Appendices for Depolarization, Repolarization and Redistribributive Ideological Change in Britain, 1983-2016

A   Analysis of Hypotheses Using Multi-Nomial Cross-Lagged Regression Coefficients Only

Why is it not generally possible to make inferences about whether ideology was stable, and whether partisanship change or ideological change was responsble for partisan polarization dynamics from the parameters of multi-nominal cross-lagged panel models without further information?

The issue is straightforwardly that multi-nominal model parameters descibe transition probabilities, but the effect of these transition probabilities generally depends on the population that they operate on. These observations are not controversial, and follow directly from the fact that the transition probabilities describe transition matricies and the operation of transition matrices generally depends on the populations they operate on. For a general discussion of these features see for example Caswell 2001. We illustrate these points in the actual case we are interested in, that is the seven wave aggregate population composition described in their Table 1 (reproduced in Table 1) and the main model described in Table 2 of Evans and Neundorf 2018 (reproduced in Table 2).

A.1   Ambiguity about ideological stability

We begin by looking at the implications of the ideological stability coefficients alone (that is we ignore the impact of partisanship on ideological dynamics) for ideological change. This approach directly compares to Evans and Nuendorf, who also discuss

| | Core values: classification | | |
	Centrist	Leftist	Rightist
Estimated proportion	58	20	22
Observed party identification (PID)			
No/other PID	52	37	28
Labour	27	58	05
Tories	20	05	66

Table 1: Latent values and partisanship (percent) (Source: Evans and Neundorf 2018, Table 1)

DV = Core values	Rightist		Centrist		Leftist	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Intercept	−0.89***	0.27	1.69***	0.22	−0.79*	0.39
Cross-lagged effects						
Conservative (t − 1)	−0.06	0.10	0.17**	0.06	−0.11	0.09
No/oth PID (t − 1)	−0.07	0.08	−0.06	0.05	0.13*	0.06
Labour (t − 1)	0.13	0.11	−0.11	0.06	−0.02	0.08
Stability coefficients						
Rightist (t − 1)	4.47***	0.44	−0.90*	0.41	−3.57***	0.79
Centrist (t − 1)	−0.94**	0.29	1.26***	0.23	−0.32	0.41
Leftist (t − 1)	−3.53***	0.45	−0.36	0.28	3.89***	0.44
DV = Partisanship	Tories		No/oth PID		Labour	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Intercept	−0.61***	0.06	0.72***	0.04	−0.11**	0.04
Cross-lagged effects						
Rightist (t − 1)	0.80***	0.05	−0.11**	0.04	−0.69***	0.06
Centrist (t − 1)	−0.10*	0.04	0.01	0.03	0.09*	0.04
Leftist (t − 1)	−0.71***	0.07	0.11**	0.04	0.60***	0.05
Stability coefficients						
Tories (t − 1)	2.48***	0.06	−0.62***	0.05	−1.86***	0.07
No/oth PID (t − 1)	−0.66***	0.07	1.31***	0.05	−0.65***	0.05
Labour (t − 1)	−1.82***	0.10	−0.69***	0.06	2.51***	0.06

Source: BHPS 1991–2007.
Note: the model includes the effects of socio-demographic covariates on initial partisanship and core values when respondents entered the panel. The coefficients are reported in Appendix 4. Effect coding. * $p < 0.05$; **$p < 0.01$; *** $p < 0.001$

Table 2: Cross-lagged models: estimates of transition probabilities in raw form (Source: Evans and Neundorf 2018, Table 2)

[t]	Ideology [t-1]		
	Centrist	Leftist	Rightist
Centrist	.97	.13	.07
Leftist	.02	.87	.00
Rightist	.01	.00	.93

Table 3: Multi-nominal Cross-Lagged Model Ideological Stability Parameters in Transition Matrix Form. Source: Evans and Neundorf 2018 Table 2

ideological stability using only stability coefficients. Looking at the reduced parameter set has no impact on the conclusions which are drawn in this case (this is not surprising because the impact of partisanship on ideology is not significant in the model, which means that transition probabilities will be very similar for partisans and non-partisans). In this sub-section we show that the multi-nominal cross-lag ideological stability coefficients reported in Evans and Neundorf 2018 by themselve are compatible with ideological stability, ideological depolarization and ideological polarization conclusions. We also show that when analysed in conjection with information about population composition reported in Evans and Neundorf 2018 the model implies ideological depolarization conclusions.

Table 2 gives the stability coefficients in their raw logit form and Table 3 transforms into transition matrix form. The main observation in the paper supporting the conclusion that ideology is very stable is that the raw logit form coefficients are very large (and larger than the equivalent for party identification). The equivalent observation in transition matrix form is that the transition probabilities on the diagonal are close to 1. These transition probabilities are large on the diagonal, but this

operation of this matrix can best be understood by considering that the matrix has an equilibrium (77% centrist, 12 % rightist, 11 % leftist) and dynamics towards that equilibrium are described. Figure 1 shows the ambiguity that this creates about the description of ideological polarization trajectories by plotting trajectories of leftist, centrist and rightist population proportions from a depolarized, equilibrium and polarized initial starting points. From the depolarized starting point we observe ideological polarization (centrism declines whilst rightism and leftism increase), from equilibrium starting points we observe ideological stability (the proportions of centrism, leftism and rightism remain stable) whilst from a polarized starting point we observe ideological depolarization (centrism increases whilst rightism and leftism decrease).

The case of polarizaed initial conditions used in this example is of particular importance because 49% centrist, 25% leftist and 25% rightist, are the initial conditions which generate the seven wave population aggregate ideological composition reported in the paper and reproduced in Table 1 of 58% centrist, 20% leftist and 22% rightist. This shows that the information reported in Evans and Neundorf 2018 implies ideological depolarization, but the same conclusion is immediately accessible by noting that the reported aggregate population composition is more polarized than the matrix equilibrium.
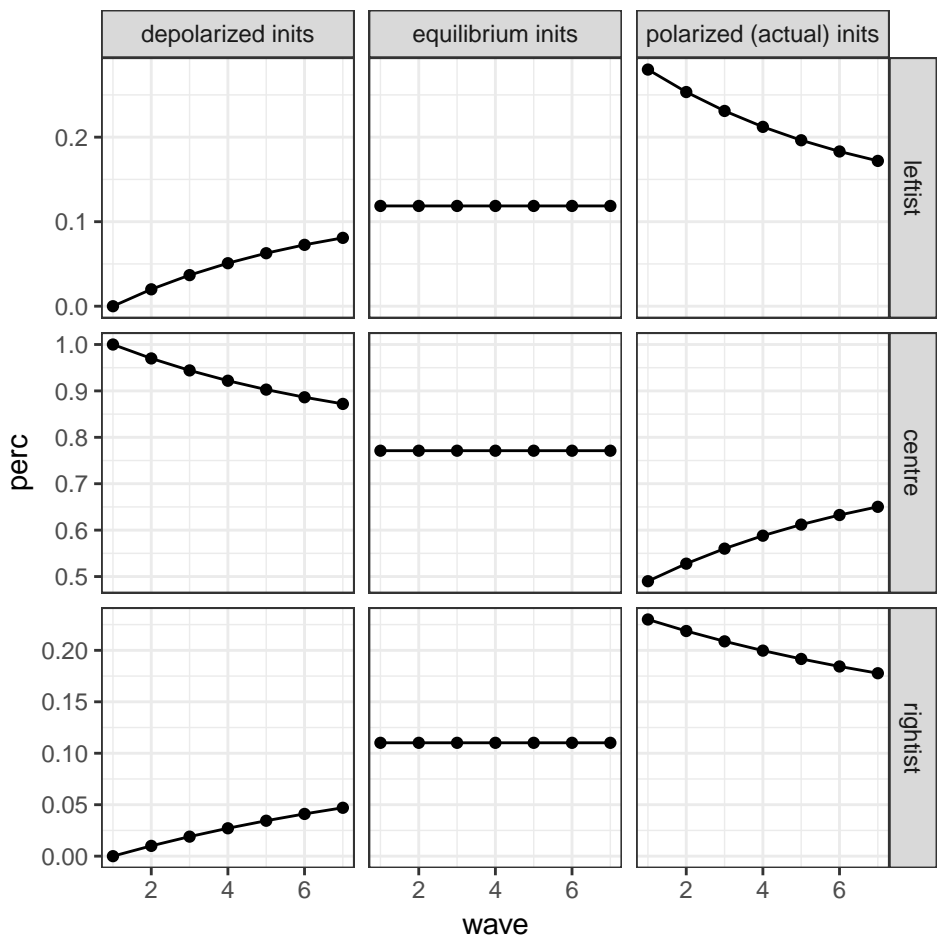
Figure 1: Multi-nominal logit predicted changes in leftist, centrist and rightist population compostion in seven survey waves from different initial conditions. The right-hand three panels show the ideological depolarization that arises from initial conditions that generate the observed seven wave aggregate ideological compostion reported in Evans and Neundorf (2018). The two other columns illustrate that the transition matrix would describe very different patterns if inital conditions were different and so no inferences can be made from model parameters alone.

A.2 Cross-lagged Panel Model Parameters and Further Information Imply Partisan Depolarization Was Caused by Ideological and Not Partisanship Change

We now turn to showing that the cross-lagged model analysis implies that ideological change and not partisanship change was responsible for the observed pattern of partisan depolarization. We also show that inferences about this cannot be made from model parameters alone in isolation from information about initial conditions.

Multi-nominal cross-lagged model the parameters describe two transition matricies, one of these matricies describes ideological dynamics and the other describes partisanship dynamics. The combined dynamics are described by the operation of both these matricies together. In addition to providing an account of both partisanship dynamics and ideological dynamics independently, because it models all 81 transitions between all nine latent states (which are the combinations of three ideological conditions and the three partisanship condition) the model also describes the changing association between ideology and partisanship. The cross-lagged coefficients are informative about the equiliburim state of the transition matrix. The insignificant cross-lagged coefficient of partisanship on ideology indicates that the equilibrium state of ideological transitions alone describes a condition where there is (approximately) zero correlation between ideology and partisanship. The significant cross-lagged coefficient of ideology on partisanship indicates that there is a correlation between ideology and partisanship in the equilibrium resulting from partisanship dynamics alone. If we were starting from an initial condition where ideology and partisanship were uncorrelated, we would conclude that increasing partisan polarization was due entirely to partisanship changes. However, the initial condition in the BHPS is that ideology and partisanship start from a highly correlated position. Therefore the ideological transitions described by the model are leading unambiguously to partisan depolarization, whilst the depolarizing 'desorting' described by partisanship transitions is being at least to some extent counter-acted by a sorting dynamics.

To demonstrate this we plot patterns of partisan polarization measured by correlation between partisanship (where Conservative = 0, No Identification = 0.5, and Labour = 1) and ideology (rightist=0, centrist=.5, leftist=1) all caused by the full transition matrix derrived from the parameters in Table 2 above from different starting points. We plot trends in partisan polarization with both ideological and partisanship transitions in place in grey, the trends caused by partisanship change alone in the left panels in black and the trend caused by ideological change alone in the right hand panels in black. The three rows in Figure 2 are all generated by the same transition matrix operating on different starting populations. In the top case partisanship change alone does not come close to generating the partisan polarization trend, but ideological change does, in the middle case ideological change alone does not come close to generating the partisan polarization trend, but partisanship change does, whilst in the bottom case both dynamics are required to come close to the partisan polarization trend. Taken together this illustrates that the question of whether partisanship change or ideological change explains observed trends in partisan polarization cannot be determined from model parameters (or equivalently transition matricies) alone. However, the top panel is the trajectory which is of substantive interest because it is these initial starting points which generates the seven wave population compostions reported in Table 1. It is thus clear that cross-lagged models show that ideological change is required and partisanship change is not required to explain the observed pattern of partisan depolarizaiton. There is thus agreement between cross-lagged model conclusions and our analysis using fixed partisanship and fixed ideology trends.
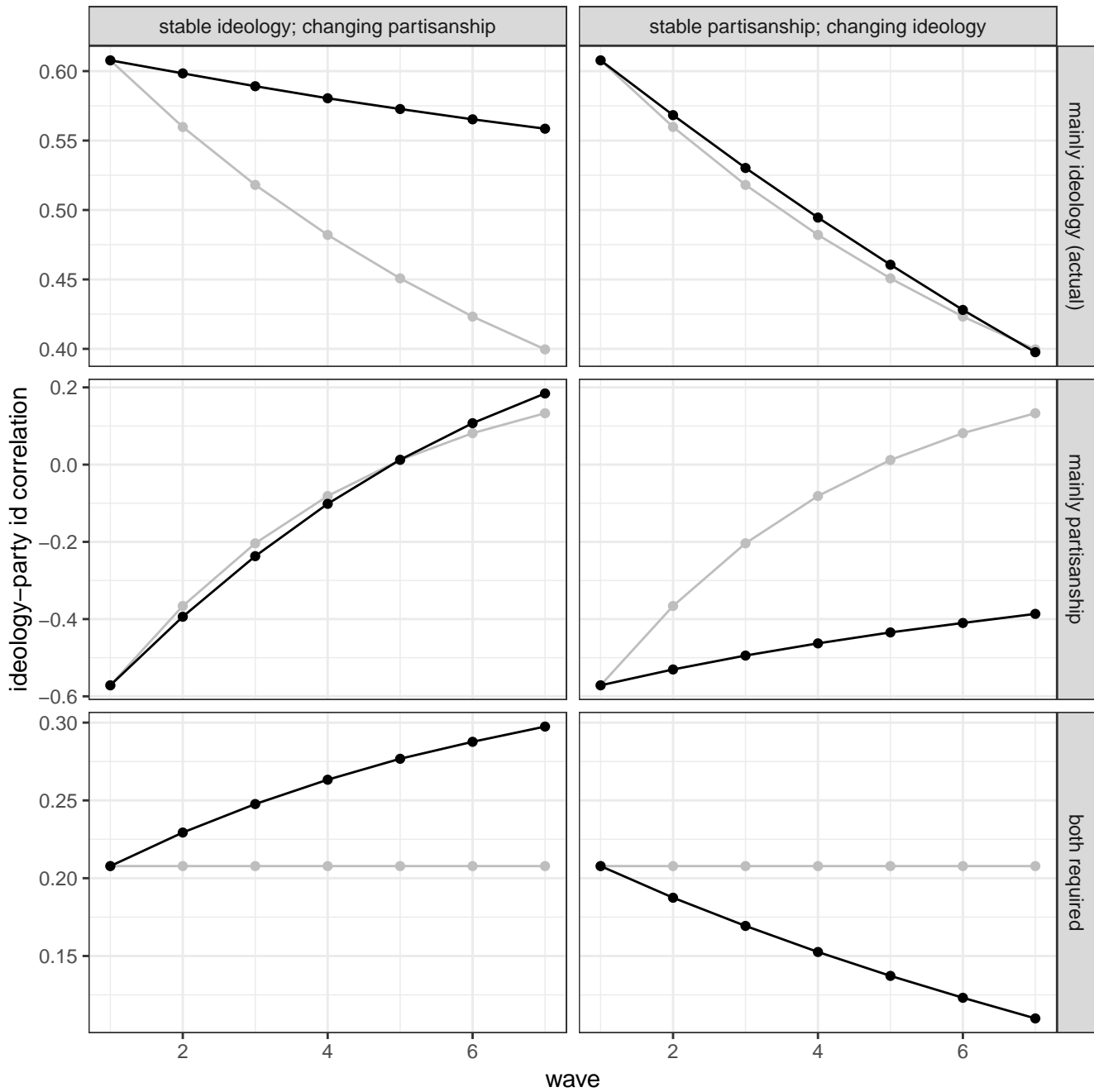
Figure 2: Multi-nominal logit cross-lagged model predicted partisan depolarization (grey) compared to model projected partisan depolarization by changing partisanship alone (black, left panels) and changing ideology alone (black, right panels) from initial conditions generating observed seven wave reported population structure (top panel) and two other starting points. The top panel shows that the model and reported starting positions imply changing ideology is required but changing partisanship is not required to explain partisan depolarization. The other panels show that this conclusion cannot be derrived from the transition matrix alone.

A.3 Cross-Lagged Panel Model Parameters and Further Information Imply Ideological Convergence amongst partisans and initially ideological similar non-partisans alike

We now show that the cross-lagged model parameters imply that partisans and initially ideologically similar non-partisans show similar patterns of ideological convergence. We create the group of initially ideologically similar non-partisans by creating a case for each partisan with the same ideological condition but with a non-partisan ideological state. Figure 3 provides the evidence on the relative depolarization rates. The left panel shows the clearly depolarizing trend of the initial group of partisans and the right hand panel showing depolarizaiton between non-partisans with the same initial ideological distribution as the partisans. The two groups share a virtually identical downward trend so we conclude that that convergence is observed in partisans and initially ideologically similar non-partisans alike.
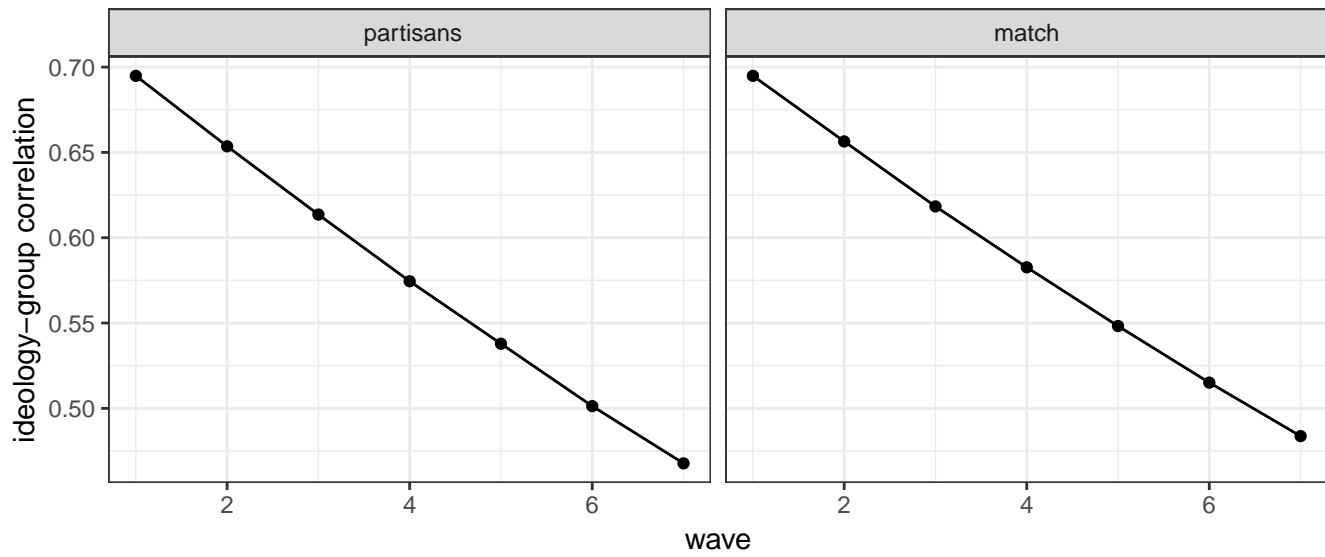
Figure 3: Partisan depolarization (fixed groups) and matched (fixed groups) depolarization

B   Redistributive Questions Used in the Analysis

Survey	Name	Question	Response type	Number waves
BSAS scale	rich	There is one law for the rich and one for the poor	5-point agree disagree	29
BSAS scale	wealth	Ordinary working people do not get their fair share of the nation's wealth	5-point agree disagree	27
BSAS scale	redist	Government should redistribute income from the better off to those who are less well off	5-point agree disagree	28
BSAS scale	boss.exploit	Management will always try to get the better of employees if it gets the chance	5-point agree disagree	29
BSAS scale	big.busns	Big Business benefits owners at the expense of workers	5-point agree disagree	28
BSAS	dole	Are benefits for unemployed people too low and cause hardship or too high, discouraging them from finding jobs?	binary agree disagree	29
BSAS	more.welf	Government should spend more on welfare benefits for the poor even if it leads to higher taxes	5-point agree disagree	26
BSAS	unemp.job	Around here most unemployed people could get a job if they wanted one	5-point agree disagree	26
BSAS	welf..feet	If welfare benefits weren't so generous, people would learn to stand on their own two feet	5-point agree disagree	26
BSAS	welf.dam.lives	Cutting welfare benefits would damage too many people's lives	5-point agree disagree	17
BSAS	soc.help	Many people who get social security don't really deserve any help	5-point agree disagree	26
BSAS	dole.fidl	Most people on the dole are fiddling in one way or another	5-point agree disagree	26
BSAS	income.gap	Would you say the gap between those with high incomes and those with low incomes is too large, about right or too small?	3 choices	27
BSAS	tax.spend	Should government reduce taxes and spend less on health, education and social benefits OR keep taxes and spending the on these services the same OR increase taxes and spend more on health, education and social benefits	3 choices	32
BSAS	proudwlf	The creation of the welfare state is one of Britain's proudest achievements	5-point agree disagree	17
BSAS	fail.clm	Do you agree that large numbers of people who are eligible for benefits these days fail to claim them	binary agree disagree	20
BSAS	welf.helpn	The welfare state encourages people to stop helping themselves	5-point agree disagree	29
BHPS	fairshare	Ordinary people get a fair share of the nation's wealth	5-point agree disagree	7
BHPS	onelaw	The is one law for the rich and one for the poor	5-point agree disagree	7
BHPS	privateent	Private enterprise is the best way to solve Britain's economic problems	5-point agree disagree	7
BHPS	gvtprovjob	It is the government's responsibility to provide a job for everyone who wants one	5-point agree disagree	7
BHPS	strngtu	Strong trade unions are needed to protect the working conditions and wages of employees	5-point agree disagree	7
BHPS	stateown	Major public services ought to be in state ownership	5-point agree disagree	7
BES	redist	Some people feel that government should make much greater efforts to make people's incomes more equal. Other people feel that government should be less concerned about how equal people's incomes are. And other people have views in-between. Which view comes closest to your own?	11-point self-placement	4
BES	natlize	Some people feel that government should nationalize many more private companies. Other people feel that government should sell off many more nationalised industries. And other people have views somewhere in-between. Which view comes closest to your own?	11-point self-placement	4
BES	infunemp	Some people feel that getting people back to work should be the government's top priority. Other people feel that keeping prices down should be the government's top priority. And other people have views somewhere in-between. Which view comes closest to your own?	11-point self-placement	4
BES	taxspend	Some people feel that government should put up taxes a lot and spend much more on health and social services. Other people feel that government should cut taxes a lot and spend much less on health and social services. And other people have views somewhere in-between. Which view comes closest to your own?	11-point self-placement	4

Table 4: Redistributive Attitude Questions in the British Social Attitudes Survey, the British Household Panel Survey and the British Election Study

C Additional Evidence on Ideological Polarization

	Proportion of extreme responses in redistributive attitudes				
		1983-2007			2007-2016
	All Surveys	BSA	BHPS	BES	BSA
Intercept	0.24 (0.02)	0.21 (0.01)	0.17 (0.02)	0.45 (0.06)	0.04 (0.01)
Time (decades)	-0.04 (0.01)	-0.04 (0.01)	-0.03 (0.01)	-0.05 (0.04)	0.04 (0.01)
Residual SD:					
Intercepts	0.12	0.05	0.05	0.11	0.02
Trends	0.02	0.02	0.02	0.06	0.02
Data	0.03	0.03	0.02	0.06	0.01
N	275	217	42	16	130
Groups	23	13	6	4	13

Table 5: Results of Multi-Level Models With Dependent Variable as proportion of Extreme Responses in Redistributive Attitudes in Period 1983-2007. Models show results across all three surveys and in each survey independently.

Figure 4 shows the proportion of extreme redistributive attitudes in each survey wave relating to each of the twenty-three attitudes with more than three response categories and models are summarized in Table 5. The overall negative trend in extreme values across all three surveys in the first period is summarized in the regression with the significant trend of -.04 (SE: .01) per decade. Significant average negative trends are also found when analyzing the subset of attitudes from just the BSAS and the BHPS, the trend in the BES data alone is also negative but not statistically significant. In the period after 2007 the pattern is reversed, with increasing proportion of redistributive attitudes falling into the extreme categories with an average positive per decade trend of +.04 (SE: .01).

	$\rho = $ attitude $\times$ attitude				
		1983-2007			2007-2016
	All Surveys	BSA	BHPS	BES	BSA
Intercept	0.25 (0.01)	0.24 (0.01)	0.34 (0.01)	0.31 (0.02)	0.07 (0.02)
Time (decades)	-0.03 (0.00)	-0.03 (0.00)	-0.08 (0.01)	-0.02 (0.02)	0.05 (0.00)
Residual SD:					
Intercepts	0.15	0.16	0.05	0.03	0.19
Trends	0.03	0.03	0.02	0.03	0.03
Data	0.03	0.03	0.03	0.04	0.03
N	2140	2011	105	24	1219
Groups	157	136	15	6	136

Table 6: Results of Multi-Level Models With Dependent Variable as Correlation between Two Redistributive Attitudes in Period 1983-2007. Models show results across all three surveys and in each survey independently.

Figure 5 and Table 7 show the results relating to attitude constraint. Because constraint involves the relationship between two attitude pairs there are 157 attitude pairs to consider. This is too many to display, so for reasons of space figure 5 is restricted to all 15 attitude pairs from the BHPS, all 6 pairs from the BES the all 10 attitude pairs from the BSAS redistributive scale (thus omitting 126 pairs from the BSAS). All 157 attitude pairs are included in the model used to generate the trend lines, and in the regression table. During the period of partisan depolarization there is a statistically significant decline in attitude constraint across the 157 attitude pairs of -.03 (SE: .00) per decade. Significant negative trends are also found when analyzing the subset of attitudes from just the BSAS and the BHPS, the trend in the BES data alone is also negative but not statistically significant.
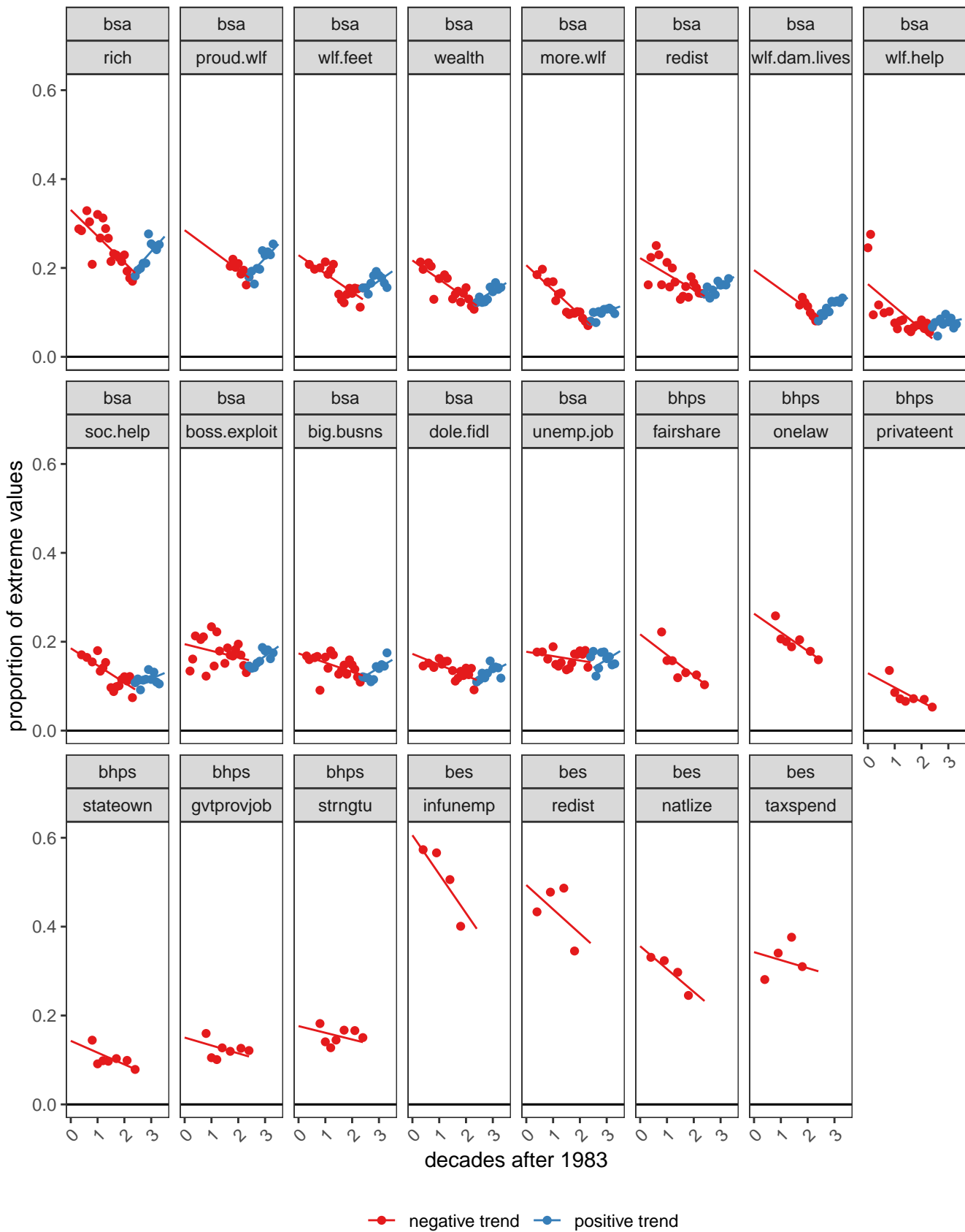
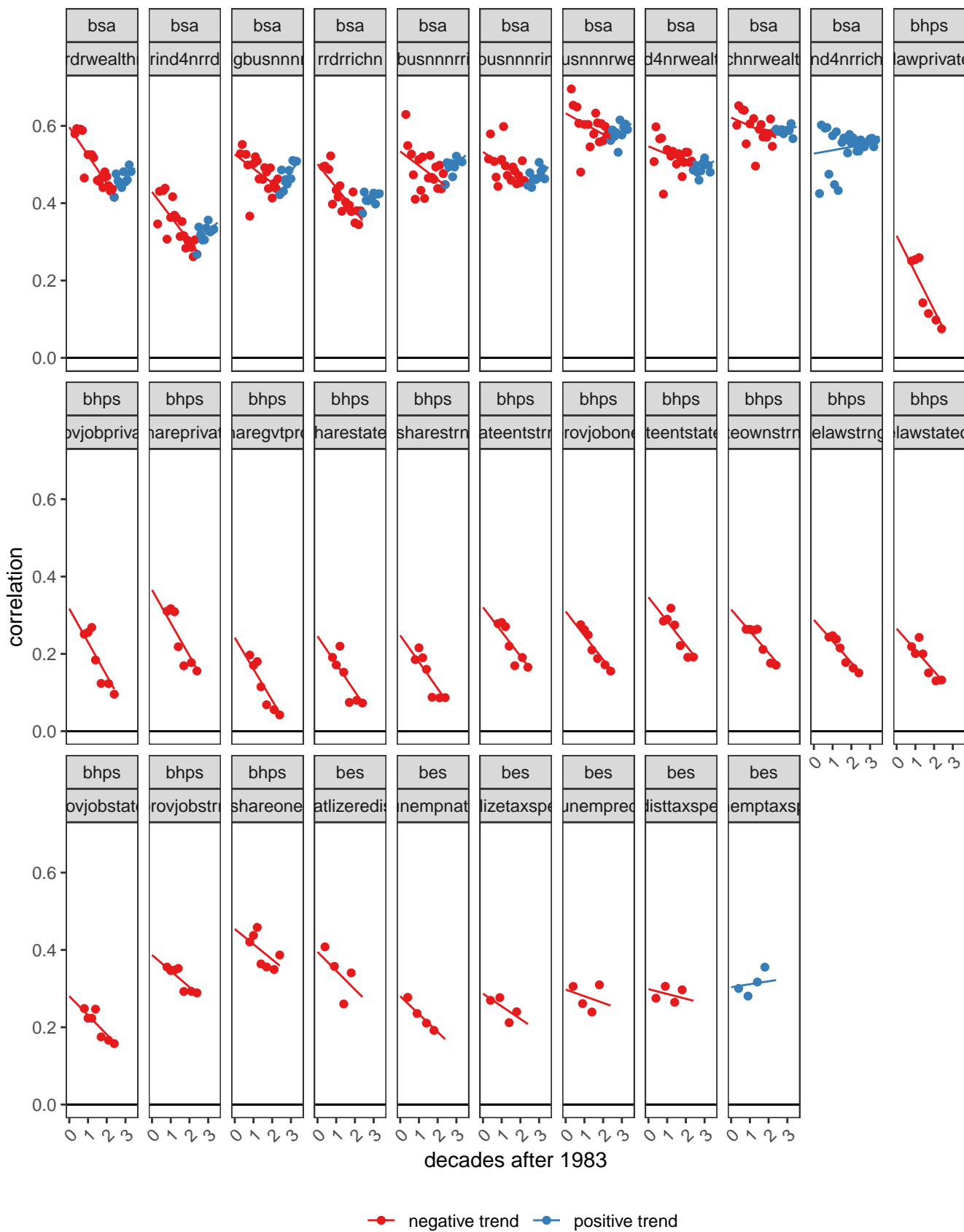Figure 4: Trends in Proportion of Extreme Views

Figure 5: Trends in Constraint Between Redistributive Attitudes 1983-2007 and 2007-2016

In the period of party repolarization after 2007 the reverse pattern is found with a significant positive trend of redistributive attitude constraint of magnitude +.05 (SE: .00).

| | σ of redistributive attitudes | | | | |
| | 1983-2007 | | | | 2007-2016 |
	All Surveys	BSA	BHPS	BES	BSA
Intercept	0.21 (0.01)	0.22 (0.00)	0.22 (0.00)	0.16 (0.01)	0.18 (0.00)
Time (decades)	-0.01 (0.00)	-0.01 (0.00)	-0.01 (0.00)	-0.01 (0.00)	0.01 (0.00)
Residual SD:					
Intercepts	0.03	0.02	0.01	0.01	0.01
Trends	0.01	0.01	0.01	0.01	0.00
Data	0.01	0.01	0.01	0.00	0.01
N	275	217	42	16	130
Groups	23	13	6	4	13

Table 7: Results of Multi-Level Models With Dependent Variable as Standard Deviation of Redistributive Attitudes in Period 1983-2007. Models show results across all three surveys and in each survey independently.

The models for standard deviations broken down by survey are summarized in Table 8. In the data overall we find that there is a statistically significant decline in the average standard deviation of attitudes, the magnitude of which is -.01 per decade (SE: .00) during the period of party depolarization. A significant negative trend is found in all three of the surveys independently. In the period of party polarization after 2007 this trend is reversed with a statistically significant trend of +.01 (SE: .00).

D   Additional Evidence on Partisans and Non-partisan ideological trends

D.1   Trends in Ideological Depolarization amongst Partisans and Non-Partisans

| | σ | | extremism | | constraint | |
	non-partisan	partisans	non-partisan	partisans	non-partisan	partisans
Intercept	0.19 (0.01)	0.21 (0.00)	0.12 (0.02)	0.15 (0.01)	0.14 (0.02)	0.40 (0.01)
Time (decades)	-0.01 (0.00)	-0.01 (0.00)	-0.02 (0.01)	-0.03 (0.01)	0.01 (0.01)	-0.09 (0.01)
Residual SD:						
Intercepts	0.01	0.01	0.05	0.04	0.06	0.04
Trends	0.01	0.01	0.02	0.02	0.02	0.02
Data	0.01	0.01	0.02	0.02	0.04	0.03
N	42	42	42	42	105	105
Groups	6	6	6	6	15	15

Table 8: Results of Multi-Level Model With dependent variable as standard deviation, extremism and constraint of responses amongst the fixed group of partisans (partisan in initial wave) and the fixed group of non-partisans (non-partisan in initial wave) in the BHPS 1991-2007.

Table 9 shows the trends in attitude standard deviations, attitude extremism and attitude constraint in the BHPS for the fixed group of inital wave Labour and Conservative partisans and the fixed group of initial wave non-partisans. The analysis shows that there is a signficant reduction in standard deviations, attitude extremism and attitude constraint amongst the partisans, and a significant reduction in standard deviations and extremism but not constraint amongst the non-partisans. The central elements of ideological convergence can be observed amongst the non-partisans, so we reject the idea that ideological

convergence is restricted to partisans whilst the ideology of non-partisans remains unchanged, but ideological convergence is much more pronounced amongst the partisans. Although signs of convergence are much clearer amongst partisans than non-partisans, analysis does not establish the elite cue claim that ideological convergence is because of partisanship. Cleaer patterns of convergence could occur because of the large initial differences, particularly on constraint, between partisans (intercept: .40 SE: .01) and non-partisans (intercept: .14, SE: .01). To address this question directly it is necessary to examine the ideological trajectory of initially ideologically similar partisans and non-partisans, that is the logic of the analysis in section 7.

D.2   Balance Tests on Ideological Matching

case	variable	non.partisan	partisan	difference	sig.diff
Labour and Labour Matches	fairshare	4.02	4.00	-0.02	
Conservative and Conservative Matches	fairshare	3.15	3.16	0.01	
Labour and Labour Matches	onelaw	4.07	4.08	0.00	
Conservative and Conservative Matches	onelaw	3.26	3.23	-0.03	
Labour and Labour Matches	privateent	3.61	3.59	-0.03	
Conservative and Conservative Matches	privateent	2.50	2.54	0.05	
Labour and Labour Matches	stateown	3.43	3.46	0.02	
Conservative and Conservative Matches	stateown	2.58	2.56	-0.02	
Labour and Labour Matches	gvtprovjob	3.53	3.47	-0.05	
Conservative and Conservative Matches	gvtprovjob	2.59	2.49	-0.10	*
Labour and Labour Matches	strngtu	3.78	3.82	0.04	
Conservative and Conservative Matches	strngtu	2.56	2.56	0.01	

Table 9: Balance check on ideological matching. Significance indicated by Mann-Whitney Test. * indicates p<.05.

References

Caswell, Hal (2001). *Matrix Population Models*. Sinauer Associates.

Evans, G. and Anja Neundorf (2018). "Core Political Values and the Long-Term Shaping of Partisanship in the British Electorate".
   In: *British Journal of Political Science*.