Forecasting Referendums: A Structural Model Predicting Adoption and Support in Irish Plebiscites 1968-2024

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APPENDIXES

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APPENDIX A SUMMARY STATISTICS, CORRELATIONS, AND PLOTS

A1) TABLES

Table A1 Summary Statistics for variables included in models explaining the percentage share of the Yes Vote in Irish referendums 1968-2024

Variables	N	M	S/d	Min	Max
Percentage share of the Yes Vote in Referendum	42	62.02	18.321	26.1	98.8
GDP Growth $^{t-6\ months}$	42	1.21	1.816	-2.5	6.3
Referendum issue: Electoral reform	42	0.12	0.327	0	1
Bi-partisan support for the referendum	42	0.52	0.505	0	1
Main governing party performance in prev. general election	42	38.79	7.072	22.1	50.6
Referendum issue: Good Friday Agreement	42	0.02	0.154	0	1
Decade: 1970s	42	0.12	0.328	0	1
CPI $^{t-6\ months}$	42	3.85	3.096	-2.6	12.4
Referendum issue: EU	42	0.21	0.415	0	1
Referendum opinion poll data available	42	0.50	0.506	0	1
Referendum Vote Intention Incl. DK t_{1-2}	21	51.93	15.479	29.0	88.0
Referendum Vote Intention Excl. DK t_{1-2}	21	66.27	16.493	16.5	96.6

Table A2 List of Irish referendums 1968-2024 detailing topic, year, the vote share yes, and whether the proposal was accepted or rejected

Obs ID	Referendum Topic:	Year	Vote Share Yes	Proposal Accepted/Rejected
1002	Constituency boundaries	1968	39.2	REJECT
1003	Change from STV to FPTP	1968	39.2	REJECT
1004	Join the EEC	1972	83.1	PASS
1005	Voting Age	1972	84.6	PASS
1006	Church: Remove Special Position of RCC	1972	84.4	PASS
1007	Adoption: To ensure Adoption Board was acting constitutionally	1979	99.0	PASS
1008	Allow Seanad representation of universities	1979	92.4	PASS
1009	Abortion: Constitutional recognition to the life of the unborn	1983	66.9	PASS
1010	Allowing citizens of other countries to vote in Dail elections	1984	75.4	PASS
1011	Divorce: To remove constitutional ban on divorce	1986	36.5	REJECT
1012	Single European Act	1987	69.9	PASS
1013	Maastricht Treaty	1992	69.1	PASS
1014	Abortion: Right to travel for procedure outside Ireland	1992	62.4	PASS
1015	Abortion: Right to procedure in case of risk of life to mother but not suicide	1992	34.6	REJECT
1016	Abortion: Right to access information	1992	59.9	PASS
1017	Divorce: To remove constitutional ban on divorce	1995	50.3	PASS
1018	Bail laws	1996	74.8	PASS
1019	Disclosure of cabinet discussions in certain circumstances	1997	52.6	PASS
1020	Amsterdam Treaty	1998	61.7	PASS
1021	Good Friday Agreement: Articles 2 and 3	1998	94.4	PASS
1022	Local Government elections to take place every five years	1999	77.8	PASS
1023	Ratify the International Criminal Court	2001	64.2	PASS
1024	Constitutional ban on death penalty even in national emergency	2001	62.1	PASS
1025	Nice Treaty I	2001	46.1	REJECT
1026	Abortion: Exclude risk of suicide as reason for procedure	2002	49.6	REJECT
1027	Nice Treaty II	2002	62.9	PASS
1028	Citizenship: Abolished constitutional right us soli to Irish citizenship	2004	79.2	PASS
1029	Lisbon Treaty I	2008	46.6	REJECT

1030	Lisbon Treaty II	2009	67.1	PASS
1031	Judicial salaries	2011	79.7	PASS
1032	Reverse a 2002 Supreme Court ruling preventing Oireachtas enquiries from making findings	2011	46.7	REJECT
1033	European Fiscal Compact	2012	60.3	PASS
1034	Children's Rights	2012	58.0	PASS
1035	Abolish Seanad	2013	48.3	REJECT
1036	Establishment of the Court of Appeal	2013	65.2	PASS
1037	Civil Marriage Equality	2015	62.1	PASS
1038	Lowering age of President eligibility from 35 to 21	2015	26.9	REJECT
1039	Abortion: Allowing procedure	2018	66.4	PASS
1040	Blasphemy	2018	64.9	PASS
1041	Divorce: Remove the requirement of a period of separation before proceedings	2019	82.1	PASS
1042	Family: Recognition of Family to include durable relationships	2024	32.3	REJECT
1043	Family: Remove References to Womens' Position in Home & insert new provisions on care	2024	26.1	REJECT

A2) FIGURES & PLOTS

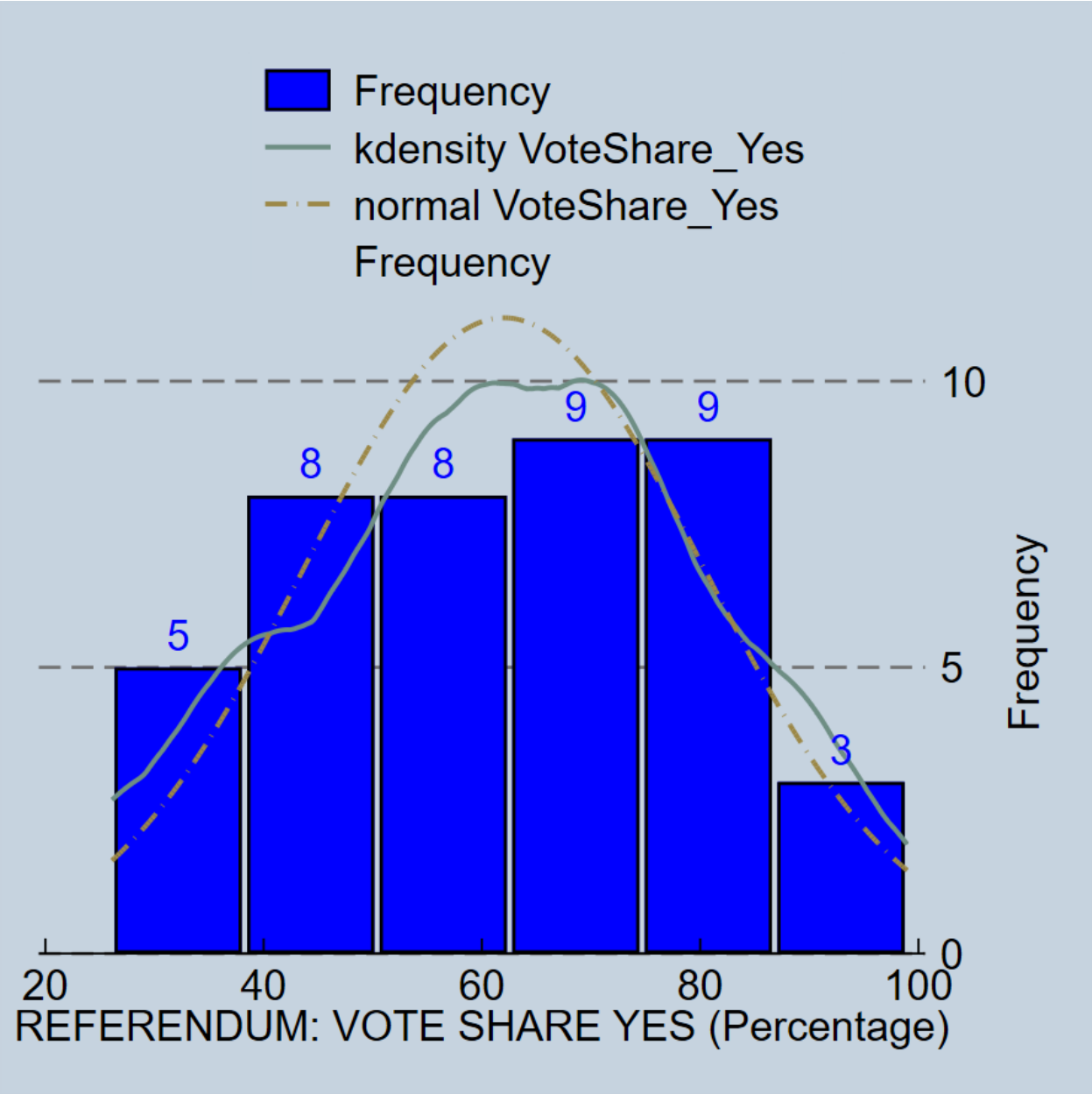

Figure A1 Histogram of **percentage share of the Yes Vote in Irish referendums 1968-2024** illustrating the normal distribution and kernel density curves.

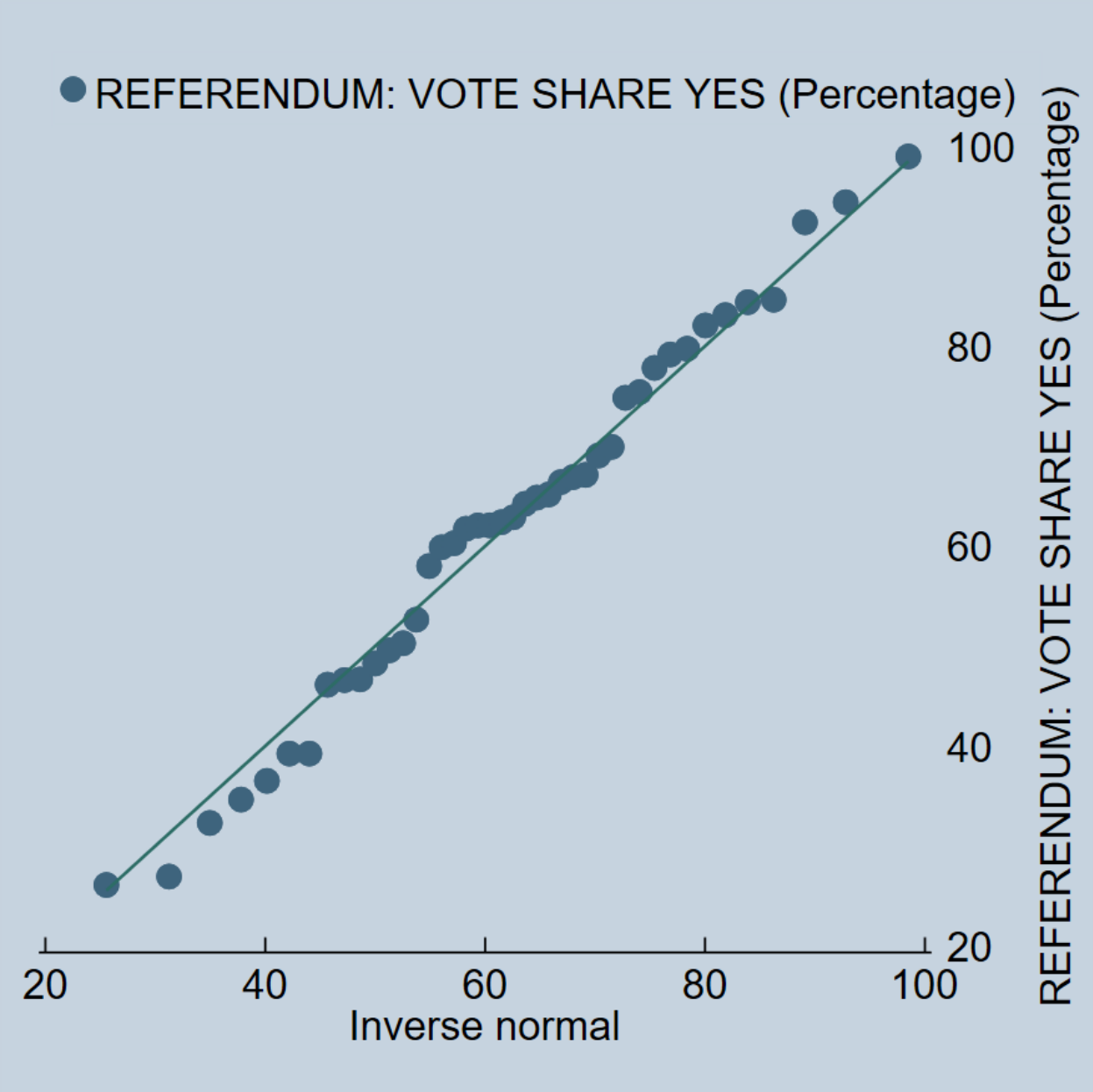

Figure A2 QQ plot of **percentage share of the Yes Vote in Irish referendums 1968-2024** to assess whether a dataset follows a normal distribution. *Note:* When most observations fall on the 45-degree line, it indicates the data closely follows the theoretical normal distribution.

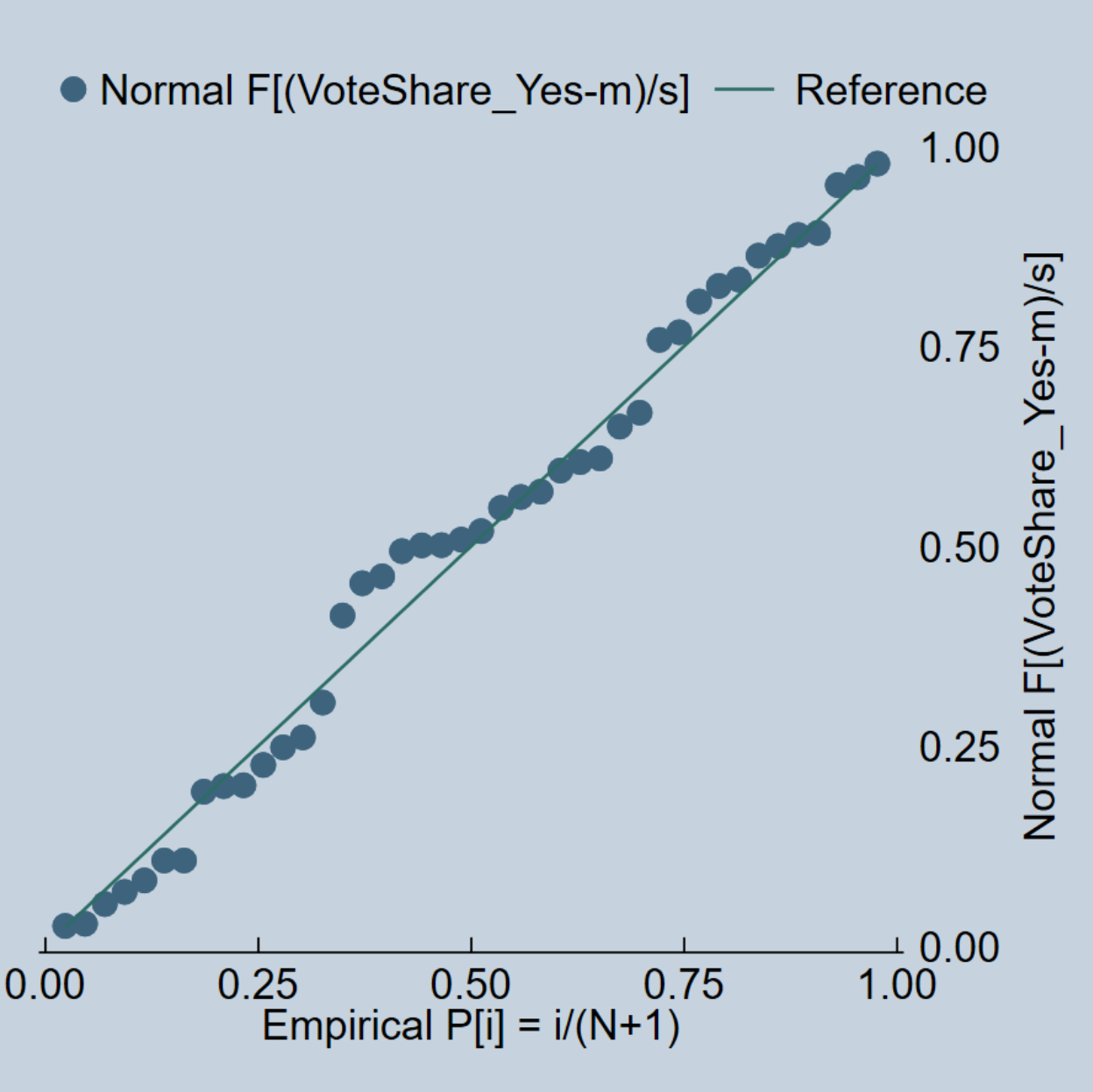

Figure A3 Pnorm plot of **percentage share of the Yes Vote in Irish referendums 1968-2024** to assess whether a dataset follows a normal distribution.

APPENDIX B VARIABLE OPERATIONALIZATIONS

Percentage share of the Yes Vote in Referendum

This variable (continuous) measures the percentage vote share in Irish referendums from 1968 to 2024.

GDP Growth $^{t-6\ months}$

This variable (continuous) measures the GDP growth per quarter at t-6 months from the referendum.

Referendum issue: Electoral Reform

This dichotomous variable measures whether the referendum concerns electoral or institutional reform. All referendums classified as electoral reform referendums are coded 1; all others are coded 0. The referendums classified as electoral reform referendums are:

Obs ID	Topic	Year
1002	Constituency boundaries	1968
1003	Change from STV to FPTP	1968
1005	Voting Age	1972
1035	Abolish Seanad	2013
1038	Lowering age of President eligibility from 35 to 21	2015

Referendum issue: Bi-partisan support

This dichotomous variable measures whether the referendum was supported by opposition parties as well as the government. All referendums classified as having bi-partisan support are coded 1; all others are coded 0.

Main governing party performance in prev. general election

This variable (continuous) measures the support (first preference vote share) of the main government party in the previous general election. The main governing party is denoted by the majority share of the party's cabinet seats in the government.

Referendum issue: Good Friday Agreement

This dichotomous variable classifies the 1998 Good Friday Agreement Referendums on Articles 2 and 3 of the Irish Constitution. This referendum is coded 1 and all others are coded 0.

Decade: 1970s

This dichotomous variable classifies whether a referendum was held in the 1970s or not. All referendums held in the 1970s are coded 1, and all others are coded 0.

CPI $^{t-6\ months}$

This variable (continuous) measures the Consumer Price Index (CPI) per quarter at t-6 months from the referendum.

Referendum issue: EU

This dichotomous variable measures whether the referendum concerns the European Union (EU). All referendums classified as EU referendums are coded 1; all others are coded 0. The referendums classified as electoral reform referendums are:

Obs ID	Topic	Year
1004	Join the EEC	1972
1012	Single European Act	1987
1013	Maastricht Treaty	1992
1020	Amsterdam Treaty	1998
1025	Nice Treaty I	2001
1027	Nice Treaty II	2002
1029	Lisbon Treaty I	2008
1030	Lisbon Treaty II	2009
1033	European Fiscal Compact	2012

Referendum opinion poll data available

This dichotomous variable classifies whether opinion poll data is available for the referendum in question. Referendums where they are available are coded 1 and all others are coded 0.

Referendum Vote Intention Incl. DK t_{1-2}

This variable (continuous) classifies the Yes Vote Share intention, including the proportion of respondents expressing Don't Know as measured by opinion polls in either T-1 or T-2 months from the referendum. All other referendums are classified as Not Applicable.

Referendum Vote Intention Incl. DK t_{1-2}

This variable (continuous) classifies the Yes Vote Share intention, excluding the proportion of respondents expressing Don't Know as measured by opinion polls in either T-1 or T-2 months from the referendum. All other referendums are classified as Not Applicable.

APPENDIX C SUPPLEMENTARY ANALYSIS

C1) FIGURES

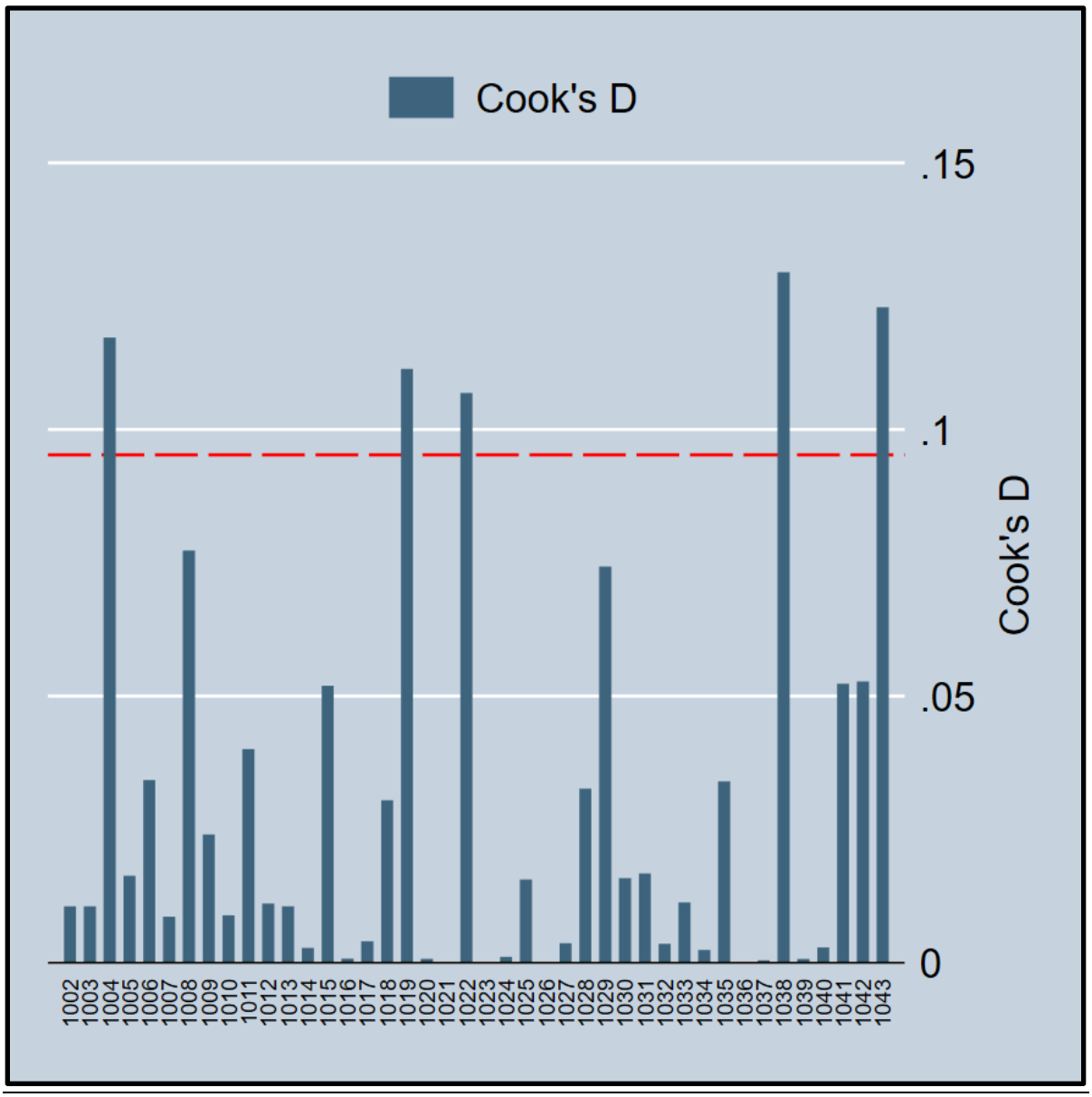

Figure C1 Cooks Distance classification of potential influential observations. *Note:* Critical value of 0.095 based on the critical value of 4 and N observations of 42.

C2) TABLES

Table C1 Variable Inflation Factor (VIF) of independent variables included in model.

Independent variables	VIF	1/VIF
Decade: 1970s	1.84	0.543
Main governing party performance in prev. general election	1.78	0.561
Bi-partisan support for referendum	1.69	0.593
Referendum issue: Good Friday Agreement	1.07	0.934
Referendum issue: Electoral reform	1.04	0.959
GDP Growth $^{t\text{-}6\ months}$	1.01	0.992

Note: Variance Inflation Factors (VIFs) were calculated to assess multicollinearity. VIF values below 5 indicate low to moderate multicollinearity, which does not compromise the stability of the regression coefficients. The mean VIF is 1.41, indicating multicollinearity is not a significant issue in the model.

Table C2 Political-Economy Model: OLS regression models exploring the percentage share of the Yes Vote in Irish referendums 1968-2024 excluding Good Friday Agreement observation.

Dependent variable: Percentage share of the Yes Vote in Irish Referendums 1968-2024				
Independent Variables	Unstandardized Coefficients B	S/e	Standardized coefficients β	S/d of x
GDP Growth $^{t\text{-}6\ months}$	2.896*	(1.051)	5.321	1.837
Referendum issue: Electoral reform	-18.961**	(4.889)	-6.282	0.331
Bi-partisan support for referendum	9.585+	(5.003)	4.581	0.506
Main governing party vote share in prev. general election	0.633+	(0.329)	4.935	7.797
Decade: 1970s	21.259**	(7.878)	7.043	0.331
Constant	28.005+	(13.925)		
Model summary				
N referendums	41			
Adjusted R^2	0.53			
DW Statistic	2.27			
Root Mean Square Error (RMSE)	12.2			

Note: Standard errors in parentheses. S/d of x = standard deviation of standardized coefficient. + = p<0.1; * = p<0.05; ** = p<0.01; *** = p<0.001. Root mean squared error (RMSE) is also called standard error of estimate (SEE). Durbin-Watson statistic is a measure of autocorrelation in the time-series data.

Table C3 Political-Economy Model: OLS regression models exploring the percentage share of the Yes Vote in Irish referendums 1968-2024 excluding potential influential observations (Observation ID 1004, 1019, 1038, and 1043).

Dependent variable: Percentage share of the Yes Vote in Irish Referendums 1968-2024				
Independent variables	Unstandardized Coefficients B	S/e	Standardized coefficients B	S/d of x
GDP Growth $^{t\text{-}6\ months}$	2.681*	(1.095)	4.590	1.712
Referendum issue: Electoral reform	-15.230*	(6.111)	-4.737	0.311
Bi-partisan support for referendum	13.858**	(4.745)	7.012	0.506
Main governing party vote share in prev. general election	0.567+	(0.327)	4.265	7.524
Referendum issue: Good Friday Agreement	23.263+	(7.998)	3.774	0.162
Decade: 1970s	19.371*	(7.998)	6.025	0.311
Constant	30.435*	(13.994)		
Model summary				
N referendums	38			
Adjusted R^2	0.58			
DW Statistic	2.33			
Root Mean Square Error (RMSE)	11.0			

Note: Standard errors in parentheses. S/d of x = standard deviation of standardized coefficient. + = p<0.1; * = p<0.05; ** = p<0.01; *** = p<0.001. Root mean squared error (RMSE) is also called standard error of estimate (SEE). Durbin-Watson statistic is a measure of autocorrelation in the time-series data.

Table C4 Political-Economy Model: OLS regression models exploring the percentage share of the Yes Vote in Irish referendums 1968-2024 including Consumer Price Index (CPI) T-6 months from referendum instead of GDP t-6 months

Dependent variable: Percentage share of the Yes Vote in Irish Referendums 1968-2024				
Independent variables	Unstandardized Coefficients B	S/e	Standardized coefficients β	S/d of x
CPI $^{t\text{-}6\ months}$	-1.342	(0.793)	-4.158	3.096
Referendum issue: Electoral reform	-20.401**	(6.352)	-6.687	0.328
Bi-partisan support for referendum	8.864+	(5.177)	4.481	0.505
Main governing party vote share in prev. general election	0.727+	(0.361)	5.598	7.702
Referendum issue: Good Friday Agreement	26.166+	(13.611)	4.038	0.154
Decade: 1970s	27.019**	(8.797)	8.856	0.328
Constant	32.946*	(14.592)		
Model summary				
N referendums	42			
Adjusted R^2	0.50			
DW Statistic	2.25			
Root Mean Square Error (RMSE)	12.9			

Note: Standard errors in parentheses. S/d of x = standard deviation of standardized coefficient. + = p<0.1; * = p<0.05; ** = p<0.01; *** = p<0.001. . Root mean squared error (RMSE) is also called standard error of estimate (SEE). Durbin-Watson statistic is a measure of autocorrelation in the time-series data.

Table C5 Political-Economy Model: OLS regression models exploring the percentage share of the Yes Vote in Irish referendums 1968-2024 including European Union referendums as an additional covariate

Dependent variable: Percentage share of the Yes Vote in Irish Referendums 1968-2024				
Independent variables	Unstandardized Coefficients B	S/e	Standardized coefficients β	S/d of x
GDP Growth $^{t\text{-}6\ months}$	2.922**	(1.061)	5.306	1.186
Referendum issue: Electoral reform	-17.819**	(6.228)	-5.841	0.328
Bi-partisan support for referendum	11.108+	(5.463)	5.615	0.505
Main governing party vote share in prev. general election	0.635+	(0.333)	4.891	7.702
Referendum issue: Good Friday Agreement	27.047**	(12.864)	4.173	0.154
Decade: 1970s	20.368**	(8.062)	6.676	0.328
Referendum issue: EU	3.511	(5.420)	1.458	0.415
Constant	26.311+	(14.283)		
Model summary				
N referendums	42			
Adjusted R^2	0.55			
DW Statistic	2.36			
Root Mean Square Error (RMSE)	12.3			

Note: Standard errors in parentheses. S/d of x = standard deviation of standardized coefficient. + = p<0.1; * = p<0.05; ** = p<0.01; *** = p<0.001. Root mean squared error (RMSE) is also called standard error of estimate (SEE). Durbin-Watson statistic is a measure of autocorrelation in the time-series data.

Table C6 OLS regression models exploring the percentage share of the Yes Vote in Irish referendums 1968-2024 using opinion polls at T1-2 before referendum

Dependent variable: Percentage share of the Yes Vote in Irish Referendums 1968-2024				
	Unstandardized Coefficients B	S/e	Unstandardized Coefficients B	S/e
Referendum Vote Intention Incl. DK t_{1-2}	0.609**	(0.192)	-	
Referendum Vote Intention Excl. DK t_{1-2}	-		0.491**	(0.219)
Constant	25.042*	(10.410)	24.137*	(15.202)
Model summary				
N referendums	21		21	
Adjusted R^2	0.31		0.22	
DW Statistic	1.21		1.64	
Root Mean Square Error (RMSE)	13.3		14.2	
Within-sample diagnostics				
$\bar{x}$ MAE	10.2		11.4	
Largest Absolute Prediction Error (% Share Yes Vote)	25.4		28.4	
Correctly calls Referendum Outcome	62%		62%	

Note: Standard errors in parentheses. S/d of x = standard deviation of standardized coefficient. + = p<0.1; * = p<0.05; ** = p<0.01; *** = p<0.001. . Root mean squared error (RMSE) is also called standard error of estimate (SEE). Durbin-Watson statistic is a measure of autocorrelation in the time-series data.

Table C7 Political-Economy Model: OLS regression models exploring the percentage share of the Yes in Irish referendums 1968-2024 on opinion poll-only available data

	Unstandardized Coefficients B	S/e	Standardized coefficients B	S/d of x
GDP Growth $^{t\text{-}6\ months}$	4.115**	(1.051)	9.334	2.268
Referendum issue: Electoral reform	-20.345**	(8.401)	-6.120	0.301
Bi-partisan support for referendum	8.785	(6.092)	4.496	0.512
Main governing party performance in prev. general election	0.914+	(0.441)	6.486	7.099
Constant	17.486	(17.167)		
Model summary				
N referendums	21			
Adjusted R^2	0.51			
DW Statistic	2.20			
Root Mean Square Error (RMSE)	11.2			
Within-sample diagnostics				
$\bar{x}$ MAE	8.1			
Largest Absolute Prediction Error (% Share Yes Vote)	24.1			
Correctly calls Referendum Outcome	72%			

Note: Standard errors are in parentheses. S/d of x = standard deviation of standardized coefficient. += p<0.1; * = p<0.05; ** = p<0.01; *** =p<0.001. Root mean squared error (RMSE) is also called standard error of estimate (SEE). Durbin-Watson statistic is a measure of autocorrelation in the time-series data.