Spatial Insights into the Relationship between Unemployment and the Nazi-Vote Twilight at the End of the Weimar Republic[1]

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1. Introduction

In the course of the Great Depression unemployment in Germany soared from 1.1 millions in May 1928 to 6 millions in March 1933. At the same time, the radical parties NSDAP and KPD increased their share of the vote from 13 percent to 56 percent, while the electoral support of all other parties considerably decreased.[2] Voters in the final phase of the Weimar Republic voted obviously not only for "an opposition within the system but an opposition to the system" (Kaltefleiter, 1966, 95). In such an economic siutation one would expect unemployment to have had a positive impact on the share of the vote of both radical parties. Although on the level of the administrative unit of the *Kreise* a strong positive impact of rising unemployment and the Communist vote could be detected, the NSDAP-vote was found to be negatively correlated with the unemployment rate. (Falter, 1984)

Apparently, at the end of the Weimar Republic on the aggregate level voters made the incumbent parties responsible for the economic crisis and punished them by going over to the radical parties. Since workers were especially hard hit by rising unemployment, the positive impact of unemployment on the KPD-share and the negative impact on the NSDAP-share for the entire Reich can be explained by partisan-behaviour. By choosing the KPD instead of the NSDAP, the unemployed voted, on average, for the party which they perceived as traditionally representing workers' interests.

Since political parties advocate the interests of certain socio-economic groups the party-preference of an individual voter is influenced by the preference-structure of a representative

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[2] Only the share of the Zentrum / BVP, the political representation of the Catholics, remained stable.

member of the socio-economic group to which he/she belongs. An important factor in determining the affiliation of a voter to a certain group is his/her economic status. This implies that the unemployed should mainly vote for the party advocating the interests of the jobless irrespective of location. In contrast to this view, spatial analysis considers, that due to place-specific context location plays an important role in mediating the effects of structural forces. (O'Loughlin and Anselin, 1992) This means that group-oriented voting behaviour has a spatial dimension, too, and as a consequence, the party-choice of the unemployed may be partially regionally determined. In addition, a spatial perspective is also necessary, because due to contagious effects, there may exist a systematic spatial dependence of variables in adjacent regions. (Cox, 1969)

By using techniques of spatial data analysis this paper aims at showing that in spite of the overall negative relationship between unemployment and the Nazi-vote for the entire Reich, there were a considerable number of spatially clustered *Kreise* where the relationship was positive. This indicates that there were regional contextual variations in the voting-behaviour of the unemployed meaning that the cleavages in the final phase of the Weimar Republic were not so clearly defined as previously supposed. (Falter, 1991) Considering this contextual variation, a spatial model of the Nazi-vote for a subset of *Kreise* with a positive relationship between change in unemployment and change in the NSDAP-share is specified. This model is applied to make a crude counterfactual estimation: we explore the extent to which in spite of an overall negative relationship between unemployment and the NSDAP-share a decrease in unemployment in a subsample of *Kreise* with a positive relationship between unemployment and the Nazi-vote would have lowered the *total* NSDAP-share. It will be shown that at least for our simple counterfactual model such a policy would only have had a minor effect.

2. Descriptive Spatial Statistics and Mapping

We focus on the Reichstag-election of July 1932 using a sample of 651 *Kreise* for which boundaries remained unaltered in the analyzed period.[3] This election was chosen because in the period from the election in 1930 to the election in 1932 both the votes for the radical parties and unemployment showed the highest absolute increase (8.1 millions respectively 2.4

millions) in comparison to other pairs of elections. Data for this period are only available on the regional level of aggregation.[4] We will first elaborate the spatial characteristics of the relationshipship between unemployment and the Nazi-vote and then proceed to the full model in section 4.

For making the concept of spatial dependence and heterogeneity more concrete, it is necessary to determine which units in a spatial system influence one another. This influence is expressed with the notion of neighbourhood, more precisely binary contiguity between spatial units. According to this concept, if two spatial units i and j have a common border, they are said to be contigous. In such a case, the cell w_{ij} assumes a value of one in a square matrix with dimension of n, where n stands for the number of spatial units. If they have no common border, the corresponding value of w_{ij} would be zero. For spatial processes operating on a larger scale than directly adjacent *Kreise* higher order contiguity matrices can be constructed. For example, a *Kreis* i would be second order contigous to *Kreis* j if it is directly connected to a *Kreis* k that in turn is first order contigous to j.

In order to find out the *Kreise* with a positive relationship between rise in unemployment and the NSDAP-share a *Kreis*-specific measure of association r_i was computed.[5]

$$ri = \frac{(UECHA_i - \mu)(NAZICHA_i - \mu)}{\sigma_{UECHA}\sigma_{NAZICHA}} \qquad (1)$$

Subsequently, the degree of spatial clustering or spatial autocorrelation for this measure was determined by using the Moran's *I* statistic which can be expressed as

$$I = \frac{\sum_i \sum_j w_{ij}(r_i - \mu)(r_j - \mu)}{\sum_i (r_i - \mu)^2} \qquad (2)$$

[3] The data set was provided by Jürgen Falter, University of Mainz. The spatial statistics and regression estimations were carried out by SPACESTAT. (Anselin, 1992)
[4] This means that inferences about the individual level can not be made. This shortcoming may not be too serious though, since it has been shown that aggregate rather than individual data yield valid inferences about individual voting behaviour. (Kramer, 1983)
[5] For variable definition see Appendix.

where w_{ij} is the element of the weights matrix that refers to the *Kreise* i and j and μ is the mean. (Cliff and Ord, 1973) This is a global measure of spatial autocorrelation, informing us about the extent to which a variable in a *Kreis* is surrounded by similar values of that variable.[6] Table 1 shows the Moran's *I* statistic for spatial weights matrices of different order.

Table 1: Moran's *I* statistic for the relationship between change in unemployment and change in Nazi-vote, September 1930 - July 1932

order of contiguity	*I*	Mean	Z-value	Prob
first	.181	-.002	6.269	.000
second	.123	-.002	6.416	.000
third	.086	-.002	5.377	.000
fourth	.038	-.002	2.596	.005

Table 1 demonstrates that *Kreise* with a positive relationship between the increase in unemployment and the NSDAP-share tended to be surrounded by Kreise in which this relationship was also positive. The reverse holds as well, and the spatial correlation is statistically siginificant (up to contiguity of third order p<0.000).[7] The more *Kreise* lie between a pair of observations the lower *I* becomes, i.e. the relationship between UECHA and NAZICHA gets weaker.

The Moran's *I* statistic measures the global extent of spatial clustering, but it does not locate the centers of the clustering. For this purpouse the G_i-statistic, a local measure of spatial association has been computed for each observation in the dataset.

$$G_i = \frac{\sum_j w_{ij} r_j}{\sum_j r_j} \qquad (3)$$

[6] The significance of this test can be judged by comparing the z-value which for large samples follows a standard normal distribution to its probability in a standard normal table.
[7] The mean of the Moran's *I* statistic is *-1 / n-1*.

It is the ratio of the sum of the values in the locations j neighbouring location i - w_{ij} is again an element of the weights matrix that refers to the observations i and j - to the sum over all values. It indicates the extent to which a *Kreis* with a strong relationship between the increase in unemployment and the Nazi-vote (either positive or negative) is surrounded by similar values.[8] It therefore can be used to assess the extent to which the global pattern of association is reflected uniformly throughout the data set. (Anselin and Bao, 1996) By plotting the p-values of this statistic on a map it is possible to detect *Kreise* where the unemployment-NSDAP-relationship was particularly strong (either positive or negative), thereby indicating the existence of spatial regimes in the data-set.

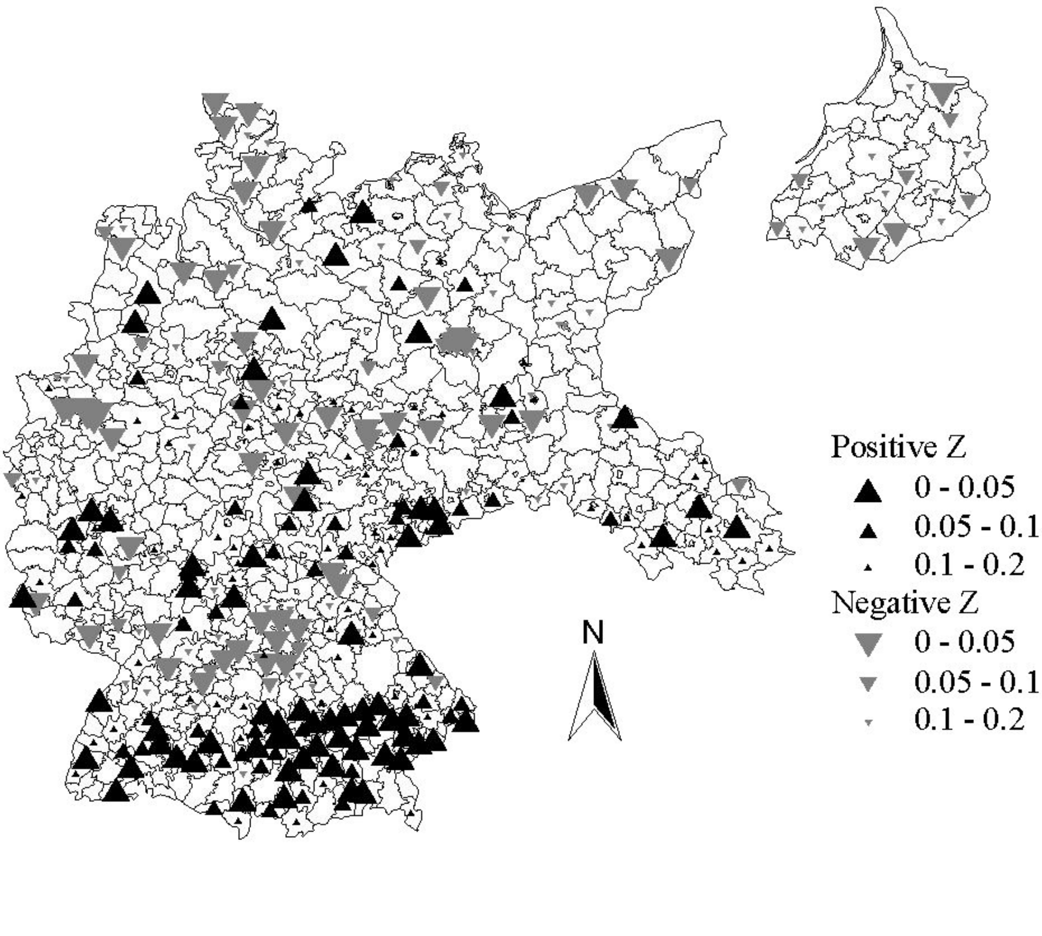

Fig. 1: P-values of the G_i-Statistic for the relationship between change in unemployment and change in Nazi-vote, September 1930 - July 1932

Since unemployment was practically increasing in all *Kreise* (only in four *Kreise* there was a decrease), the upward triangles represent clusters of *Kreise* where a rise in unemployment

[8] The significance of the G_i statistic can be judged in the same way as Moran's *I* by comparing the z-value which for large samples follows a standard normal distribution to its probability in a standard normal table.

fostered the Nazi-vote; downward triangles indicate the reverse. The size of the triangles increases with augmenting statistical significance of spatial clustering. Clearly, *Kreise* with either a positive or a negative relationship between increase in unemployment and change in NSDAP-share are spatially clustered. *Kreise* with a positive relationship are primarily situated in the southern part of Bavaria and Wurttemberg, Saxony and Lower Franconia with additional smaller clusters in Upper Silesia and west of Koblenz. *Kreise* with a negative relationship are clustered in Upper Franconia, Schleswig-Holstein, between Hesse and Thuringia, parts of East-Prussia, the Berlin-area and the Ruhr.

3. Controlling for Spatial Effects

Due to the existence of regional contextual variation and spatial dependence which is evidently indicated by the G_i-statistic and by Moran's I statistic the standard OLS assumption of uncorrelated and homoscedastic error terms is not fulfilled. Therefore, several diagnostics for this kind of misspecification have been included in the following regressions in order to find the best model yielding reliable inferences. Models that show both heteroscedasticity and spatial dependence have been shown to react sensitive to to the presence of heteroscedasticity. This means that even when there are clear indications of spatial dependence the real problem may be lying in heteroscedasticity or vice versa. (Anselin, 1992)

If the null hypothesis of spatial independence has to be rejected, the alternative can take two forms: spatial dependence can either accrue to the dependent variable (spatial lag case) or it may pertain to the error term (spatial error case) in the form of a spatial autoregressive form.[9] (Anselin, 1988) The spatial lag case can be interpreted as spatial contagion or spill-over: the behaviour in one *Kreis* is partially explained by similar behaviour in adjacent *Kreise*. In addition to this substantive interpretation, the spatial error case can be caused by model misspecification which is not restricted to one *Kreis* but spills over across *Kreise*.

The *spatial lag* case can be expressed in a mixed regressive, autoregressive model as follows:

$$y = \rho W y + X\beta + \varepsilon \quad (4)$$

where Wy is a spatially lagged dependent variable[10], and ρ is the spatial autoregressive coefficient.

The *spatial error* case can be formalized as an autoregressive process in the error terms:

$$y = X\beta + \varepsilon \qquad (5a)$$

$$\varepsilon = \lambda W\varepsilon + \zeta \qquad (5b)$$

whith $W\varepsilon$ as spatially lagged error term, λ as the autoregressive coefficient and ζ is a well-behaved (homoscedastic and uncorrelated) error term. In order to decide whether a spatial lag or a spatial error is the reason for spatial dependence a robust Lagrange Multiplier test for either case of misspecification is carried out.[11] The test with the lowest p-value indicates the likely form of misspefication.

To check for the presence of heteroscedasticity which was indicated by the G_i-statistic showing systematic regional differences in the relationship between the increase in unemployment and the change in the NSDAP-share[12] the Breusch-Pagan test is carried out.[13]

4. A National Model of the Nazi-Vote

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[9] Ignoring substantive spatial dependence will result in biased OLS estimates, disregarding error dependence will result in unbiased but inefficient OLS estimates.

[10] A spatial lag is a weighted average of the variable values in *Kreise* adjacent to the observed *Kreis*.

[11] The Lagrange Multiplier error test (LM_{err}) is χ^2 distributed with one degree of freedom and has the form

$$LM_{ERR} = \frac{\{e'We/s^2\}^2}{tr\{W'W + W^2\}}$$

where tr is the trace matrix operator, e is a vector of OLS residuals, $s^2 = e'e / N$ represents the ML estimate for the residual variance and W stands for the spatial weights matrix.

The Lagrange Multiplier lag test (LM_{LAG}) has a χ^2 distribution with one degree of freedom and can be expressed as

$$LM_{LAG} = \frac{\{e'Wy/s^2\}^2}{\{(WXb')MWX\beta / s^2 + tr(W'W + W^2)\}}$$

where tr is the trace matrix operator, $M = I-X(X'X)^{-1}X'$, y is the the vector containing the dependent variable, e is a vector of OLS residuals, W is the spatial weights matrix, $s^2 = e'e / N$ represents the ML estimate for residual variance and β is the vector of OLS estimates. The robust form of the the Lagrange Multiplier test which is applied here is rather robust for non-normality in the error terms. (Anselin, 1992)

[12] Another reason for heterogeneity would be that the observations differ markedly in size. It will be shown though that regional regimes are the main cause for heteroscedasticity.

Based on the findings of previous studies three socio-economic variables were selected for explaining the change in the NSDAP-share of the vote (NAZICHA): the share of Catholics as percentage of total population in 1933 (CATH), the share of farm-owners as percentage of total labour force in 1933 (FARMOWN) and the difference of the unemployment rate between October 1930[14] and July 1932 (UECHA). Table 2 shows the results of a standard ordinary least squares estimation with diagnostics for spatial effects.

Table 2: OLS estimation for change in the NSDAP-share of the vote at the *Kreis*-level, September 1930 - July 1932 and diagnostics

Constant	UECHA	FARMOWN	CATH
.24 (30.53)	-.17 (-3.42)	.17 (11.08)	-.21 (-32.08)

n = 651, t-values in brackets

R2adj .62

Log likelihood 923.0

Multicollinearity Condition Number 7.61

Test	DF	Value	Prob
Breusch-Pagan test for heteroskedasticity	3	34.08	.000
Lagrange Multiplier spatial lag	1	8.47	.004
Lagrange Multiplier spatial error	1	23.43	.000

[13] The Breusch-Pagan test equals one half of the sum of squares in a regression of $(e_i^2 / s_{ML}^2 - 1)$ on a constant and z variables (Anselin, 1992)

[14] Unemployment statistics at the disaggregated level of *Kreise* are unavailable before December 1931. In order to obtain unemployment figures on *Kreis*-level for the election in September 1930, data for December 1931 were extrapolated backwards by splicing *Kreis*-data for December 1931with unemployment data at the regional level of the thirteen state labour exchange offices (Landesarbeitsämter) which are available for October 1930.

Among all variables the catholic share has the highest statistical influence. The reason for the strong adverse impact of this variable on the the NSDAP-share is that the Catholics were a minority concentrated in the south and west of Germany and had their own political parties, the Zentrum and the BVP. The strong commitment of Catholics to the Zentrum and BVP resulted in a stable immunization against the Nazi-movement. (Falter, 1991, 172) It is a consistent result of all studies about the Nazi-voters that confession is such an important determinant, that it modifies or even reverts the influence of all other factors.

The share of farm-owners has a clear positive influence on the change in the NSDAP-share. This reflects that the Nazis' agricultural program calling for impartible inheritance and the resettlement of the disinherited in the East was perceived to redress the grievances of the typical farm owner much more than the agricultural policy of the governement having brought out the *Osthilfe-Programm* in 1931 which was directed at East-German farmers.[15] An additional variable measuring the degree of urbanization was found to be statistically insignificant indicating that the share of farmowners does not indirectly reflect rural-urban-differences in the NSDAP-share.

For the entire sample the increase of unemployment between 1930 and 32 has a negative impact on the NSDAP-share.

The OLS regression exlpains about two-thirds of the variance in the NSDAP-share. The value of the multicollinearity condition number of 7.61 is far below the critical range (20-30) indicating that multicollinearity is not a problem.

The diagnostics for heteroscedasticity and spatial dependence show that the model for the entire sample is spatially misspecified. The Breusch Pagan test points clearly ($p<0.000$) to non-constant variances of the observations, which means that the standard deviations of the coefficients of the standard OLS-model are not correct. This finding indicates a structurally significant regional variation in the relationship between the NSDAP-share and the explanatory variables and it calls for an estimation of the model for more homogenous subsets. The robust Lagrange Multiplier tests for spatial dependence hint at spatial dependence at a very high probability level. The lower p-value of the robust Lagrange Multiplier for the error case (0.0001) in comparison to the lag case (0.004) suggests that for

[15] For the impact of the NSDAP on the agrarian sector see for example Farquharson, 1976.

the entire Reich spatial dependence is probably caused by model specification errors which are not restricted to one *Kreis* rather than by the NSDAP-share having a contagious effect on adjacent *Kreise*.

5. A Spatially Adjusted Model of the Nazi-Vote

Since the diagnostics showed significant values both for spatial dependence and heteroscedasticity, two alternatives were estimated in order to decide which is the major source of misspecification for the above OLS model. To remedy the spatial heterogeneity, an OLS estimation solely for those *Kreise* with a positive relationship between the increase in unemployment and the change of the NSDAP-share was carried out.[16] For removing spatial dependence a spatial error model was estimated for the same subset by means of maximum likelihood (ML).[17] The diagnostic for spatial dependence for the ML estiamation is based on a Likelihood Ratio test.[18] Table 3 shows the regression coefficients and diagnostics for both models.

Table 3a: OLS and Maximum Likelihood estimations for a homogenous subsample

Method	Constant	UECHA	FARMOWN	CATH	λ	Fit
OLS	.20 (17.43)	.34 (4.45)	.06 (3.36)	-.13 (-14.00)	- -	R2adj. .65 Lik 509.51

[16] Since this subset was formed according to the relationship between the NSDAP-share and unemployment and both variables subsequently were employed in a regression for that subset, this procedure would of course be tautologic if the object were to test the influence of unemployment on voting behaviour. Here however, the aim is to build a spatially correctly specified model of the Nazi-vote and therefore this procedure is justified by the gain in structural stability of the parameter estimates. See Flint, 1995 for using a politically/historically motivated delimitation of subsets for estimating regional models of the Nazi-vote.

[17] A maximum likelihood approach is used for the spatial error model because as a result of the simultaneity implied by the spatial nature of the dependence the autoregressive parameter λ in (5b) has to be estimated simultanously with the regression coefficients. Expressing the regression coefficients and error variance as functions of the autoregressive coeffcient λ, an estimate for λ maximizing a likelihood function in which the regressions coefficients and error variance have been substituted by λ can be found by a numeric search. (Anselin, 1992)

[18] For the spatial error model a Likelihood Ratio test on the spatial autoregressive coefficient is carried out which corresponds to twice the difference between the log likelihood in this model and the the log likelihood in the standard regression model with the same independent variables with λ equalling zero. The Likelihood Ratio test is χ^2 distributed with one degree of freedom. (Anselin, 1992)

ML	.20 (17.58)	.33 (4.35)	.06 (3.34)	-.14 (-14.20)	.08 (1.22)	PseudoR2 .66 Lik 510.14

n = 308, t-values (OLS) and z-values (ML) in brackets

Tables 3b: Diagnostics for OLS and Maximum Likelihood estimations

OLS

Test	DF	Value	Prob
Breusch-Pagan test for heteroskedasticity	3	2.25	.522
Lagrange Multiplier spatial lag	1	1.06	.302
Lagrange Multiplier spatial error	1	2.02	.155

Maximum Likelihood

Test	DF	Value	Prob
Breusch-Pagan test for heteroskedasticity	3	2.25	.522
Likelihood Ratio test for spatial dependence	1	1.26	.262

The results for the homogenous sample show marked differences in comparison to the estimations for the entire sample. The positive impact of the share of farmowners on the change in NSDAP-share clearly decreases, implying that in *Kreise* with a positive relationship between change in unemployment and change in NSDAP-share fewer voters with an agricultural background and more voters in the industrial and service sectors chose the

NSDAP. The clearly lower negative influence of the Catholic share in comparison to the entire sample indicates that unemployment increased the probability in predominantely catholic areas to vote for the NSDAP.

The Breusch-Pagan test for the OLS and ML estimates implies that for the chosen subset the null hypothesis of homoscedasicity is accepted with a high probability (p>0.5). The Lagrange Multiplier test for either form of spatial dependence in case of OLS and the Likelihood Ratio test for ML shows that for the homogenous sample no more spatial autocorrelation is present, imlying that for the entire sample not spatial dependence but heteroscedasticity was the major source of misspecification. This is confirmed by the insignificance of the autoregressive coefficient in the maximum likelihood estimation.

6. Preliminary Counterfactual Reflections

Since the economic crisis is unanimously seen as an important prerequisite for the Nazi seizure of power, the question of whether an expansive alternative to Chancellor Brüning's deflationary policy would have prevented the collapse of the Weimar Republic has been controversal discussed.[19] In the course of this debate, the question was raised what policy alternative would have been able to keep the NSDAP-share from rising so dramatically. Because in the analyzed period for the entire Reich there is a negative correlation between unemployment and the Nazi-vote, reducing unemployment - as one classic policy to rise government popularity - seemingly would have had the adverse effect of increasing the NSDAP-share. The finding that there existed clusters of *Kreise* with a positive relationship between unemployment and the Nazi-vote can be used, however to assess the effect of a reduction of unemployment concentrated in these Kreise on the the NSDAP-share for the *entire* Reich. Such a simple counterfactual reflection leaves the question open of course how the government could have achieved such a decrease and what such a policy would have cost. A further simplifying assumption for this calculation is that a decrease of unemployment in *Kreise* with a positive relationship between unemployment and the Nazi-vote would not have affected the other *Kreise*.[20]

[19] See for example Borchardt, 1979 and Holtfrerich, 1982.
[20] It is reasonable to assume that before the background of a general marked rise of unemployment a counterfactual reduction of unemployment in the *Kreise* with a positive relationship between unemployment and

Table 4: The impact of a reduction of unemployment in Kreise with a positive relationship between unemployment and NSDAP-share on the change in NSDAP-share, September 1930 - July 1932, for different samples

	entire sample (n = 651)		*Kreise* with positive relationship between UECHA and NAZICHA (n =308)		rest (n = 342)
	without reduction of unemployment	with reduction of unemployment	without reduction of unemployment	with reduction of unemployment	
absolute increase in Nazi-votes	4.997.293	4.728.131	1.829.145	1.571.376	3.156.755
relative increase in Nazi-share	20.0%	19.0%	17.1%	14.7%	22.7%

For estimating the impact of such a counterfactual policy the estimated parameters of the above OLS model (table 3a) were used to calculate the change in NSDAP-share if instead of augmenting - the absolute increase in the analyzed Kreise amounted to 710.064 - unemployment would have remained constant at the level of October 1930. Under these circumstances the increase in NSDAP-share in the selected *Kreise* (n = 308) would have been 14.7% instead of 17.1% which would have translated into an increase of 19% instead of 20% for the entire Reich (n = 651). For the Reichstag-election of July 1932 a counterfactual policy of reducing the NSDAP-share by keeping unemployment at the 1930-level in the *Kreise* with a positive relationship between unemployment and the Nazi-vote herewith would have reduced the NSDAP-share of all cast votes from 38% to 37%.

This result for the Reichstag-election in July 1932 indicates that a deliberate manipulation of unemployment by the government to reduce the NSDAP-share, would not have had a significant direct effect for preventing the collapse of the Weimar Republic. This finding has to be qualified though considering that a reduction of unemployment would have also decreased the share of the KPD which has not yet been included in the analysis. Therefore, in

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the NSDAP-share would not have resulted in a decrease of unemployment for the rest of the Reich. With regard to the negative correlationship between unemployment and the Nazi-vote for the entire sample this means that the future research the effect of counterfactual policies to decrease the popularity of anti-democratic parties will be investigated for both the NSDAP and the KPD. Moreover, regional income proxies will be calculated and included in the vote-function in order to portray the economic situation of the voters in the final period of the Weimar Republic more comprehensingly.

mentioned counterfactual policy would not have fostered the total NSDAP-share by reducing unemployment in the other *Kreise*.

Abreviations

Parties:

BVP	Bayerische Volkspartei
KPD	Kommunistische Partei Deutschlands
NSDAP	Nationalsozialistische Deutsche Arbeiterpartei

Variables:

CATH	Share of Catholics as percentage of total population in 1933
FARMOWN	Share of farm-owners as percentage of total labour force in 1933
NAZICHA	Change of NSDAP-share between Reichstag-elections in September 1930 and July 1932 in percent
UECHA	Change of unemployment rate between October 1930 and July 1932

μ	Mean of a variable
σ	Standard deviation of a variable

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