Bachelor Thesis in New Macroeconomics Realitites

University of Tuebingen

How Do Carbon Policy Shocks Influence Voting Behavior, Particularly in Shaping Polarisation in German State Elections?

by

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Abstract

This bachelor thesis investigates the influence of carbon policy shocks on voting behavior and political polarisation in German state elections from 2000 to 2020. Using two data sets on election results and Sunday polls, I created two new variables reflecting the political fringes. With the help of local projections, the influence of shocks on voting behavior was estimated. I find that a tighter carbon price regime does not lead to polarisation in the state elections and even negatively influences the election results of the far-right parties. In the Sunday poll, on the other hand, the AfD experiences a positive effect, which points to a complex mechanism in electoral decisions.

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1 Introduction

Climate change is one of the biggest problems of our time. As many economies have relied on fossil, unsustainable energies in the past, the transition to a sustainable economy is one of the biggest political challenges for many governments today. The problem is not the lack of tools to reduce emissions, but the political feasibility of these tools. The heating law of Germany's Federal Economics Minister Robert Habeck, which is based on a prescriptive approach, has been particularly heavily discussed and criticised. Many experts attribute the low poll ratings of the traffic light government to this law. One of the winners of this political course appears to be the AfD, which has been achieving good results in the polls for months as Mathiesen (2023) found out. However, the political impact of other tools is much less clear. In this thesis, I empirically investigate the question of the political feasibility of market-based approaches in the form of cap-and-trade systems. To be precise: "How do carbon policy shocks influence voting behaviour, particularly in shaping polarisation in German state elections?"

In order to answer this question, I compiled two different data sets on real election results from state elections and the Sunday poll from the years 2000 to 2020. Since the Cambridge Dictionary (2024) defines polarisation as an "act of dividing something, especially something that contains different people or opinions", I created new variables in both data sets that depict the political right and left fringes. The changes in these variables served as an indicator for a possible polarisation of the electorate. To avoid potential confounding factors in subsequent regressions, relevant economic parameters were integrated into the data sets as control variables. As a measure for the carbon policy shocks I used the already identified series by Känzig (2023). He had created this exogenous shock series using a high-frequency approach. To estimate the influence of these shocks on the dependent variables, I chose the econometric model of local projections according to Jordà (2005).

The evaluation of the models showed that a tighter carbon pricing regime does not lead to polarisation in the German state elections. The results show a significant negative effect on the voter share of the far-right parties. In parallel, the same model was applied to the Sunday poll, where a significant positive effect on the share of people who would vote for the AfD was found. The effect of the shocks only lasts during the first period and therefore has no influence on the next election or poll. In all models, no significant effect was identified for far-left parties.

To interpret these results, it should be noted that more right-wing parties tend to be against climate policy measures, while centre or more left-wing parties have a more ambitious attitude towards climate protection. The results of the Sunday poll model can be interpreted to mean that a tighter carbon pricing regime would primarily cause resentment among the German population due to price increases and, as a direct reaction to this, people are more likely to vote in favour of the AfD in the Sunday poll. However, as the majority of the population is fundamentally in favour of climate policy measures and even calls for them, the share of voters for right-wing parties will decrease in the real elections.

This study extends the existing field of research by focussing empirically on the political feasibility of cap-and-trade systems in the context of German state elections. In his work, Känzig (2023) identifies that as a result of tighter regulation of emission allowances in the EU, not only do GHG emissions fall, but consumer prices also rise. In their study, Brännlund and Peterson (2024) point out that rising energy costs in Sweden favour the support of radical right-wing parties. A similar pattern can be seen in the Netherlands, as found by Voeten (2022), who identifies a correlation between an increase in gas tax and an increase in support for radical right-wing parties. Interestingly, the study by Rhodes et al. (2017) in Canada confirms that voluntary measures to reduce emissions are widely supported, while market-based instruments are met with resistance. A differentiated analysis of populist parties, conducted by Huber et al. (2021) and Jahn (2021), emphasises that they have a rapid and decisive influence on greenhouse gas emissions, with right-wing populist parties being more involved. Finally, Lüth and Schaffer (2022) and Otteni and Weisskircher (2022) show that political polarisation and the rejection of certain environmental measures can strengthen the support for radical parties. In contrast, this bachelor thesis sheds light on the specific influence of carbon policy shocks on German elections and demonstrates a clear negative effect on far-right parties, in particular the AfD.

The remainder of my work is structured as follows. Section 2 explains the origin and modification of the data used. Section 3 contains a detailed explanation of the identification of the carbon policy shock and the models I used for the estimation. Section 4 explains the results of the models and the possible mechanisms underlying the results. Section 5 is a summary of my work.

2 Data

In this section, I will provide information on the source of all the data used, which covers the period from 2000 to 2020. With the exception of the shock series, which was identified for the EU member states, all data relates to Germany alone. This is followed by an explanation of the modifications to the two new data sets that I have created.

2.1 Economic data

In order to avoid distorted results due to unobserved confounding factors, I have added economic parameters as control variables in my models. I obtained quarterly data on Germany's real gross domestic product from the Federal Reserve Economic Data (FRED) website. The units of the data are presented in millions of euros and price-adjusted to the year 2010. Monthly data on inflation and the unemployment rate were taken from the Organisation for Economic Co-operation and Development (OECD). Inflation is measured by the Consumer Price Index (CPI) and presented as a monthly growth rate. The unemployment rate is expressed as a monthly percentage of the unemployed.

As shock data I used an already identified shock series from Känzig (2023) as the main independent variable in my models. I took this from the replication code of his paper. Further information on the identification of this shock series can be found in the section 3.1.

2.2 Election data

The data on the elections consists of two different data sets. I took the data set with the actual results of the state elections from the website of the Federal Returning Officer. The Federal Returning Officer organises and monitors political elections in Germany and maintains the data on its website. This also includes the state elections of all German federal states. In addition to the information on the distribution of seats in the state parliaments, this data set also contains detailed data on the votes received by the individual parties. This means that parties that did not make it over the 5% threshold are also listed here. The frequency of this data also refers to the respective state elections in the federal states.

I obtained data on the Sunday poll in Germany from Infratest Dimap, which is a provider of

election and political research in Germany. They have been conducting the Sunday poll since 1997. The aim of this question is to find out which party the participants would vote for if the federal elections were held next Sunday. It is important to note that the Sunday poll only measures current voting tendencies and not actual voting behaviour. Therefore, conclusions about the actual outcome of the election are only possible to a limited extent. The Sunday poll and thus the frequency of this data amounts to one to three polls per month, which were not always conducted on the same day. As there is no Sunday poll for the state election, I use this data as a proxy.

2.3 Modification

The following section takes a closer look at the modification of both election data sets. The procedure for the modification is the same for both data sets. First, the composition and creation of the variables used to measure polarisation are explained. This is followed by an explanation of the aggregation of the shock, before finally discussing the control variables.

2.3.1 State elections

To measure polarisation based on the election results, I introduced two new variables in the data set to represent the political right and left wing. Due to the foundation of the AfD in 2013 and the partial absence of the Linke in many state parliaments caused by the 5% threshold, it did not seem appropriate to define the target variable as the number of seats held by both parties. This problem was solved by adding up the valid votes of all far-right and far-left parties for each election. This approach enabled detailed results for each election. The definition of both political wings with their associated parties was taken from Gabriel et al. (2023) and can be found in the appendix A.1. The newly coded variables consist of the sum of all valid votes of these parties divided by all valid votes of the entire state election. The change in the newly created variables was then calculated. The rates of change refer to the difference to the last election result of the respective state in the real election data and are presented as a new variable. In the next step, the already identified shock by Känzig (2023) was added to the data set. The timing of the voting decision depends on many different factors, as Blumenstiel and Plischke (2015) state in their work on the 2009 federal election. However, the proportion of people who

only decide which party to vote for in the last few weeks before an election tends to be smaller. For this reason, I deliberately avoided using the individual shock value for the respective month of the election. Instead, I totalled the shock series for each state election individually from January to the month of the respective election. This approach allows for a more comprehensive capture of the reactions of the electorate, not just those who make their decision shortly before the election. As a final step, the economic indicators of the respective month were added. As the gross domestic product (GDP) is given in quarters, the quarterly value for the corresponding month was used. The respective monthly values were added for inflation and the unemployment rate.

2.3.2 Sunday poll

The data set for the Sunday poll was modified in an alternative way. Due to the inconsistent frequency of this poll, the monthly average value of the election results for each individual party was calculated first. This served to convert the data into a regular monthly frequency. Unfortunately, the aforementioned problem of unavailable data for the AfD before 2013 could not be fully resolved for the Sunday poll data set, as no detailed information on the performance of smaller parties was available. As a result, the AfD and the Linke party were used as representatives for right-wing and left-wing parties respectively and data was only taken into account since the foundation of the AfD in 2013. The changes in the newly created variables were also calculated in this context. In contrast to real elections, the Sunday poll captures current voting tendencies. Due to the fact that these are more likely to be influenced by current events and perceptions, the shock data was deliberately not aggregated for this data set and instead the shock value was taken directly from the corresponding month. The economic parameters were also added to this data set in the same way as already described in connection with the other data set.

3 Econometric Approach

3.1 Identification

The following section serves to explain the identification approach. I have taken the following information, as well as the identified shock, from Känzig (2023).

To understand the carbon policy shocks, one must first take a look at the European Emissions Trading Scheme (EU ETS). This was introduced by the European Union to combat climate change and covers 40% of EU emissions. This scheme is based on the cap-and-trade approach, in which an upper limit for emissions is set for each year. The corresponding quantity of emission allowances (EUAs) is then auctioned or allocated free of charge, with one EUA entitling the holder to emit one ton of carbon dioxide or an equivalent gas. Companies are obliged to cover their emissions with these certificates at the end of each year and are penalised with sanctions if they fail to do so. The identification of the carbon policy surprise series was carried out using an event study approach. This involved identifying 126 regulatory events between 2005 and 2019 that relate to the overall cap on allowances. These events can be decisions by the European Commission, votes by the European Parliament or judgements by the European Court of Justice and always relate to the supply of emission allowances and can have a significant impact on the price of an allowance. Liquid futures markets in which these allowances are traded are required for the implementation of the High Frequency Identification approach. There are several of these markets, with Känzig focussing on ICE London. Känzig analyses how this price changes within a 24-hour window following these updates. Based on the known economic conditions, reverse causality can be ruled out. The carbon policy surprise series he has created is calculated as follows:

$$CPSurpriset_{t,d} = \frac{F_{\text{carbon},t,d} - F_{\text{carbon},t,d-1}}{P_{\text{elec},t,d-1}}, \tag{1}$$

where the numerator depicts the daily change in the price of emission allowances compared to the previous day. This change is then divided by the wholesale electricity price in order to isolate the price variation caused by regulatory news. This daily series is then aggregated into a monthly series. In months without events, the series has a value of zero. Känzig also emphasises that there is no evidence of serial correlation in the series. However, as this series

is only an imperfect measure, it is only used as an instrument. He then uses VAR techniques to estimate the dynamic causal effects of a carbon policy shock. He refers to an external instrument approach for identification, in which he uses the surprise series as an instrument for the energy price residual. I use this carbon policy shock for my models.

3.2 Estimation

To estimate the dynamic effects of a carbon policy shock on population polarisation, I applied the local projection method of Jordà (2005). In all models, two lags of the control variables and the dependent variables were added. The regressions of the local projections were estimated using HAC (heteroscedasticity and autocorrelation consistent) standard errors. The regression equation is as follows:

$$Y_{t+h} = \alpha_h + \theta_h \cdot \varepsilon_t + \beta_h \cdot X_t + \xi_{t+h}, \tag{2}$$

where Y_{t+h} represents the change in the percentage point in the elections for the political right and left wings. The term α_h is a constant that depicts the baseline level of the dependent variable at time h. The coefficient θ_h represents the impact of the shock at time h, while ε_t then denotes the actual carbon policy shock. β_h is the coefficient of the control variables at time h, while X_{t+h} is the actual vector of the control variables. This vector contains the lags of the dependent variable, the shock variable and of the controls. The term ξ_{t+h} is used to account for the error at time $t + h$, and captures unobserved factors that influence the dependent variable. The control variables take into account economic uncertainties and economic performance, as well as the development of purchasing power for the regression, in order to control for possible confounding factors. This procedure enables a more precise analysis of the relationship between the dependent and independent variables.

3.2.1 Model state elections

The frequency of this data set refers to the individual state elections, which take place every 5 years for each federal state. Due to this lower frequency, I have set the horizon of the local projections to 6 periods. In addition, the maximum lags in this model were limited to 4. The dependent variable in the following models always refers to the vote share of the far-right and far-left parties.

Equation 2 was then estimated using Ordinary-Least-Square (OLS) and serves as a baseline. The added control variables help to control for certain confounding factors. Given the potential for endogeneity issues or autocorrelation arising from OLS calculations, I conducted multiple robustness checks. Since the data is available as election results in panel form to indicate the individual federal states, local projections were also estimated using PanelOLS as a robustness check. This regression also follows equation 2. A kernel-based approach with the Barlett kernel was chosen as the estimation method. This kernel helps to weight the observations based on their temporal proximity. The consideration of the temporal structure contributes to the robustness against outliers. Further endogeneity concerns could also arise from the shock variable. Although the high-frequency identification approach provides for very exogenous shocks, there could still be unrecognised endogenous variables that are correlated with the dependent variable. To address these concerns on another level, a local projection-instrument variable (LP-IV) approach was performed as another robustness check. In this specific case, the shock was regressed on the variable "inflation" in the first stage. And in the second stage, the estimator obtained was then included as an independent variable in my regressions. Both regression equations follow the scheme of the equation 2.

3.2.2 Model sunday poll

As the data set for the Sunday poll is available at a monthly frequency, I have decided to set the horizon to 12 and the maximum lags to 6. The dependent variables of the model now refer to the share of votes for the AfD and the Linke party for the years 2013 to 2020. Again I estimated equation 2 for this data using OLS.

4 Results

To visualize the temporal evolution of responses to carbon policy shocks, the impulse-response functions were created using the estimated parameters of the local projections. They show the response of the dependent variable to the shock already identified, which was normalised to a Harmonised Indices of Consumer Prices (HICP) energy component increase of one percent on impact. The grey area around the solid line shows the confidence band, which is based on a confidence level of 90%. Overall, it becomes clear that a tighter carbon pricing regime leads to a decline in the voter share of right-wing parties, while left-wing parties experience no significant effect on their voter share. The robustness of these results is illustrated by various modifications of the baseline model. The separate model, which refers to the Sunday poll data, also showed that the share of the Linke Party does not change significantly after a shock. However, the comparison with this model shows a clear and significant increase in the AfD's share of the votes. In all models, it is clear that the shock only has a short-term effect and will not last until the next elections. The results presented are all given as percentage point changes, as the target variables in the models represent the change in the share of votes for the right-wing and left-wing parties.

4.1 State elections

Figure 1 presents the impulse response functions of the local projections, which were estimated using OLS. Overall, it can be seen that the effect of the restrictive carbon policy shock on the dependent variables is limited to a range of -0.016 to 0.015 percentage points. In particular, you see that the shock has a significant negative effect on the electoral share of the far-right parties, which is -0.016 percentage points. However, this effect is only significant in the first period, which indicates a very short-lasting effect that has no influence in the long term. The remaining course of the impulse response function is insignificant. The impulse response function of the variable for the radical left-wing parties remains largely insignificant and can be seen in the appendix A.2.1. The robustness checks carried out using local projections with PanelOLS and the local projection-instrument variable method confirm these results. The only difference in the results of these models lies in the magnitude of the reaction of the far-right parties. These show a reaction to the shock with a change of -0.02 percentage points in the PanelOLS model

and -0.042 percentage points in the LP-IV model. The impulse response functions for the robustness checks models are shown in the appendix A.2.2 and A.2.3

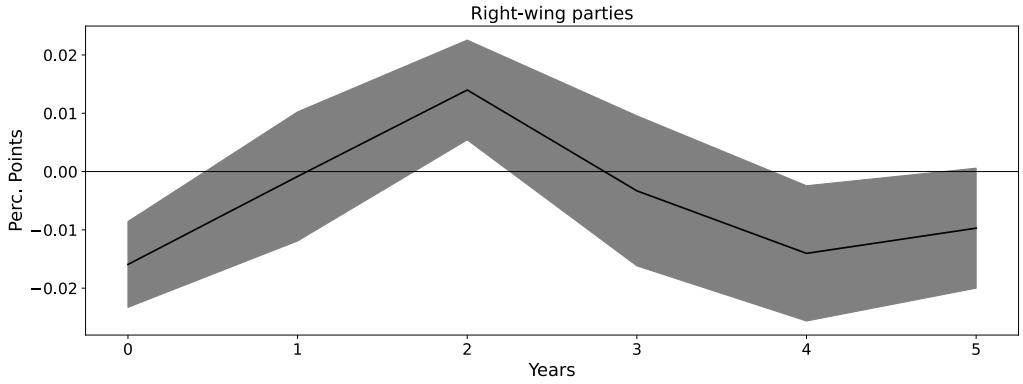

Figure 1: Impulse Response Function for right-wing parties in baseline model

4.2 Sunday poll

The impulse response functions generated by the Sunday poll model differ from the other results in terms of their magnitude and, in some cases, their sign. Figure 2 shows a direct, significant positive shock of 0.46 percentage points for the AfD in the Sunday poll results. Similar to the other models, the shock is only significant in the first period. The variable of the Linke party does not react significantly to the shock, as can be seen in appendix A.2.4.

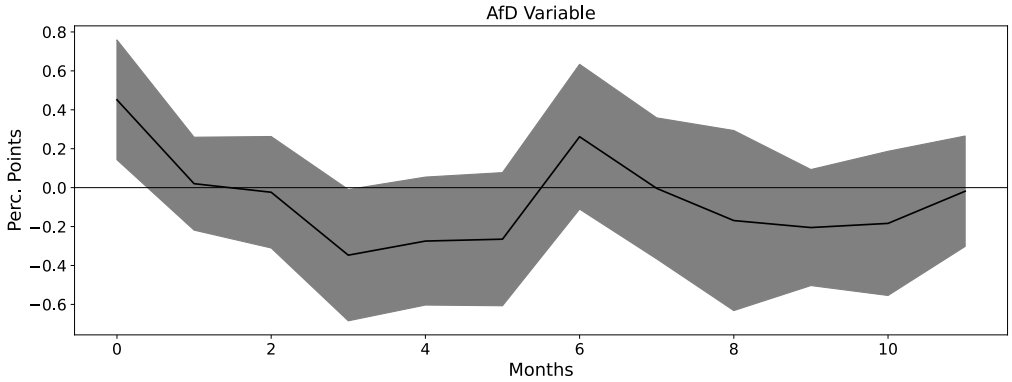

Figure 2: Impulse Response Function for AfD in Sunday poll

4.3 Possible mechanisms

In summary, the results show that the a tighter carbon pricing regime does not shape polarisation in state elections in Germany, as we can see in the last section. The positive effect for the AfD in the Sunday poll suggests that the population perceives these shocks. As Känzig (2023) has already established, carbon policy shocks lead to rising consumer prices. It is possible that people are increasingly voting for the AfD in the Sunday polls as a protest against the rising costs. The results of the actual state elections can possibly be explained by the following mechanisms. The estimated impulse response functions show that the effects of these shocks are very short-lived. This suggests that although these shocks are perceived in the short term, they have no lasting influence on long-term voting behaviour. Similar findings are provided by Voeten (2022), who found that an increase in the gas tax in the Netherlands increases support for the radical right in the short term, but does not change the political left-right alignment in the long-term. As the majority of voters in actual elections do not make their decisions in the last few weeks before the election, as shown by Blumenstiel and Plischke (2015), this short-term effect may not filter through to the actual state elections. However, another mechanism could also explain this result, which might be responsible for the fact that the vote share of the far-right parties decreases due to carbon policy shocks. These effects could be due to the fact that a large proportion of the German population is in favour of climate policy measures. The study conducted by Williams (2022), commissioned by the Federal Environment Agency, shows that over 53% of respondents are strongly in favour of restructuring the economy in Germany in an environmentally and climate-friendly way, while a further 37% are more in favour. This trend can be seen over the last 20 years, as a time series from Schipperges (2020) shows. Right-wing parties, on the other hand, are largely opposed to climate policy measures, as Huber et al. (2021) find out. The AfD (2016), for example, which is the largest right-wing party in Germany, states in its manifesto that it rejects decarbonisation plans and does not want to place an additional financial burden on carbon dioxide emissions. To summarise, the results suggest that the German population may initially support the AfD in protest at the negatively perceived carbon policy shocks caused by rising prices, but in the long term this does not benefit the right-wing parties in the state elections. This is because these parties position themselves against climate policy, while the population is generally in favour of climate policy measures.

5 Conclusion

Combating climate change is one of the greatest challenges of the present time. While there are many approaches to transform economies dominated by fossil fuels into sustainable ones, the question of political feasibility often remains unanswered. In this bachelor thesis, I analysed the impact of a tighter carbon pricing regime within the European Emissions Trading System on state election results in Germany. Two data sets on German state election results from 2000 to 2020 were collected for this purpose. Utilizing a previously identified exogenous carbon policy shock related to the European emissions trading system, I established a connection between a tighter carbon pricing regime and a change in election results. Through the use of local projections, I found out that there is no polarisation in election results following a restrictive carbon policy shock; instead, the share of votes for far-right parties decreases. Far-left parties, on the other hand, experience no significant effect on the share of their votes. Another model, which examined the results of the Sunday poll instead of state election results, observed an increase in support for the AfD. In this model, the variable for the Linke party also experiences no significant effect. The divergent outcomes of both models are attributed to the possibility that, in the sunday poll the population may support the AfD as a protest against rising prices due to carbon policy shocks. However, this short-term effect is not reflected in the actual state election results, as the effects of carbon policy shocks are short-lived, according to estimated impulse-response functions. The effects of the restrictive carbon policy shock in the actual state elections lead to a decrease in the vote share for far-right parties. This can be attributed to a significant portion of the German population supporting climate policy measures, while right-wing parties, such as the AfD, position themselves against such measures. These findings establish that a tighter carbon pricing regime does not lead to polarisation in German state elections. This insight suggests that, in the fight against climate change or the transition of the economy greater emphasis should be placed on market-based approaches such as emissions trading. In addition to its efficiency and minimizing of welfare loss, this research also substantiates the political feasibility of such an approach.

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A Appendix

A.1 Definitions of far-right and far-left parties in Germany since 1980 by Gabriel et al. (2023)

Far-right Parties:

Alternative for Germany (AfD); Freedom - Civil Rights Movement Solidarity (BFBDO); Law and Order Offensive (Schill); National Democratic Party of Germany (NPD); STATT Party; Pro Germany Citizens' Movement (ProD); The Republicans (REP); Patriots for Germany (Patrioten); German People's Union (DVU); The Right (DR); German Social Union (DSU); Bayernpartei (BP)

Far-left parties:

The Left (LINKE); Party of Democratic Socialism (PDS); Communist Party of Germany (KPD); Marxist-Leninist Party of Germany (MLPD); League of West German Communists (BWK); German Communist Party; Socialist Equality Party (SGP); Spartacist Workers' Party (SpAD)

A.2 Impulse response functions

A.2.1 Baseline model

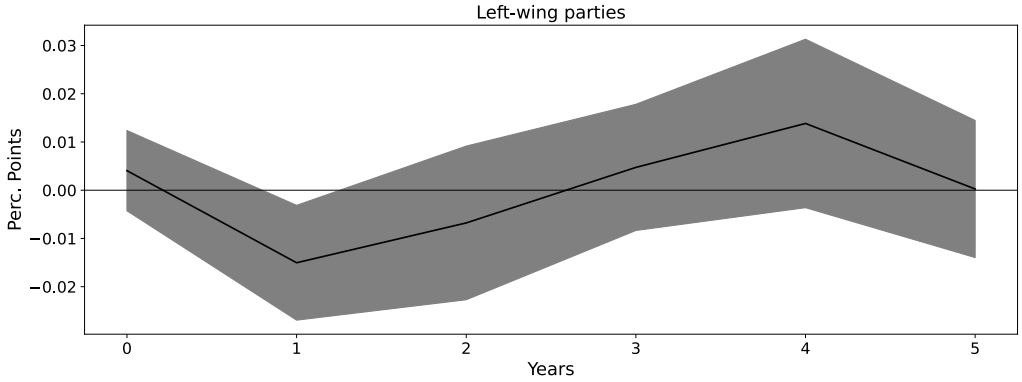

Figure 3: Impulse response function for left-wing parties in baseline model

A.2.2 PanelOLS as robustness check

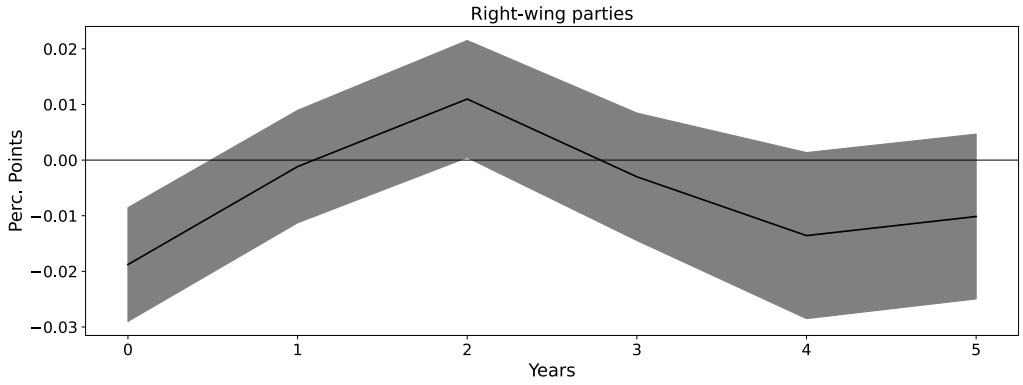

Figure 4: Impulse response function for right-wing parties in local projections PanelOLS model

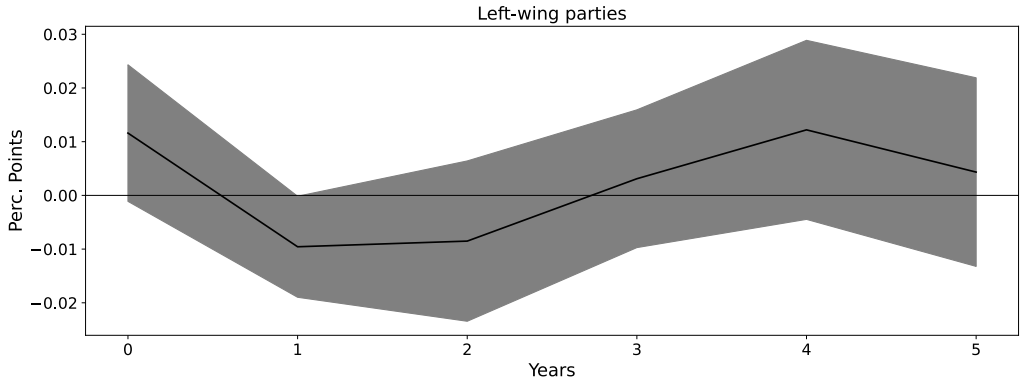

Figure 5: Impulse response function for left-wing parties in local projections PanelOLS model

A.2.3 LP-IV as robustness check

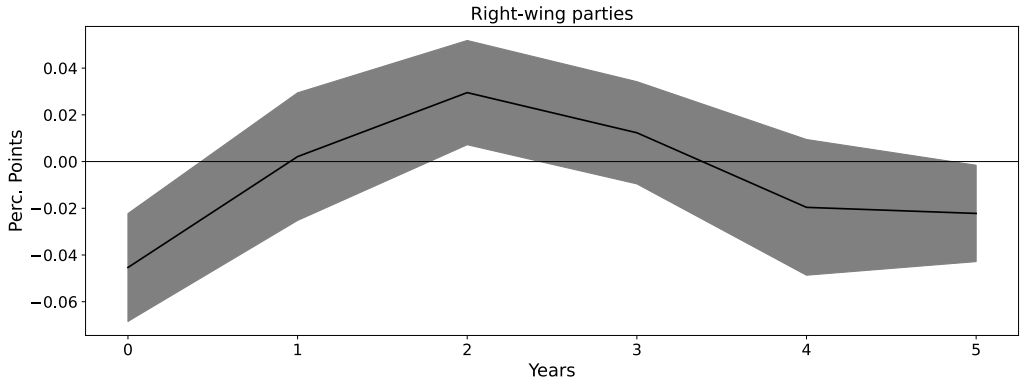

Figure 6: Impulse response function for right-wing parties in local projections-instrument variable model

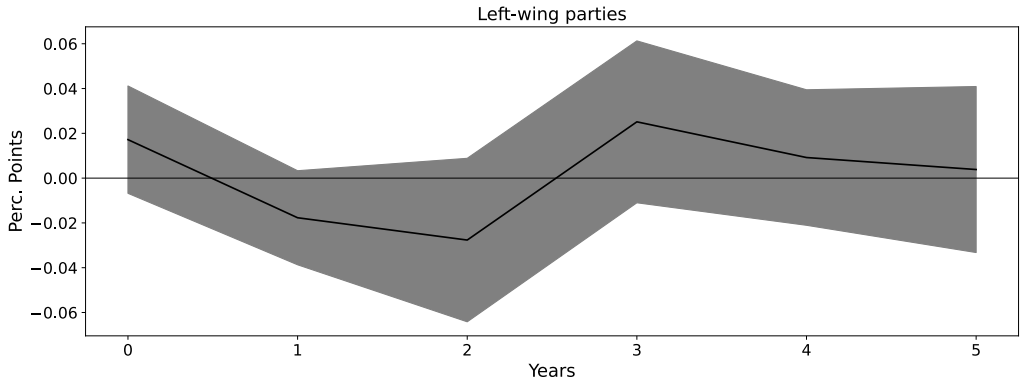

Figure 7: Impulse response function for left-wing parties in local projections-instrument variable model

A.2.4 Sunday poll model

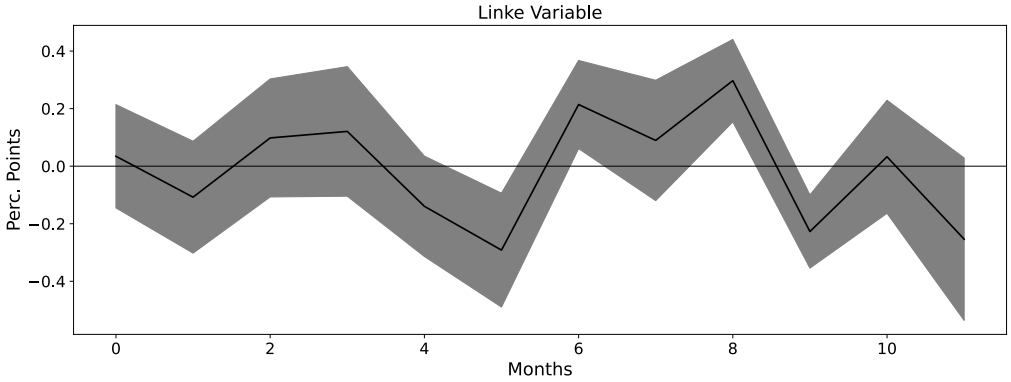

Figure 8: Impulse response function for the Linke in the sunday poll