

Religiosity, Ideology and Voting

1. Introduction

The main purpose of this note is to describe the results of a two-stage least squares analysis of the two following relationships: the effect of religiosity on ideology and the effect of ideology on voting behaviour.

The outline of this note is as follows:

In Section two we give a summary of the technique of instrumental variables and the two-stage least squares estimator that we will use for the analyses. In particular, we aim to give an intuitive explanation as to why this method is preferred to ordinary least squares in our case. In Section 3 and Section 4 the results of our analyses will be presented. Section 5 summarizes.

2. Instrumental Variables

Consider the problem of estimating the parameters of a linear model that relates a dependent variable y to a set of regressor variables x_1 to x_k and a disturbance term ε :

$$y_i = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \dots + \beta_k x_{ki} + \varepsilon_i$$

Under standard conditions, the parameters β_0 to β_k can be efficiently estimated by the method of Ordinary Least Squares. In our case, the standard conditions are not all satisfied.

In particular, the condition that all regressors x are all uncorrelated with the disturbance ε is not satisfied. To see this, consider the regression model with y =Ideology, x_1 =Religiosity and some other regressors that serve as control variables. In that regression model, the disturbance term ε is supposed to capture everything related to the dependent variable that is unobserved, i.e. that is not captured by any of the regressors in the model. In this particular case, ε could include unobserved characteristics related to ideology that are not included in the model by means of Religiosity and other regressors. It could be that subjects with a high score on Ideology tend to have a high score on an unobserved variable like “the propensity to self-guidance by means of moral standards.” If we label the latter variable w (and keeping in mind that w is unobserved, hence part of the error ε), we can argue that the covariance between w and the regressor Religiosity is non-zero ($\text{cov}(w, x_1) \neq 0$). As w is part of the disturbance ε , this implies that the covariance between ε and the regressor is non-zero ($\text{cov}(\varepsilon, x_1) \neq 0$), a violation of one of the standard assumption

for OLS to be a valid procedure. Under these circumstances OLS estimates are biased and inconsistent and another estimation procedure is needed.

The estimation procedure that was devised to solve the problem of endogenous regressors (i.e. regressors that are correlated with the disturbance) is the method of Instrumental Variables (IV). In short, it exploits the availability of another variable (a so-called Instrumental Variable or IV) to obtain a consistent estimate of the parameters. This Instrumental Variable (that we label z) is a variable that has to satisfy two conditions:

1. It is uncorrelated with the disturbance ($\text{cov}(z, \varepsilon) = 0$)
2. It is correlated with the endogenous regressor ($\text{cov}(z, x_1) \neq 0$)

Using the observations that we have on the variables y , x_1 and z in the formula of the IV-estimator, we obtain the so-called IV-estimates of the parameters. If there are several endogenous regressors, we will need to find a suitable IV for each endogenous regressor.

Instrumental Variables are not always easily available for the problem at hand. However, there are cases where even more than one IV available is available for one or more of the endogenous regressors. In that case, a generalization of IV called Two-Stage-Least-Squares (2SLS) can be used. It can be shown that it is statistically efficient to include all instrumental variables available in the estimation process. Using 2SLS instead of IV in that case would in principle reduce the variance of our estimates and hence increase precision.

3. Impact of Religiosity on Ideology

For these IV and 2SLS regressions we used the subgroup mature==0.

In the first case, we instrument the variable religious, which is suspected to be endogenous, with the variable attendance. The IV-estimation results are:

```

IV (2SLS) regression with robust standard errors      Number of obs =   4936
              F( 7, 4928) =  59.64
              Prob > F      =  0.0000
              R-squared     =    .
              Root MSE     =  2.3519
    
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-----+-----
              |               Robust
leftright |   Coef.  Std. Err.   t   P>|t|   [95% Conf. Interval]
-----+-----
religious | -3.021852 .2263548  -13.35  0.000  -3.465608 -2.578095
age      |  .032618  .0079638    4.10  0.000   .0170054 .0482306
class    |  .0124774 .0475356    0.26  0.793  -.0807136 .1056683
educagefin~d | .0418156 .0171498    2.44  0.015   .0081943 .0754369
proudnat | -0.1723573 .0552461   -3.12  0.002  -.2806643 -.0640503
    
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incomcat | .0954493 .0194161 4.92 0.000 .0573852 .1335135
cohort | .205295 .0774229 2.65 0.008 .0535116 .3570784
_cons | 6.254152 .764548 8.18 0.000 4.755297 7.753007

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If we instrument the endogenous variable with two instrumental variables, attendance and God, the “SLS procedure gives:

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IV (2SLS) regression with robust standard errors    Number of obs = 4936
                                                    F( 7, 4928) = 71.82
                                                    Prob > F    = 0.0000
                                                    R-squared   = 0.0362
                                                    Root MSE   = 1.9993

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-----+-----
|               Robust
| leftright |   Coef.  Std. Err.   t  P>|t|  [95% Conf. Interval]
-----+-----
religious | -1.715986 .1388874 -12.36 0.000 -1.988267 -1.443705
age | .0289814 .0067404 4.30 0.000 .0157671 .0421956
class | .0269817 .0403266 0.67 0.503 -.0520764 .1060399
educagefin~d | .037336 .0146206 2.55 0.011 .0086731 .0659989
proudnat | -.2851793 .0449801 -6.34 0.000 -.3733604 -.1969981
incomcat | .0937474 .0161219 5.81 0.000 .0621413 .1253535
cohort | .1052469 .0649024 1.62 0.105 -.0219907 .2324845
_cons | 5.382771 .642483 8.38 0.000 4.123218 6.642324
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If we use three instruments for religious, attendance God and afterlife,, we obtain:

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IV (2SLS) regression with robust standard errors    Number of obs = 4936
                                                    F( 7, 4928) = 72.26
                                                    Prob > F    = 0.0000
                                                    R-squared   = 0.0383
                                                    Root MSE   = 1.9971

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-----+-----
|               Robust
| leftright |   Coef.  Std. Err.   t  P>|t|  [95% Conf. Interval]
-----+-----
religious | -1.703859 .1371025 -12.43 0.000 -1.972641 -1.435077
age | .0289476 .0067313 4.30 0.000 .0157512 .042144
class | .0271164 .0402748 0.67 0.501 -.0518402 .106073
educagefin~d | .0372944 .0146053 2.55 0.011 .0086615 .0659274
proudnat | -.2862269 .0448406 -6.38 0.000 -.3741345 -.1983194
incomcat | .0937316 .0160988 5.82 0.000 .0621708 .1252923
cohort | .1043178 .0647879 1.61 0.107 -.0226952 .2313309
_cons | 5.374679 .6418469 8.37 0.000 4.116373 6.632985
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If we use God, afterlife and soul:

IV (2SLS) regression with robust standard errors Number of obs = 4420
 F(7, 4412) = 67.51
 Prob > F = 0.0000
 R-squared = 0.0458
 Root MSE = 1.9983

	Robust					
leftright	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
religious	-1.713414	.1320648	-12.97	0.000	-1.972327	-1.454501
age	.0263031	.0071368	3.69	0.000	.0123113	.0402948
class	.013447	.0420216	0.32	0.749	-.0689364	.0958304
educagefin~d	.0324054	.0155476	2.08	0.037	.0019243	.0628865
proudnat	-.2586669	.0474302	-5.45	0.000	-.3516539	-.1656798
incomcat	.0937867	.0168733	5.56	0.000	.0607066	.1268669
cohort	.0710014	.0687341	1.03	0.302	-.0637519	.2057548
_cons	5.760153	.6760716	8.52	0.000	4.434714	7.085593

From the results it seems that an estimate of around -1.7 for religiosity seems rather robust to the choice of instrumental variables used. These regressions seem therefore to give most credible results.

3. Impact of Ideology on Voting

The dependent variable is vote, a categorical variable. Hence, least squares procedures are not possible in this case. We model the categorical dependent variable by means of a multinomial logit model which we estimate by maximum likelihood. Group 1, the largest group, is the reference group. In a sense, the estimation results for each group represents differences with the reference group. The estimation results are as follows¹:

Multinomial logistic regression Number of obs = 6401
 LR chi2(168) = 1789.18
 Prob > chi2 = 0.0000
 Log likelihood = -12732.208 Pseudo R2 = 0.0656

	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
2						
leftright	-.1318709	.0186098	-7.09	0.000	-.1683454	-.0953963
religious	.1296063	.060819	2.13	0.033	.0104033	.2488094
age	-.0145048	.0086405	-1.68	0.093	-.0314399	.0024302
class	.1854329	.0323343	5.73	0.000	.1220588	.248807
educagefin~d	.000517	.0161094	0.03	0.974	-.0310569	.0320909

¹ no weights were used in this analysis.

proudnat		.1770176	.0522921	3.39	0.001	.0745269	.2795083
incomcat		.0351985	.0151409	2.32	0.020	.0055228	.0648741
cohort		-.1262979	.0828459	-1.52	0.127	-.2886729	.036077
_cons		.4007068	.8401333	0.48	0.633	-1.245924	2.047338

3							
leftright		-.1348326	.0191558	-7.04	0.000	-.1723773	-.097288
religious		.1488916	.0614894	2.42	0.015	.0283746	.2694087
age		.0265548	.0093019	2.85	0.004	.0083235	.0447862
class		-.0023892	.0319176	-0.07	0.940	-.0649465	.0601681
educagefin~d		.0059456	.0163826	0.36	0.717	-.0261637	.0380548
proudnat		.2462495	.0527009	4.67	0.000	.1429576	.3495414
incomcat		-.0287594	.0149277	-1.93	0.054	-.058017	.0004983
cohort		.3050967	.089783	3.40	0.001	.1291252	.4810681
_cons		-2.859344	.8992334	-3.18	0.001	-4.621809	-1.096879

4							
leftright		-.11163	.0263775	-4.23	0.000	-.163329	-.059931
religious		.1193468	.083111	1.44	0.151	-.0435478	.2822414
age		-.0405436	.0120421	-3.37	0.001	-.0641458	-.0169415
class		.1248103	.0446189	2.80	0.005	.0373589	.2122617
educagefin~d		.0836354	.0226677	3.69	0.000	.0392076	.1280632
proudnat		.2778399	.0701182	3.96	0.000	.1404108	.4152691
incomcat		-.0744833	.0206558	-3.61	0.000	-.114968	-.0339987
cohort		-.3144816	.1149971	-2.73	0.006	-.5398718	-.0890913
_cons		.4139417	1.177964	0.35	0.725	-1.894826	2.722709

5							
leftright		-.2881627	.0298532	-9.65	0.000	-.3466738	-.2296516
religious		-.1835064	.0847817	-2.16	0.030	-.3496755	-.0173372
age		.0046998	.0139427	0.34	0.736	-.0226275	.0320271
class		-.1026957	.0476219	-2.16	0.031	-.1960329	-.0093585
educagefin~d		.1229613	.0251836	4.88	0.000	.0736024	.1723201
proudnat		.5604327	.0703718	7.96	0.000	.4225065	.6983589
incomcat		-.0551619	.0212098	-2.60	0.009	-.0967323	-.0135915
cohort		.2307753	.1340291	1.72	0.085	-.031917	.4934676
_cons		-3.805921	1.355521	-2.81	0.005	-6.462693	-1.149149

6							
leftright		-.2850947	.0392582	-7.26	0.000	-.3620393	-.2081501
religious		.3361811	.1117279	3.01	0.003	.1171985	.5551637
age		.0568631	.0202028	2.81	0.005	.0172663	.0964599
class		-.3248631	.0665532	-4.88	0.000	-.455305	-.1944211
educagefin~d		.1266385	.0337903	3.75	0.000	.0604108	.1928662
proudnat		.2394706	.0969023	2.47	0.013	.0495455	.4293957
incomcat		-.041472	.0272148	-1.52	0.128	-.094812	.0118681
cohort		.6041173	.1965961	3.07	0.002	.218796	.9894387
_cons		-8.414113	1.946165	-4.32	0.000	-12.22853	-4.599701

7							

leftright		-.0519718	.0408145	-1.27	0.203	-.1319668	.0280231
religious		-.0771808	.1279069	-0.60	0.546	-.3278738	.1735122
age		.0832249	.0224642	3.70	0.000	.0391958	.127254
class		-.2606079	.0673261	-3.87	0.000	-.3925646	-.1286512
educagefin~d		.0765841	.0349301	2.19	0.028	.0081224	.1450458
proudnat		.3680886	.105456	3.49	0.000	.1613986	.5747786
incomcat		-.1265487	.029141	-4.34	0.000	-.183664	-.0694334
cohort		.896096	.2197537	4.08	0.000	.4653867	1.326805
_cons		-10.5855	2.157815	-4.91	0.000	-14.81474	-6.35626

8							
leftright		-.1855035	.0443977	-4.18	0.000	-.2725214	-.0984857
religious		.0272412	.129639	0.21	0.834	-.2268465	.281329
age		.0404968	.0247793	1.63	0.102	-.0080697	.0890634
class		-.6560149	.0829612	-7.91	0.000	-.8186159	-.493414
educagefin~d		.0048125	.0370061	0.13	0.897	-.0677181	.0773431
proudnat		.4024458	.1110747	3.62	0.000	.1847433	.6201483
incomcat		-.0905346	.0305638	-2.96	0.003	-.1504386	-.0306307
cohort		.5841128	.2404249	2.43	0.015	.1128886	1.055337
_cons		-5.42992	2.348565	-2.31	0.021	-10.03302	-.8268168

9							
leftright		.1045994	.0502411	2.08	0.037	.0061287	.20307
religious		-.2011247	.1731433	-1.16	0.245	-.5404793	.1382299
age		-.1070727	.023001	-4.66	0.000	-.1521539	-.0619916
class		-.2586494	.089438	-2.89	0.004	-.4339447	-.0833541
educagefin~d		.1538873	.0433934	3.55	0.000	.0688377	.2389369
proudnat		.2686922	.1345985	2.00	0.046	.0048839	.5325005
incomcat		-.1768384	.0385373	-4.59	0.000	-.25237	-.1013067
cohort		-1.138754	.2210171	-5.15	0.000	-1.57194	-.7055686
_cons		4.457013	2.284708	1.95	0.051	-.0209329	8.934959

10							
leftright		-.1251316	.0590939	-2.12	0.034	-.2409536	-.0093097
religious		.4447078	.1680405	2.65	0.008	.1153545	.7740611
age		.1216555	.0315192	3.86	0.000	.059879	.183432
class		.3986305	.0964678	4.13	0.000	.2095571	.587704
educagefin~d		.2323895	.0530819	4.38	0.000	.1283508	.3364282
proudnat		.6824697	.1335647	5.11	0.000	.4206878	.9442516
incomcat		-.0313448	.0429165	-0.73	0.465	-.1154597	.05277
cohort		1.328571	.3073827	4.32	0.000	.7261122	1.93103
_cons		-20.55022	3.059984	-6.72	0.000	-26.54768	-14.55276

11							
leftright		-.0232154	.0502658	-0.46	0.644	-.1217345	.0753037
religious		-.0646272	.1507175	-0.43	0.668	-.360028	.2307737
age		.0661589	.0262257	2.52	0.012	.0147576	.1175602
class		.0903147	.0820026	1.10	0.271	-.0704074	.2510367
educagefin~d		.186819	.0464345	4.02	0.000	.095809	.2778291
proudnat		.6999928	.118375	5.91	0.000	.467982	.9320037

incomcat		-.0534179	.0364597	-1.47	0.143	-.1248775	.0180418
cohort		.8192609	.2543264	3.22	0.001	.3207904	1.317731
_cons		-13.75579	2.554829	-5.38	0.000	-18.76317	-8.748422

12							
leftright		-.189233	.1738829	-1.09	0.276	-.5300373	.1515713
religious		-.2571219	.5113079	-0.50	0.615	-1.259267	.7450232
age		.0081434	.0884135	0.09	0.927	-.1651438	.1814307
class		-.4352159	.2810108	-1.55	0.121	-.985987	.1155552
educagefin~d		.0227729	.1388126	0.16	0.870	-.2492949	.2948407
proudnat		.5919975	.4108227	1.44	0.150	-.2132002	1.397195
incomcat		-.2485904	.1280859	-1.94	0.052	-.4996342	.0024535
cohort		.1413419	.8623297	0.16	0.870	-1.548793	1.831477
_cons		-4.525661	8.483253	-0.53	0.594	-21.15253	12.10121

13							
leftright		.0779872	.125913	0.62	0.536	-.1687977	.3247722
religious		-1.083255	.4120275	-2.63	0.009	-1.890814	-.2756964
age		-.0241429	.0751113	-0.32	0.748	-.1713582	.1230725
class		-1.286931	.3282478	-3.92	0.000	-1.930285	-.643577
educagefin~d		-.235356	.1001519	-2.35	0.019	-.4316502	-.0390619
proudnat		.3181683	.3429606	0.93	0.354	-.354022	.9903587
incomcat		-.1436229	.0897647	-1.60	0.110	-.3195586	.0323127
cohort		.0902992	.7279804	0.12	0.901	-1.336516	1.517115
_cons		2.341327	7.00229	0.33	0.738	-11.38291	16.06556

14							
leftright		.3766127	.0665034	5.66	0.000	.2462684	.5069569
religious		-.8321443	.2087798	-3.99	0.000	-1.241345	-.4229435
age		.0471012	.0413941	1.14	0.255	-.0340296	.1282321
class		-29.86076	438389.1	-0.00	1.000	-859256.7	859197
educagefin~d		-.0482037	.0485146	-0.99	0.320	-.1432906	.0468832
proudnat		.390076	.1634782	2.39	0.017	.0696646	.7104874
incomcat		-.0722524	.0421983	-1.71	0.087	-.1549595	.0104546
cohort		.4699	.4088413	1.15	0.250	-.3314143	1.271214
_cons		-6.829581	3.867592	-1.77	0.077	-14.40992	.7507598

15							
leftright		-.1807132	.232143	-0.78	0.436	-.6357051	.2742787
religious		-.5221482	.7182012	-0.73	0.467	-1.929797	.8855003
age		-.0169739	.1309382	-0.13	0.897	-.2736081	.2396603
class		-.9519476	.4640922	-2.05	0.040	-1.861552	-.0423437
educagefin~d		-.1709415	.183105	-0.93	0.351	-.5298206	.1879376
proudnat		-.0244458	.6662369	-0.04	0.971	-1.330246	1.281355
incomcat		-.1231165	.1660374	-0.74	0.458	-.4485438	.2023109
cohort		.0890025	1.26299	0.07	0.944	-2.386412	2.564417
_cons		.8709688	12.20362	0.07	0.943	-23.04769	24.78963

16							
leftright		.2272005	.0736548	3.08	0.002	.0828397	.3715613

religious		-.1447776	.2345208	-0.62	0.537	-.6044299	.3148748
age		.0494261	.0436072	1.13	0.257	-.0360425	.1348947
class		-1.140199	.1749556	-6.52	0.000	-1.483105	-.7972921
educagefin~d		-.2179952	.0576666	-3.78	0.000	-.3310197	-.1049708
proudnat		.0690591	.2075824	0.33	0.739	-.337795	.4759131
incomcat		-.0036718	.0510192	-0.07	0.943	-.1036676	.0963239
cohort		.740084	.4255025	1.74	0.082	-.0938856	1.574054
_cons		-5.447827	4.094981	-1.33	0.183	-13.47384	2.578189

17							
leftright		-.2100087	.1279798	-1.64	0.101	-.4608445	.040827
religious		-.3077131	.383636	-0.80	0.422	-1.059626	.4441996
age		.1196363	.0707768	1.69	0.091	-.0190837	.2583563
class		-.1491	.1960484	-0.76	0.447	-.5333479	.2351479
educagefin~d		-.1277999	.1040211	-1.23	0.219	-.3316775	.0760777
proudnat		.6124622	.2998234	2.04	0.041	.0248191	1.200105
incomcat		-.0042702	.0949297	-0.04	0.964	-.1903289	.1817885
cohort		1.346961	.6936633	1.94	0.052	-.0125946	2.706516
_cons		-13.11958	6.728182	-1.95	0.051	-26.30657	.0674181

18							
leftright		-.3024986	.2231204	-1.36	0.175	-.7398065	.1348092
religious		.056785	.6115224	0.09	0.926	-1.141777	1.255347
age		.0029965	.1020543	0.03	0.977	-.1970261	.2030192
class		.1927416	.3494139	0.55	0.581	-.492097	.8775802
educagefin~d		.1162312	.1852864	0.63	0.530	-.2469235	.479386
proudnat		.1864916	.5300981	0.35	0.725	-.8524815	1.225465
incomcat		-.0044108	.1603709	-0.03	0.978	-.318732	.3099103
cohort		.3706137	.9667746	0.38	0.701	-1.52423	2.265457
_cons		-8.929895	9.862815	-0.91	0.365	-28.26066	10.40087

21							
leftright		-.3265764	.173515	-1.88	0.060	-.6666596	.0135068
religious		.1619079	.4276509	0.38	0.705	-.6762725	1.000088
age		-.0825664	.0813477	-1.01	0.310	-.2420049	.0768721
class		-.0638302	.2481267	-0.26	0.797	-.5501495	.4224892
educagefin~d		-.1436681	.1353017	-1.06	0.288	-.4088545	.1215183
proudnat		.5636431	.3620487	1.56	0.120	-.1459594	1.273246
incomcat		-.0981605	.1180103	-0.83	0.406	-.3294564	.1331354
cohort		.2306539	.723411	0.32	0.750	-1.187205	1.648513
_cons		.0181156	7.367192	0.00	0.998	-14.42132	14.45755

23							
leftright		-.1227273	.2219455	-0.55	0.580	-.5577326	.3122779
religious		.3543264	.6091256	0.58	0.561	-.8395378	1.548191
age		.1113414	.1268813	0.88	0.380	-.1373414	.3600242
class		.5613579	.366627	1.53	0.126	-.1572178	1.279934
educagefin~d		.0383543	.179773	0.21	0.831	-.3139943	.3907029
proudnat		.4784418	.5071781	0.94	0.346	-.515609	1.472493
incomcat		-.3082763	.1824038	-1.69	0.091	-.6657811	.0492286

```

    cohort | 1.70111 1.219508 1.39 0.163 -.689081 4.091302
    _cons | -19.94847 11.93553 -1.67 0.095 -43.34168 3.444741
-----+-----
others |
leftright | -.2961265 .0436293 -6.79 0.000 -.3816384 -.2106146
religious | -.0021363 .1272161 -0.02 0.987 -.2514752 .2472026
    age | -.0470045 .0184887 -2.54 0.011 -.0832416 -.0107673
    class | .3429948 .0763728 4.49 0.000 .1933068 .4926828
educagefin~d | .0273561 .0359961 0.76 0.447 -.043195 .0979073
proudnat | .2057231 .1086615 1.89 0.058 -.0072495 .4186957
incomcat | .0332193 .0346671 0.96 0.338 -.0347269 .1011655
    cohort | -.2985425 .1750004 -1.71 0.088 -.641537 .0444519
    _cons | .6549767 1.805758 0.36 0.717 -2.884244 4.194198
-----+-----
would not ~e |
leftright | -.2894675 .0993262 -2.91 0.004 -.4841433 -.0947918
religious | -.0737126 .2539279 -0.29 0.772 -.571402 .4239769
    age | .0769975 .0494533 1.56 0.119 -.0199292 .1739243
    class | .3395098 .1559409 2.18 0.029 .0338711 .6451484
educagefin~d | -.1019182 .0780813 -1.31 0.192 -.2549547 .0511184
proudnat | .810629 .2055461 3.94 0.000 .4077661 1.213492
incomcat | -.1429488 .072874 -1.96 0.050 -.2857792 -.0001185
    cohort | 1.339339 .4761629 2.81 0.005 .4060767 2.272601
    _cons | -11.97226 4.686305 -2.55 0.011 -21.15725 -2.787272
-----+-----

```

(Outcome vote==1 is the comparison group)

For some groups religious is significant, for others not. The interpretation will depend on the semantic meaning of the groupings.

5. Summary

First, we introduced the method of Instrumental Variables and two-stage-least squares and their relevance to the problem at hand. We then reported the analyses on the two estimation problems stated in the first section.