Web Appendix to

"A model for ordinal responses with an application to policy interest rate."

Appendix A: Details of Monte Carlo design

Three vectors of covariates $\mathbf{v_1}$, $\mathbf{v_2}$ and $\mathbf{v_3}$ were drawn once (and held fixed in all simulations) as $\mathbf{v_1} \overset{iid}{\sim} Normal(0,1)+2$, $\mathbf{v_2} \overset{iid}{\sim} Normal(0,1)$, and $\mathbf{v_3} = -1$ if $\mathbf{w} \leq 0.3$, 0 if $0.3 < \mathbf{w} \leq 0.7$, or 1 if $0.7 < \mathbf{w}$, where $\mathbf{w} \overset{iid}{\sim} Uniform[0,1]$[24]. The dependent variable was generated with five outcome categories: -0.5, -0.25, 0, 0.25 and 0.50. The values of the parameters were calibrated to yield on average the following frequencies of the above outcomes : 7%, 14%, 58%, 14% and 7%, respectively, which are close to the empirical ones. The vectors of disturbance terms in the latent equations were repeatedly generated as i.i.d. $Normal(0,1)$ in the case of OP, NOP and CNOP d.g.p's, whereas in the case of NOPC and CNOPC models the errors $\boldsymbol{\nu}$ were generated as i.i.d. $Normal(0,1)$, but the errors $\boldsymbol{\varepsilon}^-$ and $\boldsymbol{\varepsilon}^+$ were drawn so that $(\boldsymbol{\nu}, \boldsymbol{\varepsilon}^-)$ and $(\boldsymbol{\nu}, \boldsymbol{\varepsilon}^+)$ are standardized bivariate normal i.i.d. with correlation coefficients ρ^- and ρ^+, respectively.

In case of the OP d.g.p. the repeated samples were generated with the data matrix $(\mathbf{v_1}, \mathbf{v_2})$, vector of slope coefficients $(0.4,\ 0.8)'$ and vector of cutpoints $(-1.83,\ -1.01,\ 1.01,\ 1.83)'$. In case of the NOP d.g.p. the repeated samples were generated with $\mathbf{X} = \mathbf{v_1}$, $\mathbf{Z}^- = \mathbf{v_2}$, $\mathbf{Z}^+ = \mathbf{v_3}$, $\boldsymbol{\beta} = 0.6$, $\boldsymbol{\gamma} = 0.8$, $\boldsymbol{\delta} = 0.9$, $\boldsymbol{\alpha} = (0.26,\ 2.14)'$, $\boldsymbol{\mu}^- = -0.54$ and $\boldsymbol{\mu}^+ = 0.54$ under the "no overlap" scenario; $\mathbf{X} = (\mathbf{v_1}, \mathbf{v_2})$, $\mathbf{Z}^- = (\mathbf{v_1}, \mathbf{v_3})$, $\mathbf{Z}^+ = (\mathbf{v_2}, \mathbf{v_3})$, $\boldsymbol{\beta} = (0.6,\ 0.4)'$, $\boldsymbol{\gamma} = (0.2,\ 0.3)'$, $\boldsymbol{\delta} = (0.3,\ 0.9)'$, $\boldsymbol{\alpha} = (0.21,\ 2.19)'$, $\boldsymbol{\mu}^- = -0.17$ and $\boldsymbol{\mu}^+ = 0.68$ under the "partial overlap" scenario; and $\mathbf{X} = \mathbf{Z}^- = \mathbf{Z}^+ = (\mathbf{v_1}, \mathbf{v_2}, \mathbf{v_3})$, $\boldsymbol{\beta} = (0.6,\ 0.4,\ 0.8)'$, $\boldsymbol{\gamma} = (0.2,\ 0.8,\ 0.3)'$, $\boldsymbol{\delta} = (0.4,\ 0.3,\ 0.9)'$, $\boldsymbol{\alpha} = (0.09,\ 2.32)'$, $\boldsymbol{\mu}^- = -0.72$ and $\boldsymbol{\mu}^+ = 2.12$ under the "complete overlap" scenario. In case of the CNOP d.g.p. the values of $\mathbf{X}$, $\mathbf{Z}^-$, $\mathbf{Z}^+$, $\boldsymbol{\beta}$, $\boldsymbol{\gamma}$, and $\boldsymbol{\delta}$ were the same as under the NOP d.g.p., while the vectors of thresholds were different: $\boldsymbol{\alpha} = (0.95,\ 1.45)'$, $\boldsymbol{\mu}^- = (-1.22,\ 0.03)'$ and $\boldsymbol{\mu}^+ = (-0.03,\ 1.18)'$ with no overlap; $\boldsymbol{\alpha} = (0.9,\ 1.5)'$, $\boldsymbol{\mu}^- = (-0.67,\ 0.36)'$ and $\boldsymbol{\mu}^+ = (0.02,\ 1.28)'$ with partial overlap; and $\boldsymbol{\alpha} = (0.85,\ 1.55)'$, $\boldsymbol{\mu}^- = (-1.2,\ 0.07)'$ and $\boldsymbol{\mu}^+ = (1.28,\ 2.5)'$ with complete overlap. In case of the NOPC d.g.p. the repeated samples were generated with $\rho^- = 0.3$, $\rho^+ = 0.6$, and all the data matrices and other parameters (except $\boldsymbol{\mu}^-$ and $\boldsymbol{\mu}^+$) the same as under the NOP d.g.p.; the values of $\boldsymbol{\mu}^-$ and $\boldsymbol{\mu}^+$ were set, respectively, to -0.9 and 1.2 with no overlap, -0.5 and 1.31 with partial overlap, and -1 and 2.58 with complete overlap. In case of the CNOPC d.g.p. the repeated samples were generated with $\rho^- = 0.3$, $\rho^+ = 0.6$, and all the data matrices and other parameters (except the thresholds) the same as under the CNOP d.g.p.; the values of $\boldsymbol{\alpha}$, $\boldsymbol{\mu}^-$ and $\boldsymbol{\mu}^+$ were set, respectively, to $(0.91,\ 1.49)'$, $(-1.43,\ -0.18)'$ and $(0.42,\ 1.58)'$ with no overlap, $(0.9,\ 1.5)'$, $(-0.88,\ 0.12)'$ and $(.49,\ 1.67)'$ with partial overlap, and $(0.86,\ 1.55)'$, $(-1.35,\ -0.15)'$ and $(1.7,\ 2.72)'$ with complete overlap.

All competing models were always estimated using the same set of covariates. Under the OP d.g.p. the three models were estimated: the OP model with data matrix $\mathbf{X} = (\mathbf{v_1}, \mathbf{v_2})$,

[24] Since the dependent variable represents the changes to the interest rate made once per month, the covariates $\mathbf{v_1}$, $\mathbf{v_2}$ and $\mathbf{v_3}$ mimic such variables as the output growth rate, the monthly change to the inflation rate and an indicator variable for the central bank's "policy bias" statement (-1 if it is easing, 0 if neutral, 1 if tightening), respectively.

and the NOP and MOP models with $\mathbf{X} = \mathbf{Z}^{-} = \mathbf{Z}^{+} = (\mathbf{v_1}, \mathbf{v_2})$. Under the NOP and NOPC d.g.p's the following three models were estimated: the OP model with $\mathbf{X} = (\mathbf{v_1}, \mathbf{v_2}, \mathbf{v_3})$ for all scenarios, and both the NOP and NOPC models with the same sets of covariates in each latent equation as in the d.g.p. Finally, under the CNOP and CNOPC d.g.p. the four models were estimated: the OP model with $\mathbf{X} = (\mathbf{v_1}, \mathbf{v_2}, \mathbf{v_3})$ for all scenarios, and the NOP, CNOP and CNOPC models with the same sets of covariates in each latent equation as in the d.g.p.

The starting values for $\boldsymbol{\beta}$, $\boldsymbol{\alpha}$, γ, $\boldsymbol{\mu}^{-}$, $\boldsymbol{\delta}$ and $\boldsymbol{\mu}^{+}$ were obtained using independent ordered probit estimations of each of the three latent equations. The starting values for each independent ordered probit model were computed using the linear OLS estimations. The starting values for ρ^{-} and ρ^{+} were obtained by maximizing the logarithms of the likelihood functions of the correlated models holding the other parameters fixed at their estimates in the corresponding uncorrelated model.

Appendix B: Monte Carlo results

This appendix reports the brief summary of the Monte Carlo simulations. The more detailed results are available upon request.

Estimates of parameters, probabilities and *PE*

It is worthless to compare the estimated parameters of the OP model with those of the two-level models not only because their structures and number of parameters are very different, but also because in such discrete models the parameters per se are not uniquely identified and their values depend on the arbitrary identifying assumptions. Fortunately, the probabilities of each discrete choice and the *PE* of covariates on these probabilities are absolutely *estimable* functions, i.e. they are invariant to the identifying assumptions, and basically are of main interest in empirical research. Therefore, I compare only the precision of parameters' estimates in the competing models, but not their values[25].

The following measures of the accuracy of parameters' estimates for all five simulated models are computed: *Bias* - the difference between the estimated and true parameter value, averaged over all Monte Carlo runs and multiplied by 100; *RMSE* - the root mean square error of the estimated parameters relative to their true values, averaged over all replications and multiplied by 10; *CP* - the empirical coverage probability, computed as the percentage of times the estimated asymptotic 95% confidence intervals cover the true values; *M-ratio* and *A-ratio* - the ratios of the median and average of estimated asymptotic standard errors of parameters' estimates to the standard deviation of parameters' estimates in all replications.

These results are concisely summarized in Tables 11, 12 and 13 of Appendix B, where the above measures are averaged for three groups of parameters (the slope, threshold and correlation coefficients) and contrasted across the five models (the absolute values of the individual *Bias* are used)[26]. The results suggest that (i) it requires two to three times more observations for the three-part models to achieve the same accuracy of the estimated parameters as that of the OP model; (ii) the bias and dispersion of slope coefficients' estimates are smaller than those for the thresholds, and those for the thresholds are smaller than those for the correlation coefficients; (iii) the fewer exclusion restrictions on the covariates in the three latent equations, the worse the accuracy of all parameters' estimates, though the estimated errors of the threshold and correlation coefficients are most severely affected; (iv) in small samples, the distribution of the estimates of standard errors (again, mostly for the threshold and correlation coefficients) is skewed to the right: there is a small fraction of huge estimated errors, while the rest of estimated errors are downward biased; (v) the finite-sample performance of the two-level models with exclusion restrictions and with 40 or more observations per parameter are rather good: the *M-ratio* is between 0.86 and 1.00, the *RMSE* is less than three times larger than in the OP model with the same number of observations per parameter, the *CP* are between 92% and 96% for the slope and thresholds parameters, and between 87% and 91% for the correlation coefficients.

To give a taste of how the accuracy of the estimates of *PE* of each covariate on the probability of each discrete choice differ among the models, the above measures of accuracy

[25] The precision of parameters' estimates can be evaluated because each model was estimated assuming for the identification the same distribution of errors terms and the same value of the intercept parameter as those in the true d.g.p.. Therefore, the estimated parameters are directly comparable with their true values.

[26] The detailed non-aggregated results for each parameter are available upon request.

are computed with respect to the *PE* estimates and reported in Tables 14, 15 and 16 of Appendix B for five models, estimated with 1000 observations and no overlap among the covariates[27]. In such non-linear models the *PE* depend on the values of covariates; they are estimated at the covariates' population means ($\overline{\mathbf{v_1}} = 2$, $\overline{\mathbf{v_2}} = \overline{\mathbf{v_3}} = 0$).

For brevity's sake, I do not report such detailed results for the other sample sizes and overlap scenarios - they are qualitatively analogous and are available upon request. Instead, in order to make more general conclusions, the *PE* were estimated for the values of covariates at each of the same 250 observations. The above accuracy measures were computed for the *PE*, averaged over 250 observations. In addition, the root mean square error of the estimated probabilities for all the outcomes and observations (*RMSEP*) was computed as $\sqrt{1/\{N(2J+1)\}\sum_{i=1}^{N}\sum_{j=0}^{2J+1}\{\widehat{\Pr}(y_i = j) - \Pr(y_i = j)\}^2}$ for each replication, averaged over all runs and multiplied by 10. *Problems* gives the percentage of runs when there was a problem with convergence or invertibility of the Hessian (this quantity should be interpreted in relative terms, since it depends on the ML estimation algorithm and can be improved by using different starting values for parameters and methods of numerical optimization; besides, there exists a trade-off between *Problems* and *A-ratio*). Table 17 of Appendix B shows these Monte Carlo results for the OP, NOP and NOPC d.g.p's with no overlap among the covariates. The results for the CNOP and CNOPC models are reported in Table 18 of Appendix B[28].

The main conclusions from these experiments can be summarized as follows. First, each of the five models under its own d.g.p., not surprisingly, estimates the *PE* better than the other models. However, under their own d.g.p. as the sample size grows, the relative performance of the OP model slowly deteriorates, while the relative performances of the NOPC and CNOPC models considerably improve. The relative performance of the NOP model with respect to the simpler OP model and that of the CNOP model with respect to simpler OP and NOP models considerably improve too, while the relative performances of the NOP and CNOP models with respect to their correlated versions slowly decrease.

Moreover, the NOP and CNOP models under the true OP d.g.p. perform much better than the OP model under the NOP and CNOP d.g.p's. As the sample size increases, the superiority in the performance of the OP model vis-a-vis the NOP and CNOP models under the OP d.g.p. even slightly decreases, whereas under the NOP and CNOP d.g.p's the superiority of the NOP and CNOP models over the OP model increases drastically. The superiority of the NOPC model over the OP model under both the NOP and NOPC d.g.p's as well as the superiority of the CNOPC model over the OP model under both the CNOP and CNOPC d.g.p's also increases sharply as the sample size grows. Under the NOPC and CNOPC d.g.p's the NOP model clearly outperforms the OP model, and this outperforming considerably improves as the sample size increases. The same applies to the CNOP model relative to the OP and NOP models under the CNOPC d.g.p.

Second, in terms of the *M-ratio* and *A-ratio* all of the models perform almost ideally: the *A-ratio* is between 0.97 and 1.05 under all d.g.p's, except for the CNOP model under the OP d.g.p., where it is between 0.90 (for 250 observations) and 0.96 (for 1000 observations). The distribution of the standard errors of the *PE* is slightly skewed to the right only for the samples with 250 observations; for larger samples the *M-ratio* and *A-ratio* are almost identical. Third, in terms of the *RMSEP*, under the OP d.g.p. the CNOP model outperforms

[27] The only difference is that *RMSE* is now multiplied by 100.

[28] The values of the *Bias* in Tables 3.14 and 3.15 are multiplied by 1000.

the NOP model, and the latter is superior with respect to the OP model; under the NOP and NOPC d.g.p's the NOPC model outperforms the NOP model, and the latter performs better than the OP model; and under the CNOP and CNOPC d.g.p's the CNOPC model outperforms the CNOP model, the latter does better than the OP model, and the OP model outperforms the NOP model. In all cases, these differences deteriorate slowly as the sample size grows. Finally, the problems with the estimation were detected only for the CNOP, NOPC and CNOPC models in small samples: with 250 observations (less than 28 observations per parameter) the NOPC and CNOPC models have problems in 4.9-16.4% of runs, while with more than 45 observations per parameter they have problems in fewer than 4% of replications; and the CNOP model with fewer than 21 observations per parameter had problems in 3.5% of runs (basically, under the OP d.g.p. only), while with more than 40 observations per parameter in fewer than 2% of replications. As the sample grows, the problems with the estimation disappear.

Hypothesis testing and model selection

The results of the *Vuong* and *LR* tests are reported in Table 19 of Appendix B as the percentage of times when the test statistic is in favor of each model. All the tests are performed with the 95% nominal level.

Under any two-level d.g.p's the *Vuong* tests are in favor of the true model versus the OP model in 90-99% of replications with 250 observations, and even more overwhelmingly in 99.8-100% of replications with 500 or more observations. The two-level models are correctly favored more often as the sample size increases. However, under the OP d.g.p. the *Vuong* tests of the NOP and CNOP models versus the OP model fail to discriminate between the two models, and are never in favor of the true OP model but prefer the NOP and CNOP models in 0.8-7.5% of cases. The test statistic decreases with the sample size in favor of the OP model (since we are under the alternative hypothesis), though rather slowly. Under the CNOP and CNOPC d.g.p's the *Vuong* tests again mostly fail to discriminate between the NOP and OP models, but prefer the OP model, respectively, in 5.3-8.4% and 2.2-3.7% of runs, more often than the NOP model; and the test statistic decreases with the sample size in favor of the OP model.

The *LR* tests of the NOP versus NOPC and the CNOP versus CNOPC model (when the true d.g.p. is correlated) both have an empirical size between 4.1% and 5.8%, very close to the 5% nominal one. Under the alternative hypothesis, that is when the true d.g.p. is the NOPC or CNOPC model, the *Vuong* tests are in favor of the true models in 15-76% of cases; and the test statistics grow fast with the sample size in favor of the true model. The *LR* tests of the NOP versus CNOP model under the OP d.g.p. have empirical sizes ranging from 7.2% to 9% under the standard critical values, which are not valid because both models are now misspecified; hence, the *LR* test statistics converge in distribution to the weighted sum of χ^2 distributions.

Table 20 of Appendix B reports the percentage of times when each of the information criteria and hit rate select each of the estimated models. Under the OP, NOP and CNOP d.g.p. all five information criteria for all sample sizes overwhelmingly select the true model: the *AIC* and *AICc* in 84.5-89.8%, while the *BIC*, *cAIC* and *HQIC* in 96.5-100% of cases; the *BIC* and *cAIC* have the best performance, in above 98.8% of cases, over all sample sizes. Under the NOPC and CNOPC d.g.p's, the smaller the sample size the more all criteria are biased toward the less parameterized NOP and CNOP models, respectively. The *BIC* and *cAIC* select the uncorrelated versions for all sample sizes in 75.7-99.1% of cases. The *HQIC* prefers the uncorrelated versions in the samples with 250 and 500 observations in 66-89% of cases, but switches to the true correlated models with 1000 observations in 52-63% of cases. The *AIC* and *AICc* prefer the uncorrelated models only with 250 observations in 66-73% of cases, while in the larger samples they prefer the true models. Overall, while the *AIC* and *AICc* under the OP, NOP and CNOP d.g.p's select the true model slightly less frequently than the *BIC* and *cAIC*, under the NOPC and CNOPC d.g.p's they clearly outperform the *HQIC* and especially the *BIC* and *cAIC*.

The selection performance of the *Hit rate* is rather different. Under the NOP and CNOP d.g.p's, it correctly selects the true model in only 47-57% of cases. Under the NOPC and CNOPC d.g.p's, the *Hit rate* correctly prefers the true model only with 1000 observations, but marginally in 47-52% of cases; in smaller samples, it prefers the uncorrelated versions. Under the OP d.g.p. the *Hit rate* favors the OP model only in 35-40% of cases, while the NOP model does so in 32-36% of cases. Such low performance of the *Hit rate* is not surprising - the ML estimation is not optimized with respect to this measure of fit. Moreover, this goodness-of-fit statistic is based on the idea that is in discordance with the meaning of probabilities. The probabilities of each outcome mean that the alternative will be observed a certain fraction of times, but not that the outcome with the highest probability will be selected every time.

The effect of exclusion restrictions

In general, the identification of parameters of the two-level models is warranted (up to scale) by the non-linearity of the OP models; thus, there is no need in the exclusion restrictions on the specification of covariates in three latent equations to avoid the collinearity problems. In practice, however, the collinearity problems might still exist if most observations lie within the middle quasi-linear range of the normal c.d.f. Then, without the explicit exclusion restrictions (for example, when $\mathbf{X}$, $\mathbf{Z}^{-}$ and $\mathbf{Z}^{+}$ are identical or have a large set of variables in common), the parameters can be estimated imprecisely, and the model can suffer from weak identification, lack of convergence and problems with invertibility of the Hessian. Hopefully, the specifications with the complete overlap of covariates in the latent equations are unlikely to be of empirical interest and supported by the data.

To assess the effect of exclusion restrictions on the performance of estimators, Table 21 of Appendix B reports the above measures of accuracy for five models with different sample sizes and under three different scenarios of the overlap among the covariates in the specifications of three latent equations: n - "no overlap", p - "partial overlap" and c - "complete overlap"[29]. The more exclusion restrictions the more accurate the estimates of the *PE,* and the fewer the problems with estimation. The simulation results suggest that the asymptotic estimator might not perform well without the exclusion restrictions, that is with the complete overlap among the covariates, in the small samples (fewer than 35 observations per parameter). In case of the NOPC and CNOPC models under the partial overlap scenario in the small samples there might be the problems with the convergence and invertibility of the Hessian.

[29] The values of the *Bias* in Table 3.18 are multiplied by 1000.

Table 11: Accuracy of estimated slope coefficients β, γ, and δ

Sample size	True *dgp* and estimated model:	OP	NOP			NOPC			CNOP			CNOPC		
	Overlap:		n	p	c	n	p	c	n	p	c	n	p	c
250	Number of	41.7	35.7	25.0	19.2	27.8	20.8	16.7	27.8	20.8	16.7	22.7	17.9	14.7
500	observations	83.3	71.4	50.0	38.5	55.6	41.7	33.3	55.6	41.7	33.3	45.5	35.7	29.4
1000	per parameter	166.7	142.9	100.0	76.9	111.1	83.3	66.7	111.1	83.3	66.7	90.9	71.4	58.8
250		0.89	5.52	3.56	7.54	3.08	3.71	8.74	4.42	3.41	6.05	2.31	3.38	11.88
500	*Bias*	0.60	2.24	1.39	2.62	1.52	1.36	11.71	2.25	1.85	2.53	1.13	1.64	10.62
1000		0.09	1.06	0.55	1.03	0.57	0.59	10.66	0.84	1.07	1.89	0.53	0.72	7.94
250		0.94	2.66	2.46	4.65	2.67	2.55	3.31	2.19	2.34	4.03	2.09	2.31	3.98
500	*RMSE*	0.63	1.54	1.39	1.70	1.51	1.47	2.62	1.43	1.51	2.32	1.42	1.54	2.90
1000		0.46	1.03	0.95	1.10	1.07	1.01	2.19	1.00	1.04	1.61	0.98	1.04	2.16
250		94.8	96.0	95.1	95.3	95.6	94.4	93.4	92.7	91.7	85.1	94.1	90.9	86.6
500	*CP*, %	95.5	95.2	95.4	95.0	95.2	94.5	91.4	93.8	92.8	85.5	94.2	91.7	87.3
1000		95.5	95.0	95.1	95.0	94.6	94.5	90.7	94.1	93.1	86.8	94.7	92.9	88.7
250		0.98	0.85	0.89	0.72	0.88	0.91	1.27	0.89	0.83	0.62	0.93	0.83	0.77
500	*M-ratio*	1.02	0.95	0.99	0.94	0.98	0.98	1.31	0.96	0.90	0.75	0.94	0.87	0.83
1000		1.00	0.98	0.99	0.97	0.97	0.99	1.25	0.97	0.93	0.80	0.97	0.92	0.89
250		0.99	1.63	1.41	2.93	1.90	2.06	1.81	0.97	0.87	0.95	0.99	0.99	1.16
500	*A-ratio*	1.02	0.97	1.00	1.04	1.01	1.00	1.65	0.97	0.92	0.77	0.97	0.95	1.12
1000		1.00	0.99	0.99	0.98	1.00	1.00	1.49	0.98	0.95	0.83	0.98	1.00	1.13

Table 12: Accuracy of estimated threshold coefficients α, μ^{-} and μ^{+}

Sample size	True *dgp* and estimated model:	OP	NOP			NOPC			CNOP			CNOPC		
	Overlap:		n	p	c	n	p	c	n	p	c	n	p	c
250		1.85	2.69	3.52	14.72	5.24	6.91	32.37	5.02	12.36	27.29	6.97	13.69	63.86
500	*Bias*	1.09	0.99	1.13	4.91	2.44	2.40	38.69	2.55	5.16	20.80	2.66	4.94	56.68
1000		0.38	0.48	0.70	2.47	1.13	1.05	34.18	1.21	2.40	14.09	1.47	1.70	44.38
250		1.29	2.24	2.82	7.35	3.69	3.66	7.99	3.18	5.86	13.03	3.89	5.86	13.75
500	*RMSE*	0.90	1.46	1.72	3.07	2.43	2.28	7.22	2.16	3.42	9.95	2.65	3.55	11.97
1000		0.62	1.00	1.21	2.02	1.68	1.59	6.13	1.52	2.18	7.75	1.78	2.13	9.50
250		95.3	95.3	94.9	95.1	92.0	93.5	92.3	91.8	89.3	79.7	92.1	90.5	83.9
500	*CP*, %	94.7	95.1	95.5	94.7	92.7	93.6	91.3	93.2	91.3	81.1	92.8	90.5	85.2
1000		95.2	95.0	94.8	95.0	93.2	93.6	90.1	94.2	92.7	82.6	94.0	91.7	87.6
250		0.98	0.92	0.90	0.75	0.96	0.95	1.36	0.91	0.74	0.51	0.85	0.69	0.72
500	*M-Ratio*	0.98	0.97	0.99	0.96	0.98	0.99	1.30	0.97	0.85	0.57	0.87	0.74	0.70
1000		1.00	0.98	0.98	0.98	0.98	0.99	1.25	0.98	0.91	0.59	0.92	0.88	0.75
250		0.99	1.10	1.13	3.69	1.33	1.24	1.86	1.00	1.82	2.62	0.96	2.92	2604
500	*A-Ratio*	0.99	0.98	1.00	1.07	1.00	1.01	1.59	0.98	1.10	1.78	0.94	1.35	1897
1000		1.00	0.98	0.98	0.99	0.99	1.01	1.44	0.99	0.96	1.12	0.96	1.01	1575

Table 13: Accuracy of estimated correlation coefficients ρ^- and ρ^+

Sample size	True *dgp* and estimated model:	NOPC			CNOPC		
	Covariates' overlap:	n	p	c	n	p	c
250	*Bias*	8.70	14.33	41.31	9.94	22.58	54.78
500		3.82	5.36	43.01	3.72	10.18	45.80
1000		1.75	1.96	38.10	1.89	4.22	36.84
250	*RMSE*	4.27	4.76	7.27	4.36	5.66	8.09
500		3.02	3.40	7.44	3.12	4.24	7.34
1000		2.10	2.52	6.76	2.18	3.17	6.25
250	*CP*, %	85.2	85.4	87.1	84.0	79.8	73.6
500		88.2	87.8	82.1	87.2	81.6	73.4
1000		90.7	89.4	81.6	90.8	85.5	78.8
250	*M-ratio*	0.99	1.05	2.41	0.95	0.91	1.35
500		0.98	1.00	1.84	0.93	0.88	1.24
1000		0.98	0.97	1.68	0.95	0.91	1.35
250	*A-ratio*	0.99	1.07	334.3	0.97	1.03	454.1
500		0.97	1.01	128.2	0.95	0.95	285.5
1000		0.98	0.97	44.2	0.96	1.01	211.5

Table 14: Partial effects of covariates on probabilities of discrete outcomes

	True *dgp* :	OP			NOP			NOPC			CNOP				CNOPC			
	Estimated model:	OP	NOP	CNOP	OP	NOP	NOPC	OP	NOP	NOPC	OP	NOP	CNOP	CNOPC	OP	NOP	CNOP	CNOPC
								Partial effects on Pr(y = -0.50 | v1=2, v2=0, v3=0)										
v_1	*Bias*	0.01	-0.08	-0.10	-0.70	0.04	0.08	-1.08	-0.41	0.08	-1.22	0.35	0.00	0.03	-1.32	-0.01	-0.42	0.02
	A-ratio	1.00	0.98	0.92	1.06	1.00	1.01	1.06	0.99	0.99	1.13	1.00	0.98	1.02	1.14	1.04	1.01	0.99
	RMSE	0.44	0.61	0.66	0.90	0.63	0.73	1.21	0.75	0.79	1.30	0.55	0.49	0.67	1.38	0.36	0.60	0.66
	CP, %	94.4	94.1	92.6	83.1	94.6	94.7	56.1	92.3	95.3	27.7	82.3	93.5	94.7	12.6	95.2	90.4	93.0
v_2	*Bias*	0.01	0.00	-0.04	4.25	-0.05	-0.07	4.59	0.22	-0.08	3.78	2.62	0.03	0.02	4.05	2.83	0.29	0.03
	A-ratio	1.01	0.98	0.94	0.96	1.01	1.00	0.97	0.99	1.01	0.93	1.01	1.00	1.01	0.91	0.99	0.98	0.98
	RMSE	0.43	0.55	0.58	4.27	0.79	0.83	4.60	0.84	0.89	3.81	2.69	0.79	0.83	4.08	2.90	0.86	0.87
	CP, %	95.2	94.5	94.1	0.0	95.5	95.5	0.0	92.0	95.0	0.0	1.9	94.5	94.5	0.0	1.1	91.0	93.6
v_3	*Bias*				-0.60	0.00	0.00	-0.63	0.00	0.00	-2.29	0.00	0.00	0.00	-2.45	0.00	0.00	0.00
	A-ratio				1.02	n/a	n/a	1.00	n/a	n/a	1.15	n/a	n/a	n/a	1.13	n/a	n/a	n/a
	RMSE				0.72	0.00	0.00	0.76	0.00	0.00	2.32	0.00	0.00	0.00	2.48	0.00	0.00	0.00
	CP, %				65.8	n/a	n/a	63.1	n/a	n/a	0.0	n/a	n/a	n/a	0.0	n/a	n/a	n/a
								Partial effects on Pr(y = -0.25 | v1=2, v2=0, v3=0)										
v_1	*Bias*	0.00	0.09	-0.25	2.05	-0.01	-0.05	2.98	0.41	-0.08	3.39	1.29	-0.10	-0.16	4.13	2.08	0.42	-0.11
	A-ratio	1.00	0.99	0.97	0.99	0.98	0.98	0.96	0.98	1.01	1.03	1.08	1.00	1.06	1.00	1.06	0.94	0.96
	RMSE	0.78	0.96	1.20	2.22	0.97	1.05	3.11	1.05	1.06	3.47	1.53	1.27	1.31	4.18	2.23	1.37	1.41
	CP, %	94.5	94.4	94.0	34.2	94.2	94.9	8.0	90.8	94.9	1.0	69.0	95.2	95.5	0.0	33.0	90.4	94.2
v_2	*Bias*	0.01	0.03	-0.37	-5.67	0.05	0.07	-6.02	-0.22	0.08	3.15	10.18	-0.05	-0.07	2.79	9.80	-0.53	-0.15
	A-ratio	0.98	0.97	1.02	1.01	1.01	1.00	1.04	0.99	1.01	1.02	1.01	1.01	1.02	1.01	0.99	0.99	0.98
	RMSE	0.78	0.83	1.02	5.70	0.79	0.83	6.05	0.84	0.89	3.22	10.20	1.35	1.53	2.86	9.82	1.50	1.58
	CP, %	94.7	94.1	94.6	0.0	95.5	95.5	0.0	92.0	95.0	0.6	0.0	95.7	95.4	2.2	0.0	94.7	94.9
v_3	*Bias*				-1.06	0.00	0.00	-1.12	0.00	0.00	-4.15	0.00	0.00	0.00	-4.21	0.00	0.00	0.00
	A-ratio				1.01	n/a	n/a	0.99	n/a	n/a	1.06	n/a	n/a	n/a	1.05	n/a	n/a	n/a
	RMSE				1.28	0.00	0.00	1.34	0.00	0.00	4.20	0.00	0.00	0.00	4.26	0.00	0.00	0.00
	CP, %				68.2	n/a	n/a	65.5	n/a	n/a	0.0	n/a	n/a	n/a	0.0	n/a	n/a	n/a

Table 15: Partial effects of covariates on probabilities of discrete outcomes

	True *dgp* :	OP			NOP			NOPC			CNOP				CNOPC			
	Estimated model:	OP	NOP	CNOP	OP	NOP	NOPC	OP	NOP	NOPC	OP	NOP	CNOP	CNOPC	OP	NOP	CNOP	CNOPC
	Partial effects on Pr(y = 0 | v1=2, v2=0, v3=0)																	
v_1	*Bias*	0.01	0.01	0.01	0.03	-0.03	-0.03	0.10	0.02	0.02	0.10	-0.02	0.01	-0.01	-1.82	-1.93	-0.95	0.12
	A-ratio	1.01	1.01	0.99	1.03	1.01	1.01	1.05	1.02	1.02	1.02	1.04	0.99	1.01	1.02	1.05	0.94	0.97
	RMSE	0.72	0.72	1.62	0.93	1.06	1.06	0.88	1.05	1.05	0.62	0.61	1.60	1.80	1.88	1.99	1.87	2.15
	CP, %	95.4	95.4	95.5	96.3	95.7	95.8	96.2	95.8	95.9	95.8	96.4	94.8	95.7	4.9	4.1	86.2	95.2
v_2	*Bias*	-0.03	-0.01	0.60	0.01	0.00	0.00	0.02	0.00	0.00	-12.72	-12.80	0.02	0.05	-12.57	-12.63	0.24	0.12
	A-ratio	1.00	0.99	0.99	1.05	n/a	n/a	1.06	n/a	n/a	1.01	n/a	1.01	1.03	1.01	n/a	0.98	0.98
	RMSE	2.00	2.07	2.86	0.11	0.00	0.00	0.11	0.00	0.00	12.73	12.80	1.63	1.70	12.58	12.63	1.70	1.79
	CP, %	94.7	94.8	93.8	99.8	n/a	n/a	99.9	n/a	n/a	0.0	n/a	94.9	95.0	0.0	n/a	94.8	94.7
v_3	*Bias*				-0.16	0.00	0.00	-0.16	0.00	0.00	10.82	12.51	0.06	0.06	10.47	12.26	-2.27	0.01
	A-ratio				0.93	n/a	n/a	0.95	n/a	n/a	0.90	n/a	1.00	1.04	0.92	n/a	0.98	1.01
	RMSE				0.28	0.00	0.00	0.28	0.00	0.00	10.85	12.51	2.05	2.36	10.50	12.26	3.22	2.42
	CP, %				99.5	n/a	n/a	99.6	n/a	n/a	0.0	n/a	94.5	93.6	0.0	n/a	81.7	94.8
	Partial effects on Pr(y = 0.25 | v1=2, v2=0, v3=0)																	
v_1	*Bias*	-0.01	-0.08	0.26	-1.98	0.02	0.06	-3.81	-1.13	0.08	-3.30	-1.28	0.09	0.16	-3.28	-1.15	-0.34	-0.05
	A-ratio	1.01	1.01	0.96	0.99	0.99	1.00	0.94	0.96	1.00	1.02	1.08	1.00	1.05	1.01	1.07	0.96	0.97
	RMSE	0.76	0.93	1.19	2.17	0.95	1.02	3.91	1.50	1.15	3.37	1.51	1.25	1.30	3.34	1.40	1.25	1.55
	CP, %	94.8	95.0	94.2	36.6	95.2	95.1	1.4	74.8	94.9	0.9	68.7	94.7	94.4	0.4	72.4	91.6	95.0
v_2	*Bias*	0.03	-0.19	-0.30	0.89	0.00	0.00	0.88	0.00	0.00	3.51	0.00	0.00	0.00	3.36	0.00	0.00	0.00
	A-ratio	1.01	0.99	0.94	1.00	n/a	n/a	1.02	n/a	n/a	1.03	n/a	n/a	n/a	1.03	n/a	n/a	n/a
	RMSE	1.36	2.23	2.48	1.07	0.00	0.00	1.05	0.00	0.00	3.56	0.00	0.00	0.00	3.41	0.00	0.00	0.00
	CP, %	95.0	95.1	93.6	68.4	n/a	n/a	67.4	n/a	n/a	0.0	n/a	n/a	n/a	0.0	n/a	n/a	n/a
v_3	*Bias*				7.12	-0.04	-0.07	8.14	0.26	-0.10	2.90	-6.28	-0.06	-0.13	4.97	-4.83	3.01	-0.22
	A-ratio				1.03	1.01	1.02	1.01	0.99	1.00	1.03	1.01	0.97	1.02	1.07	0.98	0.89	0.98
	RMSE				7.16	0.98	0.99	8.17	1.06	1.09	3.03	6.38	1.97	2.41	5.04	4.97	3.85	2.61
	CP, %				0.0	95.2	95.2	0.0	93.0	94.9	5.3	0.0	92.5	92.5	0.0	0.6	63.3	94.0

Table 16: Partial effects of covariates on probabilities of discrete outcomes

	True *dgp* :	OP			NOP			NOPC			CNOP				CNOPC			
	Estimated model:	OP	NOP	CNOP	OP	NOP	NOPC	OP	NOP	NOPC	OP	NOP	CNOP	CNOPC	OP	NOP	CNOP	CNOPC
	Partial effects on Pr(y = 0.50 | v1=2, v2=0, v3=0)																	
v_1	*Bias*	-0.02	0.06	0.08	0.61	-0.03	-0.07	1.80	1.12	-0.10	1.03	-0.33	0.00	-0.02	2.29	1.01	1.28	0.02
	A-ratio	1.00	0.98	0.92	1.02	0.98	1.00	1.05	1.02	0.99	1.11	1.02	1.00	1.05	1.16	1.04	1.04	0.96
	RMSE	0.44	0.60	0.64	0.84	0.64	0.71	1.89	1.28	0.89	1.12	0.55	0.49	0.68	2.32	1.08	1.34	0.58
	CP, %	94.4	94.3	93.1	85.4	94.7	94.8	8.8	58.8	94.8	46.0	85.3	93.8	95.6	0.0	20.0	5.3	87.6
v_2	*Bias*	-0.03	0.17	0.12	0.52	0.00	0.00	0.54	0.00	0.00	2.29	0.00	0.00	0.00	2.37	0.00	0.00	0.00
	A-ratio	0.99	1.00	0.91	1.00	n/a	n/a	1.03	n/a	n/a	1.10	n/a	n/a	n/a	1.10	n/a	n/a	n/a
	RMSE	1.40	1.96	2.11	0.62	0.00	0.00	0.64	0.00	0.00	2.32	0.00	0.00	0.00	2.41	0.00	0.00	0.00
	CP, %	94.6	95.0	92.2	69.1	n/a	n/a	68.0	n/a	n/a	0.0	n/a	n/a	n/a	0.0	n/a	n/a	n/a
v_3	*Bias*				-5.30	0.04	0.07	-6.22	-0.26	0.10	-7.28	-6.23	0.01	0.07	-8.78	-7.43	-0.73	0.21
	A-ratio				0.96	1.01	1.02	0.94	0.99	1.00	0.95	1.01	1.01	1.03	0.93	0.98	0.99	1.01
	RMSE				5.32	0.98	0.99	6.24	1.06	1.09	7.33	6.33	1.50	1.52	8.82	7.53	1.79	1.68
	CP, %				0.0	95.2	95.2	0.0	93.0	94.9	0.0	0.1	95.5	95.5	0.0	0.0	90.7	95.2

Table 17: Performance under the OP, NOP and NOPC d.g.p's

Sample	True *dgp* :	OP			NOP			NOPC		
size	Estimated model:	OP	NOP	CNOP	OP	NOP	NOPC	OP	NOP	NOPC
250	Number of	41.7	25.0	20.8	35.7	35.7	27.8	35.7	35.7	27.8
500	observations per	83.3	50.0	41.7	71.4	71.4	55.6	71.4	71.4	55.6
1000	parameter	166.7	100.0	83.3	142.9	142.9	111.1	142.9	142.9	111.1
250		3.23	3.22	3.21	3.30	3.23	3.22	3.30	3.22	3.21
500	*RMSEP*	3.22	3.22	3.22	3.30	3.24	3.24	3.31	3.23	3.23
1000		3.24	3.24	3.23	3.31	3.25	3.25	3.32	3.24	3.24
250		0.25	0.45	1.48	22.31	0.30	0.36	26.03	3.10	0.55
500	*Bias*	0.22	0.31	0.99	22.14	0.11	0.19	25.75	2.69	0.30
1000		0.09	0.20	0.78	21.69	0.07	0.09	25.25	2.56	0.11
250		2.06	2.95	3.71	3.55	1.20	1.42	3.88	1.35	1.40
500	*RMSE*	1.43	2.04	2.48	3.30	0.81	0.96	3.63	1.01	0.97
1000		1.01	1.44	1.73	3.13	0.57	0.66	3.47	0.80	0.67
250		93.2	92.0	90.4	59.7	92.7	92.0	56.0	88.7	91.6
500	*CP* , %	94.2	93.4	92.2	50.1	93.9	93.3	47.1	86.0	93.0
1000		94.6	94.0	93.0	41.5	94.5	94.2	38.1	80.2	93.7
250		0.98	0.97	0.87	1.00	0.97	0.97	0.98	0.97	0.98
500	*M-ratio*	1.00	0.99	0.91	0.99	0.99	0.98	1.01	0.99	0.97
1000		1.00	0.99	0.94	1.00	1.00	0.99	1.00	0.99	0.98
250		0.99	0.97	0.91	1.01	0.98	1.00	1.00	0.98	1.01
500	*A-ratio*	1.00	0.99	0.93	1.00	0.99	1.00	1.01	1.00	1.00
1000		1.00	0.99	0.95	1.01	1.00	1.00	1.00	0.99	1.00
250		0.0	0.0	3.5	0.0	0.0	5.1	0.0	0.0	16.1
500	*Problems* , %	0.0	0.0	1.8	0.0	0.0	0.2	0.0	0.0	3.0
1000		0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.1

Table 18: Performance under the CNOP and CNOPC d.g.p's

Sample	True *dgp* :	CNOP				CNOPC			
size	Estimated model:	OP	NOP	CNOP	CNOPC	OP	NOP	CNOP	CNOPC
250	Number of	35.7	35.7	27.8	22.7	35.7	35.7	27.8	22.7
500	observations per	71.4	71.4	55.6	45.5	71.4	71.4	55.6	45.5
1000	parameter	142.9	142.9	111.1	90.9	142.9	142.9	111.1	90.9
250		3.368	3.398	3.269	3.266	3.379	3.406	3.274	3.268
500	*RMSEP*	3.356	3.381	3.258	3.256	3.364	3.388	3.260	3.255
1000		3.350	3.373	3.256	3.256	3.357	3.379	3.256	3.253
250		34.63	32.81	0.62	0.82	36.84	33.20	2.88	1.02
500	*Bias*	34.75	32.93	0.25	0.40	36.97	32.64	3.28	0.34
1000		34.50	32.89	0.16	0.15	36.88	32.77	3.70	0.20
250		4.86	4.44	1.96	2.34	5.20	4.59	2.22	2.36
500	*RMSE*	4.69	4.34	1.34	1.62	5.06	4.50	1.75	1.69
1000		4.59	4.27	0.96	1.11	4.97	4.44	1.42	1.17
250		36.0	45.9	91.0	90.3	28.6	45.7	87.7	89.9
500	*CP* , %	20.5	35.3	93.0	92.4	15.3	33.5	82.7	91.2
1000		13.2	27.3	94.1	93.7	10.3	24.0	74.9	92.8
250		1.03	1.03	0.92	0.93	1.05	1.04	0.96	0.93
500	*M-ratio*	1.03	1.01	0.99	1.00	1.03	1.03	0.97	0.96
1000		1.03	1.03	0.99	0.99	1.03	1.02	0.97	0.95
250		1.03	1.04	0.96	0.98	1.05	1.05	0.98	0.99
500	*A-ratio*	1.04	1.02	0.99	1.00	1.04	1.03	0.97	0.96
1000		1.03	1.03	1.00	1.03	1.04	1.03	0.98	0.97
250		0.0	0.0	0.0	4.9	0.0	0.0	0.0	16.4
500	*Problems* , %	0.0	0.0	0.0	0.4	0.0	0.0	0.0	3.2
1000		0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.2

Table 19: Performance of Vuong and LR tests

True *dgp:*	OP			NOP			NOPC			CNOP			CNOPC		
Sample:	250	500	1000	250	500	1000	250	500	1000	250	500	1000	250	500	1000
Model							*Vuong* tests								
OP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.3	5.5	8.4	2.2	2.7	3.7
NOP	2.8	1.2	0.8	90.6	99.9	100	97.8	100	100	0.7	0.8	0.7	1.4	1.3	1.2
OP				0.0	0.0	0.0	0.0	0.0	0.0						
NOPC				95.3	100	100	98.4	100	100						
OP	0.0	0.0	0.0							0.0	0.0	0.0	0.0	0.0	0.0
CNOP	7.5	3.6	3.1							94.2	99.9	100	97.5	100	100
OP										0.0	0.0	0.0	0.0	0.0	0.0
CNOPC										95.7	100	100	98.1	100	100
							LR tests								
NOP				95.9	94.2	94.9	83.2	57.3	24.8						
NOPC				4.1	5.8	5.1	16.9	42.7	75.2						
NOP	91.0	92.4	92.7							0.0	0.0	0.0	0.0	0.0	0.0
CNOP	9.0	7.6	7.3							100	100	100	100	100	100
CNOP										95.2	94.3	94.8	85.0	63.3	33.4
CNOPC										4.8	5.7	5.2	15.0	36.7	66.6

Table 20: Performance of model selection criteria and hit rate

True *dgp*:		OP (1)			NOP (2)			NOPC (3)			CNOP (4)			CNOPC (5)		
Sample size:		250	500	1000	250	500	1000	250	500	1000	250	500	1000	250	500	1000
	1	84.5	87.9	87.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
	2	9.3	7.9	8.6	87.4	84.7	86.2	66.5	40.0	12.4	0.0	0.0	0.0	0.0	0.0	0.0
AIC	3				12.6	15.3	13.8	33.5	60.0	87.6						
	4	6.3	4.2	4.4							86.5	85.2	86.1	68.3	43.6	18.8
	5										13.4	14.8	13.9	31.7	56.4	81.2
	1	100	100	100	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.2	0.0	0.0
	2	0.0	0.0	0.0	99.8	99.6	99.8	97.8	90.6	75.7	0.1	0.0	0.0	0.0	0.0	0.0
BIC	3				0.2	0.4	0.2	2.2	9.4	24.3						
	4	0.0	0.0	0.0							99.3	99.7	100	97.9	93.2	81.4
	5										0.1	0.3	0.0	2.0	6.8	18.6
	1	100	100	100	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.4	0.0	0.0
	2	0.0	0.0	0.0	99.9	99.9	99.9	99.1	94.7	82.8	0.2	0.0	0.0	0.0	0.0	0.0
cAIC	3				0.1	0.1	0.1	1.0	5.3	17.2						
	4	0.0	0.0	0.0							98.8	100	100	98.9	96.7	87.8
	5										0.1	0.0	0.0	0.7	3.3	12.2
	1	87.7	89.3	87.8	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
	2	7.9	7.0	8.4	89.7	85.8	86.8	69.5	41.3	12.9	0.0	0.0	0.0	0.0	0.0	0.0
AICc	3				10.3	14.2	13.2	30.5	58.7	87.1						
	4	4.4	3.7	3.8							89.0	86.3	86.7	72.1	45.6	19.4
	5										10.9	13.7	13.3	27.9	54.4	80.6
	1	98.4	99.3	99.6	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
	2	1.4	0.7	0.4	97.5	96.8	97.8	88.2	66.6	37.6	0.0	0.0	0.0	0.0	0.0	0.0
HQIC	3				2.5	3.2	2.2	11.8	33.4	62.4						
	4	0.2	0.1	0.0							96.7	96.5	97.3	88.8	73.5	48.0
	5										3.1	3.5	2.7	11.2	26.5	52.0
	1	39.7	35.1	35.9	16.3	10.4	3.9	14.9	7.2	1.9	23.1	15.8	9.2	27.0	15.1	10.2
	2	32.4	35.8	33.6	57.0	53.5	56.1	57.7	48.2	46.4	1.1	0.6	0.1	1.0	0.9	0.6
Hit rate	3				26.7	36.2	40.0	27.4	44.6	51.7						
	4	27.9	29.1	30.5							47.8	49.4	51.1	42.9	43.4	41.5
	5										27.9	34.2	39.6	29.1	40.6	47.8

Table 21: The effect of exclusion restrictions

Sample size	True *dgp* and estimated model:	NOP			NOPC			CNOP			CNOPC		
	Overlap:	n	p	c	n	p	c	n	p	c	n	p	c
250	Number of	35.7	25.0	19.2	27.8	20.8	16.7	27.8	20.8	16.7	22.7	17.9	14.7
500	observations per	71.4	50.0	38.5	55.6	41.7	33.3	55.6	41.7	33.3	45.5	35.7	29.4
1000	parameter	143	100	76.9	111	83.3	66.7	111	83.3	66.7	90.9	71.4	58.8
250		3.22	3.19	3.08	3.21	3.19	3.08	3.27	3.23	3.07	3.27	3.25	3.11
500	*RMSEP*	3.24	3.21	3.09	3.23	3.20	3.11	3.26	3.25	3.08	3.26	3.26	3.12
1000		3.25	3.23	3.11	3.24	3.21	3.13	3.26	3.26	3.09	3.25	3.27	3.14
250		0.28	0.30	0.43	0.55	1.31	0.59	0.60	1.34	1.24	1.02	1.76	1.52
500	*Bias*	0.12	0.23	0.29	0.30	0.41	0.35	0.24	0.82	0.77	0.34	0.86	1.22
1000		0.07	0.13	0.11	0.11	0.14	0.26	0.16	0.52	0.69	0.20	0.34	0.86
250		1.20	2.12	3.21	1.40	2.30	3.20	1.96	2.92	4.18	2.36	3.24	4.30
500	*RMSE*	0.81	1.40	2.14	0.97	1.55	2.17	1.36	1.97	2.75	1.69	2.26	2.85
1000		0.57	0.99	1.48	0.67	1.08	1.53	0.96	1.39	1.88	1.17	1.56	1.95
250		92.7	91.6	88.6	91.6	91.6	89.9	86.9	89.5	86.3	89.9	89.4	87.3
500	*CP*, %	93.9	93.6	91.4	93.0	93.0	92.5	93.0	92.0	89.4	91.2	91.0	90.4
1000		94.5	94.0	93.1	93.7	93.8	93.6	94.1	93.1	91.6	92.8	92.4	92.3
250		0.96	0.95	0.91	0.97	0.98	0.97	0.92	0.91	0.81	0.93	0.91	0.87
500	*M-ratio*	0.98	0.99	0.95	0.97	0.98	1.01	0.98	0.95	0.87	0.92	0.92	0.92
1000		1.00	0.99	0.97	0.98	0.98	1.01	0.99	0.96	0.92	0.95	0.95	0.95
250		0.98	0.96	1.00	1.01	1.01	1.11	0.92	0.94	0.88	0.99	0.99	1.06
500	*A-ratio*	0.99	1.00	0.97	1.00	1.01	1.19	0.99	0.97	0.92	0.96	0.99	1.03
1000		1.00	0.99	0.99	1.00	1.00	1.10	1.00	0.97	0.95	0.97	1.01	1.02
250		0.0	0.0	0.0	16.1	25.8	55.9	0.0	0.0	0.0	16.4	34.3	56.7
500	*Problems*, %	0.0	0.0	0.0	3.0	7.4	30.7	0.0	0.0	0.0	3.2	13.2	41.0
1000		0.0	0.0	0.0	0.1	0.5	13.4	0.0	0.0	0.0	0.2	2.8	26.7

Appendix C. Supplemental output from empirical application

Figure 5: Changes to policy rate: probabilities of latent policy regimes (loose, neutral and tight)

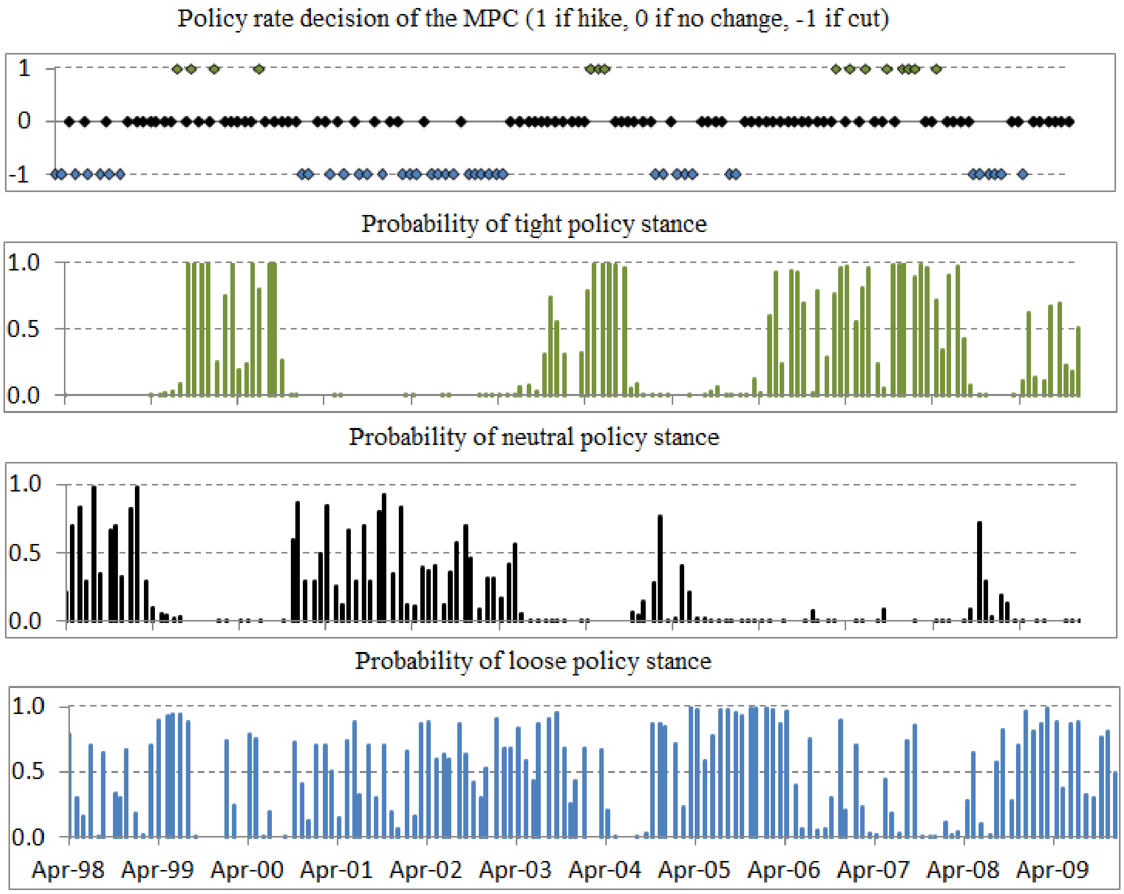

Table 22: Sample descriptive statistics

Variable	Mean	Median	Std deviation	Minimum	Maximum
Δy_i	-0.09	0.00	0.59	-1.00	1.00
spread	-0.11	0.07	0.90	-3.02	1.37
$\Delta ecbr$	-0.01	0.00	0.18	-0.75	0.50
situation	0.13	0.16	0.11	-0.20	0.34
Δcpi	-0.07	-0.10	0.49	-1.80	1.40
$\Delta nbpr$	-0.14	0.00	0.57	-2.50	2.50
bias	0.17	0.00	0.71	-1.00	1.00
$I(h)_i$	0.24	0.00	0.43	0.00	1.00
$I(d)_i$	0.14	0.00	0.35	0.00	1.00
dissent	0.07	0.00	0.21	-0.44	0.50
$I(cpi^e > tar)$	0.53	1.00	0.50	0.00	1.00

Notes: 1385 observations. For definitions of variables see Table 3.

Table 23: Dependent variable: individual policy preferrences of MPC members

MPC meeting date	Dab	Gra	Joz	Krz	Lac	Pru	Ros	Woz	Zio	Gro	Bal	Cze	Fil	Nie	Nog	Ows	Pie	Sla	Was	Woj	Skr
25-Feb-98	1	1		1	1	1	1	1		1											
18-Mar-98	0	0	0	0	0	0	0	0	0	0											
22-Apr-98	0	-1	-1	-1	-1	-1	-1	-1	-1	-1											
20-May-98	0	-1	-1	-1	-1	-1	-1	-1	-1	-1											
17-Jun-98	0	0	0	0	0	0	0	0	0	0											
16-Jul-98	0	-1	-1	0	-1	-1	-1	0	-1	-1											
19-Aug-98	0	0	0	0	0	0	0	0	0	0											
9-Sep-98	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1											
28-Oct-98		-1	-1			-1		-1	-1	-1											
18-Nov-98	0	0	0	0	0	0	0	0	0	0											
9-Dec-98	0	-1	-1	-1	-1	-1	-1	-1	-1	-1											
20-Jan-99			0	-1	-1	0	-1	-1	-1	-1											
17-Feb-99	0	0	0	0	0	0	0	0	0	0											
24-Mar-99	0	0	0	0	0	0	0	0	0	0											
21-Apr-99	0	0	0	0	0	0	0	0	0	0											
27-May-99	0	0	0	0	0	0	0	0	0	0											
16-Jun-99	0	0	0	0	0	0	0	0	0	0											
21-Jul-99	0	0	0	0	0	0	0	0	0	0											
18-Aug-99	0	0	0	0	0	0	0	0	0	0											
22-Sep-99	1	1	1	1	1	1		1	0	1											
20-Oct-99	0	0	0	0	0	0	0	0	0	0											
17-Nov-99	1	1	1	1	1	1	1	1	1	1											
15-Dec-99	0	0	0	0	0	0	0	0	0	0											
26-Jan-00	0	0	0	0	0	0	0	0	0	0											
23-Feb-00	1	1	1	1		1	1	1	1	1											
29-Mar-00	0	0	0	0	0	0	0	0	0	0											
26-Apr-00	0	0	0	0	0	0	0	0	0	0											
24-May-00	0	0	0	0	0	0	0	0	0	0											
21-Jun-00	1	0	1	0	0	1	1	0	0	0											
19-Jul-00	0	0	0	0	0	0	0	0	0	0											
30-Aug-00	1	1	1	1	1	1	1	0	1	1											
19-Sep-00	0	0	0	0	0	0	0	0	0	0											
25-Oct-00	0	0	0	0	0	0	0	0	0	0											
29-Nov-00	0	0	0	0	0	0	0	0	0	0											
20-Dec-00	0	0	0	0	0	0	0	0	0	0											
22-Jan-01	0	0	0	0	0	0	0	0	0		0										
28-Feb-01	0	-1	-1	-1	-1	-1	-1	-1	-1		-1										
28-Mar-01	0	0	0	-1	0	0	-1	-1	-1		-1										
26-Apr-01	0	0	0	0	0	0	0	0	0		0										
30-May-01	0	0	0	-1	0	0	-1	-1	-1		0										
27-Jun-01	0	-1	-1	-1	-1	-1	-1	-1	-1		-1										
20-Jul-01	0	0	0	0	0	0	0	0	0		0										
22-Aug-01	0	-1	-1	-1	-1	-1	-1	-1	-1		-1										
26-Sep-01	0	0	0	0	0	0	0	0	0		0										
25-Oct-01	0	-1	-1	-1	-1	-1	-1	-1	-1		-1										
28-Nov-01	0	0	0	-1	0	0	-1	-1	-1		-1										
19-Dec-01	0	0	0	0	0	0	0	0	0		0										
30-Jan-02	0	-1	-1	-1	-1	0	-1	-1	-1		-1										
27-Feb-02	0	0	0	0	0	0	0	0	0		0										

Table 24: Dependent variable: individual policy preferrences of MPC members (contd)

MPC meeting date	Dab	Gra	Joz	Krz	Lac	Pru	Ros	Woz	Zio	Gro	Bal	Cze	Fil	Nie	Nog	Ows	Pie	Sla	Was	Woj	Skr
27-Mar-02	0	0	0	0	0	0	-1	-1	-1		0										
26-Apr-02	0	-1	-1	-1	-1	0		-1	-1		-1										
29-May-02	0	-1	-1	-1	-1	-1	-1	-1	-1		-1										
26-Jun-02	0	-1	-1	-1	-1	0	-1	-1	-1		-1										
19-Jul-02	0	0	0	-1	0	0	-1	-1	-1		0										
28-Aug-02	-1	-1	-1	-1	-1	-1		-1	-1		-1										
25-Sep-02	0	0	-1	-1	-1	0		-1	-1		-1										
23-Oct-02	0	0	0	-1	0	0	-1	-1	-1		-1										
27-Nov-02	0	0	0	-1	0	0	-1	-1	-1		-1										
18-Dec-02	0	0	0	0	0	0	0	0	0		0										
29-Jan-03	0	-1	-1	-1	-1	0	-1	-1	-1		-1										
26-Feb-03	0	-1	0	-1	0	-1	-1	-1			-1										
26-Mar-03	0	-1	0	-1	-1	0	-1	-1	-1		-1										
24-Apr-03	0		0	-1	0	0	-1	-1	-1		-1										
28-May-03	0	0	0	-1	0	0	-1	-1	-1		-1										
25-Jun-03	0	0	0	-1	0	0	-1	-1	-1		-1										
18-Jul-03	0	0	0	0	0	0	0	0	0		0										
27-Aug-03		0	0		0	0	-1	-1	-1		0	-1									
30-Sep-03	0	0	0		0	0	0	0	0		0	0									
29-Oct-03	0	0	0		0	0	0	0	0		0	0									
26-Nov-03	0	0	0		0	0	0	0	0		0	0									
17-Dec-03	0	0	0		0	0	0	0	0		0	0									
21-Jan-04	0	0	0		0		0	0	0		0	0					0				
25-Feb-04											0	0	0	0	0	0	0	0	0	0	
31-Mar-04											0	0	0	0	0	0	0	0	0	0	
27-Apr-04											0	0	0	0	0	0	0	0	0	0	
26-May-04											0	0	0	0	0	0	0	0	0	0	
30-Jun-04											1	1	1	1	1	1	1	1	1	1	
28-Jul-04											1	0	1	0	1	0	0	1	1	1	
25-Aug-04											1	1	1	1	1	1	1	1	1	1	
29-Sep-04											0	0	0	0	0	0	0	0	0	0	
27-Oct-04											0	0	0	0	0	0	0	0	0	0	
24-Nov-04											0	0	0	0	0	0	0	0	0	0	
15-Dec-04											0	0	0	0	0	0	0	0	0	0	
26-Jan-05											0	0	0	0	0	0	0	0	0	0	
25-Feb-05											0	0	0	0	0	0	0	0	0	0	
30-Mar-05											-1	-1	0	-1	-1	-1	-1	-1	-1	-1	
27-Apr-05											-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	
25-May-05											0	0	0	0	0	0	0	0	0	0	
29-Jun-05											-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	
27-Jul-05											0	-1	0	-1	0	-1	-1	-1	0	-1	
31-Aug-05											0	-1	0	-1	0	-1	-1	-1	0	-1	
28-Sep-05											0	0	0	0	0	0	0	0	0	0	
26-Oct-05											0	0	0	0	0	0	0	0	0	0	
30-Nov-05											0	0	0	0	0	0	0	0	0	0	
21-Dec-05											0	0	0	0	0	0	0	0	0	0	
31-Jan-06											0	-1	0	-1	0	-1	-1	-1	-1	-1	
28-Feb-06											0	-1	0	-1	0	-1	-1	-1	0	-1	
29-Mar-06											0	0	0	0	0	0	0	0	0	0	

Table 25: Dependent variable: individual policy preferrences of MPC members (contd)

MPC meeting date	Dab	Gra	Joz	Krz	Lac	Pru	Ros	Woz	Zio	Gro	Bal	Cze	Fil	Nie	Nog	Ows	Pie	Sla	Was	Woj	Skr
26-Apr-06											0	0	0	0	0	0	0	0	0	0	
31-May-06											0	0	0	0	0	0	0	0	0	0	
28-Jun-06											0	0	0	0	0	0	0	0	0	0	
26-Jul-06											0	0	0	0	0	0	0	0	0	0	
30-Aug-06											0	0	0	0	0	0	0	0	0	0	
27-Sep-06											0	0	0	0	0	0	0	0	0	0	
25-Oct-06											1	0	1	0	1	0	0	0	1	0	
29-Nov-06											1	0	1	0	1	0	0	0	1	0	
20-Dec-06											1		1	0	1	0	0	0	1	0	
31-Jan-07												0	0	0	0	0	0	0	0	0	0
28-Feb-07												0	1	0	1	0	0	0	1	0	0
28-Mar-07												0	1	0	1	0	0	1	1	1	0
25-Apr-07												1	1	0	1	0	0	1	1	1	0
30-May-07												0	1	0	1	0	0	0	1	1	0
27-Jun-07												1	1	0	1	0	0	1	1	1	0
25-Jul-07												0	0	0	0	0	0	0	0	1	0
29-Aug-07												1	1	1	1	1	1	1	1	1	0
26-Sep-07												0	0	0	0	0	0	0	0	0	0
31-Oct-07												0	1	0	1	0	0	0	1	1	0
28-Nov-07												1	1	1	1	1	1	1	1	1	1
19-Dec-07												0	1	0	1	0	0	0	1	1	0
30-Jan-08												1	1	1	1	1	0	1	1	1	1
27-Feb-08												1	1	0	1	0	0	1	1	1	1
26-Mar-08												1	1	1	1	1	1	1	1	1	1
30-Apr-08												0	1	0	1	0	0	0	1	1	0
28-May-08												0	1	0	1	0	0	0	1	1	0
25-Jun-08												1	1	1	1	1	1	1	1	1	1
30-Jul-08												0	1	0	0	0	0	0	1	1	0
27-Aug-08												0	1	0	1	0	0	1	1	1	0
24-Sep-08												0	1	0	1	0	0	1	1	1	0
29-Oct-08												0	0	0	0	0	0	0	0	0	0
26-Nov-08												-1	0	-1	-1	-1	-1	-1	0	-1	-1
23-Dec-08												-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
27-Jan-09												-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
25-Feb-09												-1	0	-1	0	-1	-1	-1	-1	0	-1
25-Mar-09												-1	0	-1	0	-1	-1	0	0	0	-1
29-Apr-09												0	0	0	0	0	0	0	0	0	0
27-May-09												0	0	0	0	0	0	0	0	0	0
24-Jun-09												-1	0	-1	0	-1	-1	0	0	0	-1
29-Jul-09												0	0	0	0	0	0	0	0	0	0
26-Aug-09												0	0	0	0	0	0	0	0	0	0
30-Sep-09												0	0	0	0	0	0	0	0	0	0
28-Oct-09												0	0	0	0	0	0	0	0	0	0
25-Nov-09												0	0	0	0	0	0	0	0	0	0
23-Dec-09												0	0	0	0	0	0	0	0	0	0

Notes: Policy preferences to increase/leave unchanged/reduce the reference rate are coded as 1/0/-1. MPC members are coded as: Bal - Balcerowicz, Cze - Czekaj, Dab - Dąbrowski, Fil - Filar, Gra - Grabowski, Gro - Gronkiewicz-Waltz, Joz - Józefiak, Krz - Krzyżewski, Lac - Łączkowski, Nie - Nieckarz, Nog - Noga, Ows - Owsiak, Pie - Pietrewicz, Pru - Pruski, Ros - Rosati, Skr - Skrzypek, Sla - Sławiński, Was - Wasilewska-Trenkner, Woj - Wojtyna, Woz - Wójtowicz, Zio - Ziółkowska.

Table 26: MPC decisions on policy rate and bias, and measure of dissent at MPC meetings

MPC meeting date	Policy rate change	Policy bias	Dissent	MPC meeting date	Policy rate change	Policy bias	Dissent	MPC meeting date	Policy rate change	Policy bias	Dissent
2/25/98	50	1	0.00	2/27/02	0	0	0.00	2/28/06	-25	-1	0.40
3/18/98	0	0	0.00	3/27/02	0	0	-0.30	3/29/06	0	-1	0.00
4/22/98	-100	0	0.10	4/26/02	-50	0	-0.11	4/26/06	0	-1	0.00
5/20/98	-150	0	0.10	5/29/02	-50	0	-0.20	5/31/06	0	-1	0.00
6/17/98	0	0	0.00	6/26/02	-50	0	-0.10	6/28/06	0	0	0.00
7/16/98	-250	0	0.30	7/19/02	0	0	-0.40	7/26/06	0	0	0.00
8/19/98	0	0	0.00	8/28/02	-50	0	-0.22	8/30/06	0	0	0.00
9/9/98	-100	0	0.00	9/25/02	-50	0	0.33	9/27/06	0	0	0.00
10/28/98	-100	0	0.00	10/23/02	-50	0	0.50	10/25/06	0	0	0.40
11/18/98	0	0	0.00	11/27/02	-25	0	0.10	11/29/06	0	0	0.40
12/9/98	-150	0	0.10	12/18/02	0	0	0.00	12/20/06	0	1	0.44
1/20/99	-250	0	0.25	1/29/03	-25	0	-0.20	1/31/07	0	1	0.00
2/17/99	0	0	0.00	2/26/03	-25	0	0.11	2/28/07	0	1	0.30
3/24/99	0	0	0.00	3/26/03	-25	0	0.30	3/28/07	0	1	0.50
4/21/99	0	0	0.00	4/24/03	-25	0	0.11	4/25/07	25	1	-0.40
5/27/99	0	0	0.00	5/28/03	-25	0	0.50	5/30/07	0	1	0.40
6/16/99	0	0	0.00	6/25/03	-25	0	0.50	6/27/07	25	1	-0.40
7/21/99	0	1	0.00	7/18/03	0	0	0.00	7/25/07	0	1	0.10
8/18/99	0	1	0.00	8/27/03	0	0	-0.44	8/29/07	25	1	-0.10
9/22/99	100	1	-0.11	9/30/03	0	0	0.00	9/26/07	0	1	0.00
10/20/99	0	1	0.00	10/29/03	0	0	0.00	10/31/07	0	1	0.40
11/17/99	250	1	0.00	11/26/03	0	0	0.00	11/28/07	25	1	0.00
12/15/99	0	1	0.00	12/17/03	0	0	0.00	12/19/07	0	1	0.40
1/26/00	0	1	0.00	1/21/04	0	0	0.00	1/30/08	25	1	0.20
2/23/00	100	1	0.00	2/25/04	0	0	0.00	2/27/08	25	1	0.00
3/29/00	0	1	0.00	3/31/04	0	0	0.00	3/26/08	25	1	0.30
4/26/00	0	1	0.00	4/27/04	0	1	0.00	4/30/08	0	1	0.40
5/24/00	0	1	0.00	5/26/04	0	1	0.00	5/28/08	0	1	0.40
6/21/00	0	1	0.40	6/30/04	50	1	-0.10	6/25/08	25	1	0.00
7/19/00	0	1	0.00	7/28/04	25	1	-0.20	7/30/08	0	1	0.30
8/30/00	150	1	-0.10	8/25/04	50	1	-0.20	8/27/08	0	1	0.50
9/19/00	0	1	0.00	9/29/04	0	1	0.00	9/24/08	0	1	0.50
10/25/00	0	1	0.00	10/27/04	0	1	0.00	10/29/08	0	0	0.00
11/29/00	0	1	0.00	11/24/04	0	1	0.00	11/26/08	-25	-1	0.00
12/20/00	0	0	0.00	12/15/04	0	1	0.00	12/23/08	-75	-1	0.50
1/22/01	0	0	0.00	1/26/05	0	1	0.00	1/27/09	-75	-1	0.30
2/28/01	-100	0	-0.30	2/25/05	0	-1	0.00	2/25/09	-25	-1	0.00
3/28/01	-100	0	0.50	3/30/05	-50	-1	0.10	3/25/09	-25	-1	0.50
4/26/01	0	0	0.00	4/27/05	-50	0	0.00	4/29/09	0	-1	0.00
5/30/01	0	0	-0.40	5/25/05	0	0	0.00	5/27/09	0	-1	0.00
6/27/01	-150	0	-0.30	6/29/05	-50	-1	0.00	6/24/09	-25	-1	0.50
7/20/01	0	0	0.00	7/27/05	-25	-1	0.40	7/29/09	0	-1	0.00
8/22/01	-100	0	0.10	8/31/05	-25	-1	0.40	8/26/09	0	-1	0.00
9/26/01	0	0	0.00	9/28/05	0	-1	0.00	9/30/09	0	-1	0.00
10/25/01	-150	0	0.10	10/26/05	0	-1	0.00	10/28/09	0	0	0.00
11/28/01	-150	0	0.50	11/30/05	0	-1	0.00	11/25/09	0	0	0.00
12/19/01	0	0	0.00	12/21/05	0	-1	0.00	12/23/09	0	0	0.00
1/30/02	-150	0	0.20	1/31/06	-25	-1	0.30				

Notes: The measure of dissent at each MPC meeting is computed using Eq. (16). The indicator of 'policy bias' at each MPC meeting is defined as -1 if it is 'easing', 0 if 'neutral', and 1 if 'restrictive'.

Table 27: Average measures of individual dissents of MPC members

MPC member	Average dissent	MPC member	Average dissent	MPC member	Average dissent
Filar	0.400	Łączkowski	0.145	Nieckarz	-0.086
Dąbrowski	0.353	Grabowski	0.130	Krzyżewski	-0.109
Wasilewska-Trenkner	0.343	Balcerowicz	0.111	Pietrewicz	-0.127
Noga	0.329	Sławiński	0.086	Skrzypek	-0.143
Pruski	0.229	Gronkiewicz-Waltz	0.000	Rosati	-0.197
Wojtyna	0.214	Czekaj	-0.027	Wójtowicz	-0.225
Józefiak	0.186	Owsiak	-0.057	Ziółkowska	-0.232

Notes: The individual dissents of each MPC member are computed using Eq. (15).

Table 28: Estimated coefficients for the OP and ZIOP models with fixed effects

	Ordered Probit Model	Zero-Inflated Ordered Probit Model	
Covariates		Participation equation	Amount equation
$spread_t$	0.61 (0.06)**	-0.06 (0.11)	1.97 (0.35)**
$\Delta ecbr_t$	1.69 (0.24)**	1.90 (0.46)**	3.37 (0.68)**
$situation_t$	0.79 (0.43)	-0.66 (0.68)	2.75 (0.73)**
Δcpi_t	0.99 (0.10)**	0.84 (0.18)**	1.68 (0.31)**
$\Delta nbpr_{t-1}$	-0.51 (0.08)**	0.88 (0.22)**	1.02 (0.32)**
$I(Fil)_t$	1.30 (0.30)**	2.07 (0.66)**	1.41 (0.91)
$I(Nie)_t$	0.00 (0.29)	0.48 (0.59)	-0.09 (0.92)
$I(Nog)_t$	1.14 (0.30)**	2.08 (0.70)**	1.17 (0.91)
$I(Ows)_t$	0.00 (0.29)	0.48 (0.59)	-0.09 (0.92)
$I(Pie)_t$	-0.04 (0.29)	0.32 (0.58)	-0.10 (0.92)
$I(Sla)_t$	0.43 (0.29)	1.78 (0.76)*	0.17 (0.93)
$I(Was)_t$	1.14 (0.30)**	2.16 (0.66)**	1.17 (0.91)
$I(Woj)_t$	0.82 (0.30)**	2.25 (0.67)**	0.66 (0.92)
$I(Cze)_t$	0.12 (0.29)	1.04 (0.67)	-0.13 (0.92)
$I(Skr)_t$	-0.11 (0.33)	0.94 (0.72)	-0.47 (1.07)
$I(Bal)_t$	0.10 (0.31)	0.87 (0.50)	0.21 (0.87)
$I(Dab)_t$	0.98 (0.28)**	-1.01 (0.48)*	1.15 (0.86)
$I(Gra)_t$	0.05 (0.29)	0.05 (0.40)	-0.17 (0.77)
$I(Joz)_t$	0.18 (0.29)	0.04 (0.40)	0.02 (0.78)
$I(Krz)_t$	-0.46 (0.30)	0.58 (0.41)	-1.06 (0.85)
$I(Lac)_t$	0.01 (0.29)	-0.02 (0.40)	-0.41 (0.78)
$I(Pru)_t$	0.38 (0.29)	-0.18 (0.41)	0.34 (0.76)
$I(Ros)_t$	-0.47 (0.30)	0.67 (0.41)	-1.09 (0.88)
$I(Wojz)_t$	-0.53 (0.30)	0.54 (0.41)	-1.18 (0.84)
$I(Zio)_t$	-0.57 (0.30)	0.66 (0.41)	-1.26 (0.88)
$bias_{t-1}$	1.36 (0.08)**	-2.01 (0.43)**	1.53 (0.18)**
$dissent_{t-1}$	1.20 (0.20)**	-0.51 (0.38)	2.09 (0.37)**
$I(cpi^e>tar)_t$	0.05 (0.09)	0.86 (0.19)**	-0.27 (0.20)
$threshold_1$	-1.00 (0.26)**	-0.60 (0.41)	-1.35 (0.87)
$threshold_2$	2.91 (0.28)**		3.7 (0.81)**

Notes: For definitions of variables see Table 3. **/* denote statistical significance at 1/5 percent level, respectively. Robust to serial dependence asymptotic standard errors are in parentheses.

Table 29: Estimated coefficients for the CNOP model with fixed effects

Covariates	Cross-Nested Ordered Probit Model		
	Inclination equation	Policy amount equations	
		Loose regime	Tight regime
$spread_t$	2.38 (0.28)**		
$\Delta ecbr_t$	3.94 (0.54)**		
$situation_t$	6.42 (1.19)**		
Δcpi_t	4.43 (0.39)**		
$\Delta nbpr_{t-1}$	7.16 (1.32)**	-1.08 (0.10)**	-3.69 (0.39)**
$I(Fil)_t$	1.97 (0.54)**	1.96 (0.51)**	1.88 (0.60)**
$I(Nie)_t$	0.21 (0.56)	0.45 (0.34)	-0.22 (0.68)
$I(Nog)_t$	1.74 (0.58)**	1.59 (0.48)**	1.74 (0.61)**
$I(Ows)_t$	0.21 (0.56)	0.45 (0.34)	-0.22 (0.68)
$I(Pie)_t$	0.20 (0.56)	0.45 (0.34)	-0.41 (0.70)
$I(Sla)_t$	0.94 (0.58)	0.38 (0.34)	0.57 (0.64)
$I(Was)_t$	1.57 (0.59)**	1.54 (0.44)**	1.97 (0.61)**
$I(Woj)_t$	1.03 (0.59)	1.02 (0.39)**	1.56 (0.62)*
$I(Cze)_t$	0.11 (0.57)	0.37 (0.33)	0.29 (0.65)
$I(Skr)_t$	-0.54 (0.67)	-0.13 (0.43)	-0.12 (0.75)
$I(Bal)_t$	1.07 (0.46)*	0.23 (0.30)	1.93 (0.68)**
$I(Dab)_t$	-0.75 (0.75)	2.65 (0.42)**	1.50 (0.62)*
$I(Gra)_t$	0.05 (0.38)	0.73 (0.29)*	-0.02 (0.77)
$I(Joz)_t$	-0.16 (0.43)	0.86 (0.30)**	1.38 (0.58)*
$I(Krz)_t$	-0.16 (0.35)	0.00 (0.25)	0.06 (0.66)
$I(Lac)_t$	0.06 (0.42)	0.72 (0.30)*	-0.26 (0.76)
$I(Pru)_t$	-0.02 (0.52)	1.14 (0.32)**	1.34 (0.59)*
$I(Ros)_t$	-0.50 (0.44)	-0.10 (0.28)	1.39 (0.60)*
$I(Wojz)_t$	-0.40 (0.41)	-0.06 (0.28)	-0.45 (0.69)
$I(Zio)_t$	-0.38 (0.41)	-0.15 (0.28)	-0.46 (0.69)
$bias_{t-1}$	0.18 (0.30)	2.18 (0.12)**	1.99 (0.17)**
$dissent_{t-1}$	0.93 (0.74)	1.32 (0.21)**	1.34 (0.80)
$I(cpi^e>tar)_t$			1.56 (0.17)**
$threshold_1$	-0.43 (0.52)	1.15 (0.25)**	3.03 (0.60)**
$threshold_2$	3.44 (0.63)**		

Notes: For definitions of variables see Table 3. **/* denote statistical significance at 1/5 percent level, respectively. Robust to serial dependence asymptotic standard errors are in parentheses.

Table 30: Estimated coefficients for the OP, ZIOP, CNOP and CNOPC models with two dummies for hawkish and dovish MPC members

Model	OP	ZIOP		CNOP			CNOPC		
Covariates	X	X	Z	X	Z^-	Z^+	X	Z^-	Z^+
$spread_t$	0.74** (0.06)	-0.05 (0.21)	1.22** (0.12)	2.32** (0.23)			2.30** (0.25)		
$\Delta ecbr_t$	1.57** (0.24)	2.27** (0.72)	2.23** (0.35)	3.79** (0.48)			3.82** (0.66)		
$situation_t$	0.73 (0.42)	-2.33 (1.51)	1.72** (0.55)	4.96** (0.87)			4.46** (1.34)		
Δcpi_t	0.92** (0.09)	2.55** (0.51)	1.19** (0.15)	3.70** (0.38)			3.65** (0.42)		
$\Delta nbpr_{t-1}$	-0.43** (0.07)	2.07** (0.50)	0.69** (0.14)	4.81** (0.65)	-0.95** (0.10)	-2.58** (0.30)	4.61** (0.98)	-0.96** (0.13)	-2.62** (0.39)
$I(h)_{it}$	0.83** (0.10)	-0.62 (0.58)	1.10** (0.13)	1.17** (0.20)	0.93** (0.13)	1.14** (0.21)	1.08** (0.33)	0.81 (0.45)	1.18** (0.26)
$I(d)_{it}$	-0.66** (0.12)	0.40 (0.44)	-0.54** (0.13)	-0.64** (0.17)	-0.80** (0.11)	-0.11 (0.21)	-0.60** (0.23)	-0.82** (0.20)	-0.15 (0.28)
$bias_{t-1}$	1.18** (0.07)	-1.34** (0.36)	1.01** (0.07)		2.03** (0.07)	1.73** (0.17)		1.89** (0.63)	1.84** (0.24)
$dissent_{t-1}$	1.24** (0.19)	-1.92** (0.61)	1.61** (0.22)		1.37** (0.21)	1.13* (0.57)		1.39** (0.28)	1.15 (0.70)
$I(cpi^e > tar)_t$	0.09 (0.09)	0.93** (0.29)	0.09 (0.12)			1.14** (0.19)			1.17** (0.26)
$threshold_1$	-1.07** (0.10)	-3.38** (0.86)	-0.94** (0.12)	-0.76** (0.17)	0.64** (0.06)	2.13** (0.28)	-0.69** (0.22)	0.65** (0.11)	2.26** (0.34)
$threshold_2$	2.60** (0.13)			2.61** (0.28)			2.57** (0.42)		
ρ^-								-0.48 (1.39)	
ρ^+								0.25 (0.33)	

Notes: For definitions of variables see Table 3. **/* denote statistical significance at 1/5 percent level, respectively. Robust to serial dependence asymptotic standard errors are in parentheses.