std. Error (df = 93)	0.994	1.542	1.878	2.203

Note:

*p<0.1; **p<0.05; ***p<0.01

the base model.

Third model consisted of the polling variable, last election vote share (*Last election*) and government membership (*Gov*). Third model produced also an improvement of 0.001 in *adjusted R²* to the second model. All variables except *Gov* were statistically significant. In the model, polls variable coefficient was given lower emphasis, as in the previous models (only 0.820). Last election variable had a coefficient of 0.134 and government membership dummy had a negative effect on party's election performance (-0.627), constant was 0.876. Negative government membership variable means that if party was in the government, it would expect -0.6% loss in the next election.

Fourth model is a combination of models 2 and 3 replacing government membership variable with *Gov X Last election* variable. This interaction variable has a negative coefficient, but it is not statistically significant, nor is the other interaction variable in the model. It takes account for the last election vote share, if party was member of the government. Fourth model produced also an improvement of 0.001 in *adjusted R²* to the third model, having thus the highest fit of represented models (see Table 6 for detailed information).

Table 6: Regression models with full data 1975-2015

	<i>Dependent variable:</i>			
	Vote share (in percentages)			
	(1)	(2)	(3)	(4)
Polls 210-240	0.933*** (0.019)	0.934*** (0.019)	0.820*** (0.055)	0.834*** (0.057)
PM X Unemp		0.238** (0.115)		0.201* (0.116)
Last election			0.134** (0.059)	0.139** (0.066)
Gov			-0.627* (0.334)	
Gov X Last election				-0.043* (0.024)
Constant	0.840*** (0.268)	0.816*** (0.263)	0.876*** (0.284)	0.639** (0.272)
Observations	95	95	95	95
R ²	0.963	0.965	0.966	0.967
Adjusted R ²	0.963	0.964	0.965	0.966
Residual Std. Error	1.542 (df = 93)	1.515 (df = 92)	1.505 (df = 91)	1.491 (df = 90)

Note:

*p<0.1; **p<0.05; ***p<0.01

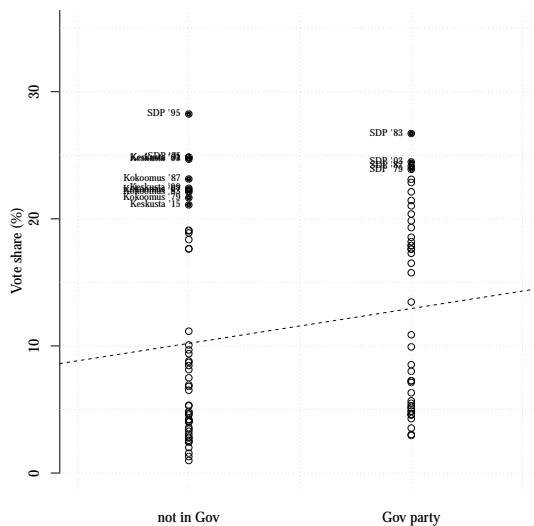
We can take a more detailed look into two variables: *Gov* and *Last election*. Examining the Figure 2a, one detects that *Gov* variable itself has a positive relation with party vote share, which is the opposite as in the model 3. This leads us to hypothesize, that there can be two mechanisms, which can explain one of the relationships. Either being in the government brings credibility to the party and trust that it is capable of taking care of the matters of government, gaining more

momentum for the next election, or the decisions taken under coalition governments are too often compromises between multiple parties thus not fulfilling the desires of party's supporters leading to decreased support. In reality both mechanisms are in play, but in model 3 the latter seems to outweigh the former one.

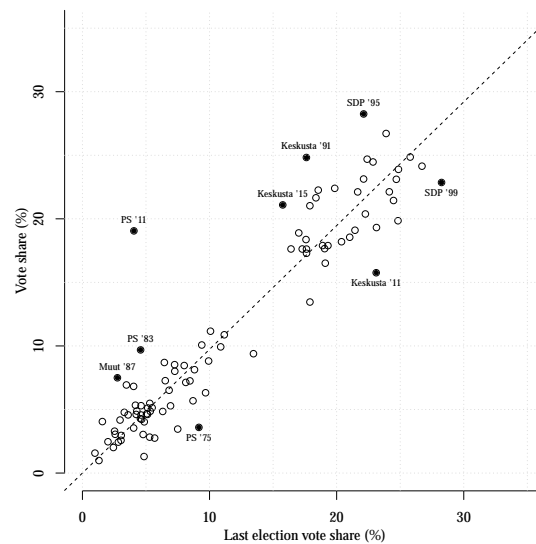
The second variable we were to investigate is Last election which was given relatively small but statistically significant coefficient in model 3 and model 4 (0.134 and 0.139 respectively), in comparison to the polling variable. One can detect in the Figure 2b that there are multiple deviations from the regression line which mimics almost completely stable voting pattern, where vote shares of two consecutive elections are equal. Most distinct data point is PS'11, referring to the electoral landslide victory of the Finns Party, as the party increased its vote share from below 5% to almost 20%. The possibility of the electoral success of the Finns was detected by the pollsters 6 months before the election (see Figure 1b), but by taking account only the last election result that result seemed highly unlikely. Therefore, it is not such a big surprise that Last election has a much smaller coefficient than polling variables.

Figure 3: Two structural model variables

(a) Government membership on party support



(b) Last election on current vote share



Results

In the previous section, four linear models with best relative fit to the data were introduced. To avoid overfitting we limited model size to be maximally four variables, so to be clear these models are not the four best fits, but they are four best fits with one to four variables. Next, the predictive capabilities of these four models will be tested to answer the first research question of this paper:

1. What is the most accurate model to predict Finnish parliamentary elections for the past 20 years of elections?

Testing the prediction models was performed by doing out-of-sample predictions with the last five elections from 1999 to 2015. For instance, predicting the 1999 election, all election years

Table 7: The RMSE of the out-of-sample predictions by data basis and election year.

Model	1999-2015	1999	2003	2007	2011	2015
Polls 210-240	1.75	1.75	2.04	1.46	2.54	0.97
2-variable model	1.78	1.74	2.09	1.47	2.57	1.02
3-variable model	1.74	1.67	1.67	1.46	3.19	0.72
4-variable model	1.75	1.57	1.74	1.39	3.21	0.82

after 1995 were omitted from the training data and 1999 result was the only observation to be predicted. After calculating out-of-sample predictions, the prediction results were compared to the actual voting results by calculating root mean squared error (RMSE) for each model for each election:

$$RMSE = \sqrt{\frac{1}{n} \sum_{i=1}^n (y_i - \hat{y}_i)^2}$$

The prediction errors of all prediction models are represented in Table 7. Model 3, with three predictors: Polls, Gov and Last election, ended up with the lowest mean RMSE (1.74) for the past five elections. The model outperformed 4-variable model and polling model by having 0.01 lower RMSE than those models. The two variable model had the weakest performance with 1.78 RMSE.

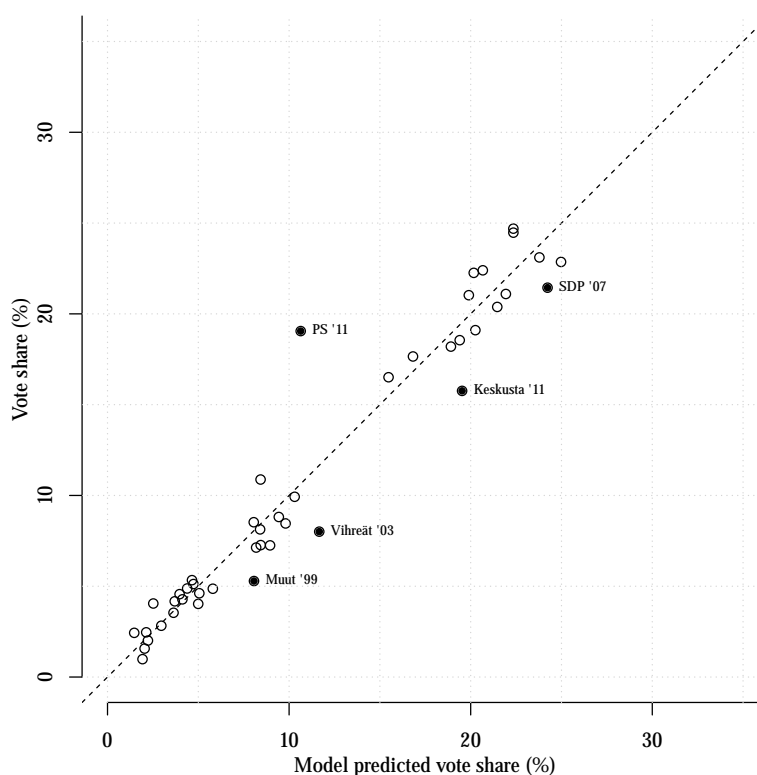
With a more closer look to the model performances, we can detect that model 3 had a lower RMSE than 4-variable model in 2003, 2011 and 2015, but it had slightly higher RMSE in 1999 and 2007. The 2011 election proved to be very difficult to predict for all models (RMSE over 2.5 for all models). In that election the Finns Party tripled its vote share and the party's rise was fully detected less than a month to election day. For 2011, the polling model had the least amount of root mean squared error (2.54) and adding variables just increased the error, model 4 having the highest RMSE (3.21). Besides 2011, the polling model was outperformed by 3-variable and 4-variable models.

In Figure 4 we can examine the prediction deviations from the actual vote shares. Every data point on the right side of the dashed line was overestimated by the prediction model and every point on the left side of the line was underestimated by the model. Outliers are filled points having a label indicating party and year they represent. One can notice that SDP's vote share was overestimated the most in 1995 and the Finns Party's result in 2011 was the biggest underestimation. The underestimation of the Finns Party support in 2011 is easy to diagnose, because the prediction model takes into the account the previous election result and this makes its predictions a bit more conservative (leaning towards the previous election), even though the previous election gets a small emphasis in comparison to polling. Let us consider an example, where a party had 20% support in the previous election and the coefficient for last election result is 0.10, then this would add 2% support for the party's next election vote share. Conversely, if party had a low support in the previous election, it draws the prediction down from the polling numbers, as polling variable does have a coefficient below 1.0.

We can conclude that model 3 is the answer for the first research question. The model had the lowest out-of-sample prediction root mean squared errors. Here is the model 3 formula with full data fit (see Table 6 for all models):

$$Voteshare = 0.876 + 0.820Polls_{210-240} + 0.134Lastelection - 0.627Gov + \epsilon$$

Figure 4: Model 3 out-of-sample predictions compared to actual vote shares



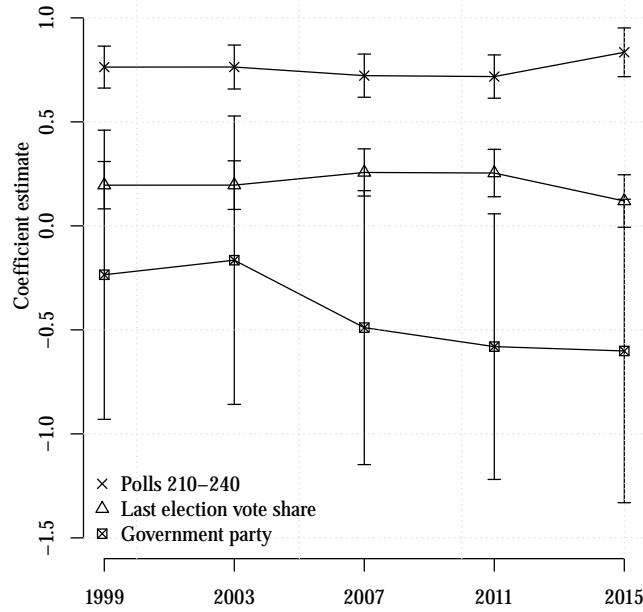
Out-of-sample predictions do not have constant coefficients as the model is being fitted for each election with different training data points. Therefore, it is worth investigating the fluctuations of model variables. We can see in Figure 5 that polling variable has had a relatively stable coefficient of around 0.75 from 1999 to 2011 with a small downward bump in 2007 and 2011, then in 2015 the coefficient surges over 0.80. Last election vote share, on the contrary, was around 0.15 in 1999 and 2003, but in 2007 and 2011 it increased to approximately 0.25, then in 2015 the coefficient decreased to 0.10. The government party variable was statistically insignificant for all years, but the coefficient became more and more negative almost reaching statistical significance for 2015 prediction. What we can deduce from this is that the party affiliations of voters have diminished over the years, as previous elections have less to say about the upcoming elections. Also, the evidence is growing that participation to government can have a negative effect on party support.

Next, we will seek to answer to the second research question:

2. What predictions can structural model provide for the upcoming 2019 parliamentary election?

We will use the fully fitted version of model 3 which was proven to be the most accurate structural model for forecasting Finnish parliamentary elections. The difficulty to predict next Finnish election is that we do not yet have the required polling data as the election is more than 6 months away (the next election is held in the April of 2019). Therefore, we will only provide a “what if” version of the prediction, this means that we will use the most recent polling data and

Figure 5: Model 3 coefficients with 95% confidence intervals



Note: Government party -variable is not statistically significant

pretend that this data is the real polling average of 1-30, 210-240 or 480-510 days to the election. This way we can also compare the predictions and their prediction intervals with using different days of polling in the model. In practice this means that we develop three models:

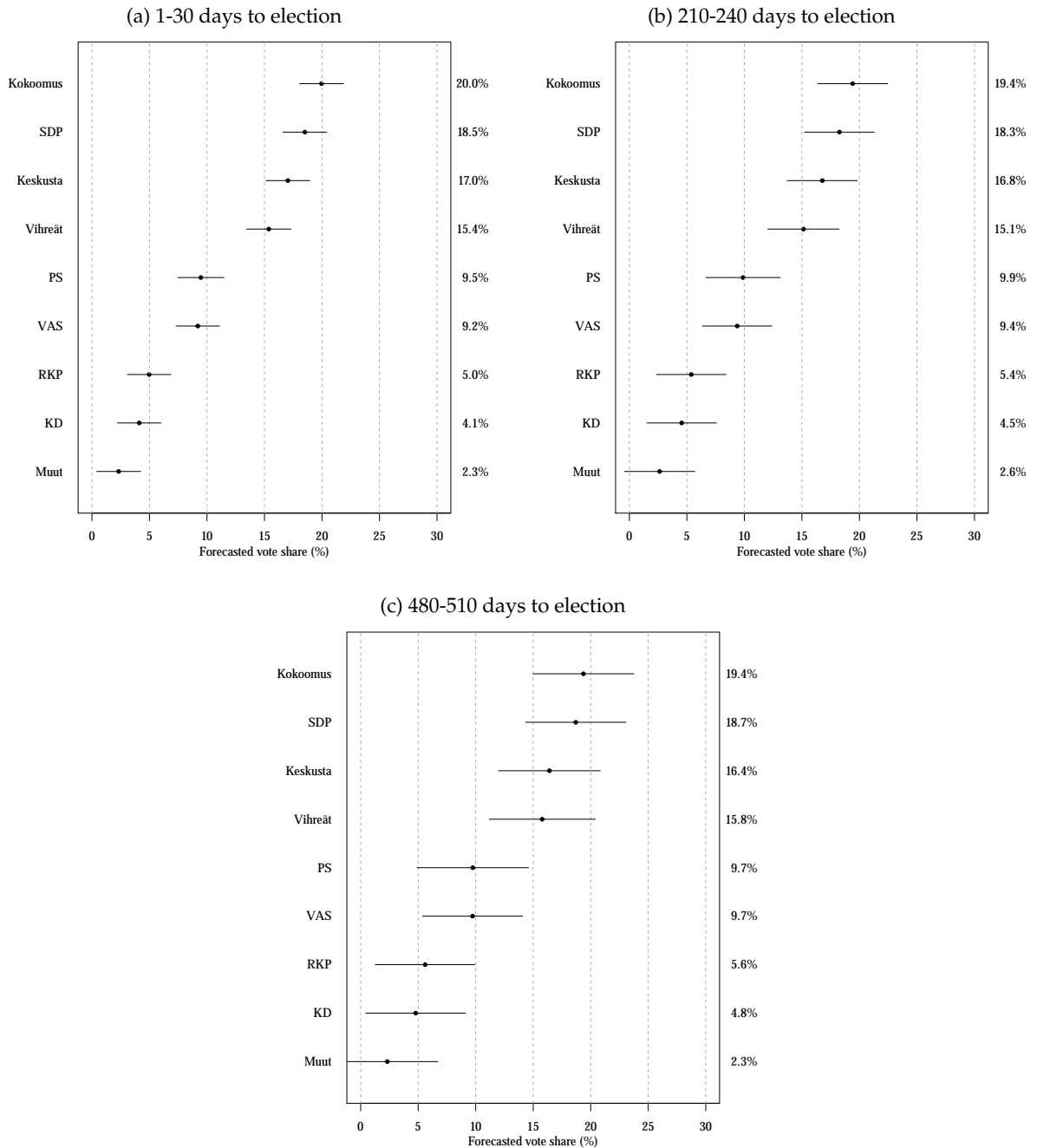
$$Voteshare = a + \beta_0 \text{Polls}_{1-30} + \beta_1 \text{Lastelection} + \beta_2 \text{Gov} + \epsilon$$

$$Voteshare = a + \beta_0 \text{Polls}_{210-240} + \beta_1 \text{Lastelection} + \beta_2 \text{Gov} + \epsilon$$

$$Voteshare = a + \beta_0 \text{Polls}_{480-510} + \beta_1 \text{Lastelection} + \beta_2 \text{Gov} + \epsilon$$

These models are trained with the full data. Then we input the missing polling averages to the test data to be KESK:16.7, KOK:20.4, PS:8.1, SPD:18.5, VIHR:16.0, VAS:9.2, RKP:4.7, KD:3.9, Muut:2.5 for all three time frames. The results of the predictions are illustrated in Figure 6. We can detect that the prediction intervals decrease significantly as the election date approaches, (e.g., Kokoomus' upper prediction interval is around 22% and the lower is circa 18% in the model where polling is 1-30 days before the election, but in 480-510 days of polling before the election the prediction interval limits are 24% and 15%). Also, the prediction means are different for different polling time frames, but they are very similar. Interestingly, the prediction intervals differ from party to party within the models the Finns Party (PS) having the widest prediction intervals. In all models Kokoomus (the National Coalition party) is the largest party with around 20% of the total vote, SDP is the second largest with circa 18.5%, Keskusta (the Center party) is the third followed by Vihreät (the Green League).

Figure 6: Prediction results with prediction intervals for 2019 parliamentary election, if it were...



Discussion

In this paper, party specific election forecasts were made for Finnish 2019 parliamentary election. The final prediction model was chosen by testing four candidate models' performance in out-of-sample predictions for 1999 to 2015 elections. Model with three predictors (polling, vote share of the last election and government membership) had the lowest root mean squared error. This model was next used to create forecasts for 2019 election by pretending that latest polling available would be within the range of three polling time frames. These forecasts differed significantly in terms of their prediction intervals, the intervals grew as polling time frames were further from the election day. In all prediction exercises Kokoomus was predicted to be the winner of 2019 election, followed by SDP and Keskusta as the third largest party. One has to remember that these predictions are, yet, very uncertain, as we are not, in reality, in range of any of these polling time frames.

The prediction model used in the paper was a synthesizing model. It combines poll aggregation and a structural element (government membership). Synthesizing model was the only option for predicting individual party vote shares, as purely structural models lack predicting power on party level, ie. how could economic variables account party specific support? Usually structural accounts are used in two-party races. One possibility could have been to use purely structural model to predict government and opposition vote shares, but in the Finnish political system cabinet positions are renegotiated after each election, and there are no ideological barriers to forming coalitions in the government, thus trying to forecast with the unpredictable governmental and opposition party structures is unreliable.

The final prediction model developed in this paper performed very well and it provided significant improvement to polling model if 2011 election result is not considered. Polling itself has been very accurate even though party identification has been decreasing and voting decisions are made close to election. It seems to be so, that the developed 3-variable model was a good fit for elections with stable party settings, as the model itself is inherently conservative giving leaning towards previous election result and punishing parties with governmental positions.

The difficulty with the 2019 prediction is that the Finnish party landscape is experiencing changes, as the Finns Party split during the summer of 2017. Predicting the vote share of the Finns Party will be very difficult, as it is not at all clear how many supporters of the earlier party establishment will continue to give their support for the new leadership or will they follow Timo Soini and his trustees to the Blue Future. Therefore, giving the historical voting results of Soini's Finns Party to train the model in predicting the vote shares of the current Finns Party may be strongly misleading. Similarly, the ad hoc placement of the Blue Future into the Others (Muut) section of the model can result in great prediction error.

To ponder other possible models, term length and GDP growth could be possible extensions of the variables to look at. Also, using communal elections instead of previous parliamentary elections could yield interesting results as communal elections are usually held half way through the normal parliamentary election cycle. Presidential elections could also provide some information about the strength of parties. Most importantly, it would be important to try to expand historical pre-election polling accounts for elections prior to 1995. Future work should focus on developing dynamic linear models for predicting Finnish elections.

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