

Can Economic Integration reduce social unrest? Evidence from China, Hong Kong and Macau

Online Appendix

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A. Impact of Trade Liberalization on Social Unrest in Hong Kong and Macau, 1994-2018.

A1: Descriptive Statics

Descriptive statistics across Hong Kong and Macau:

Table 1: Descriptive Statistics of the Empirical Analysis

	Mean	Median	Std. Dev.	Min	Max
Confidence in 1C2S %	0.653	0.696	0.157	0.376	0.902
Dissent in 1C2S %	0.247	0.231	0.146	0.045	0.584
UEI	8.040	6.354	4.540	3.291	19.627
Dependence	194.544	23.747	207.367	9.090	529.906
Total Trade (Billion USD)	368,768.800	354,201.400	381,991.500	2,249.088	1,139,859.000

Descriptive Statistics by region:

Table 2: Descriptive statistics by region.

	Mean	SD	Min	Max
Hong Kong				
Confidence in 1C2S pc.	0.56	0.1	0.42	0.74
No Confidence in 1C2S pc.	0.33	0.1	0.2	0.5
UEI	8.64	4.28	4.48	16.24
Dependence	18.75	4.75	10.95	24.16
Trade Volume (bn. USD)	676190.07	269974.52	351953.4	1139859.44
RGDPe (2011 Intl Dollar).	295812.03	69757.95	187624.44	413570.16
N	24			

Table 3: Descriptive statistics by region.

	Mean	SD	Min	Max
Macau				
Confidence in 1C2S pc.	0.8	0.06	0.7	0.9
No Confidence in 1C2S pc.	0.11	0.06	0.04	0.23
UEI	5.97	3.22	3.29	13.01
Dependence	429.48	57.78	325.15	529.91
Trade Volume (bn. USD)	7884.89	2806.56	2540.29	12739.12
RGDPe (2011 Intl Dollar).	37840.47	22143.21	11657.3	72913.15
N	19			

A2: Time Series Plot of Trade Data

The implementation of the CEPA in 2003 is highlighted by a vertical dash line in the following plots.

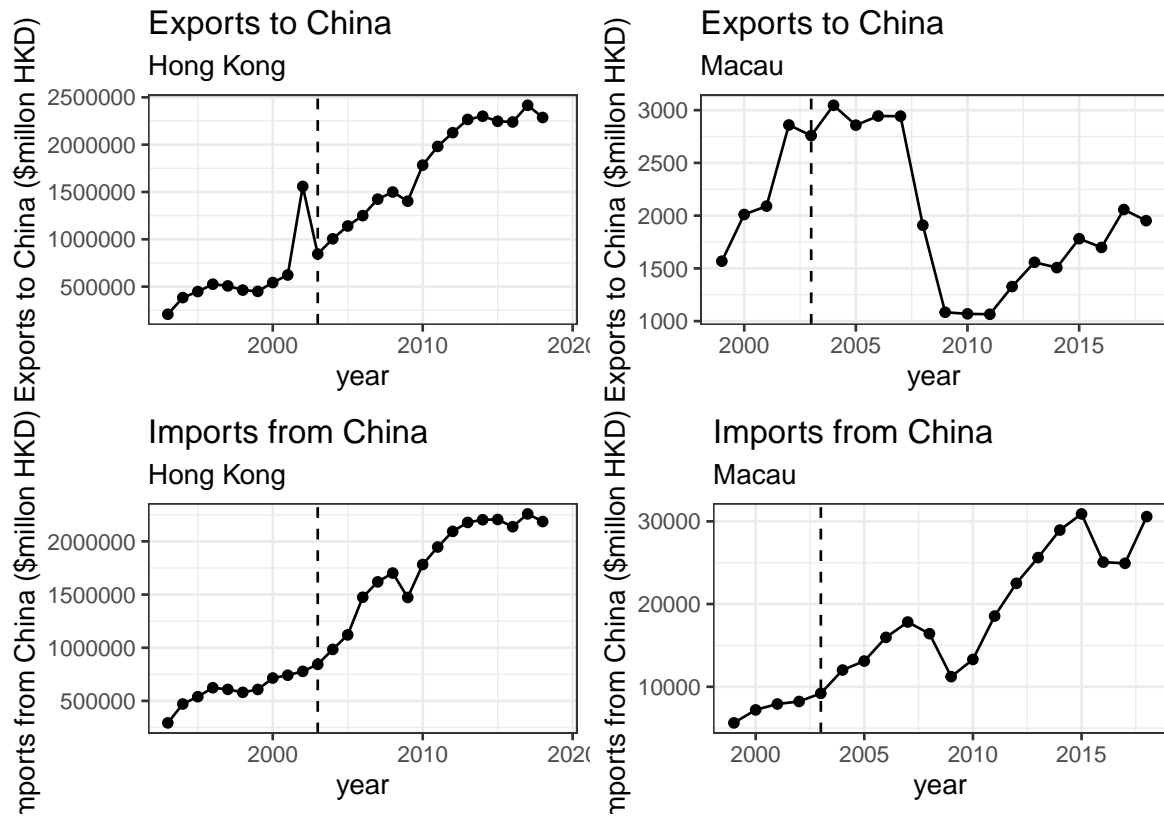


Figure 1: Trade Data Series in Hong Kong and Macau, 1994-2018

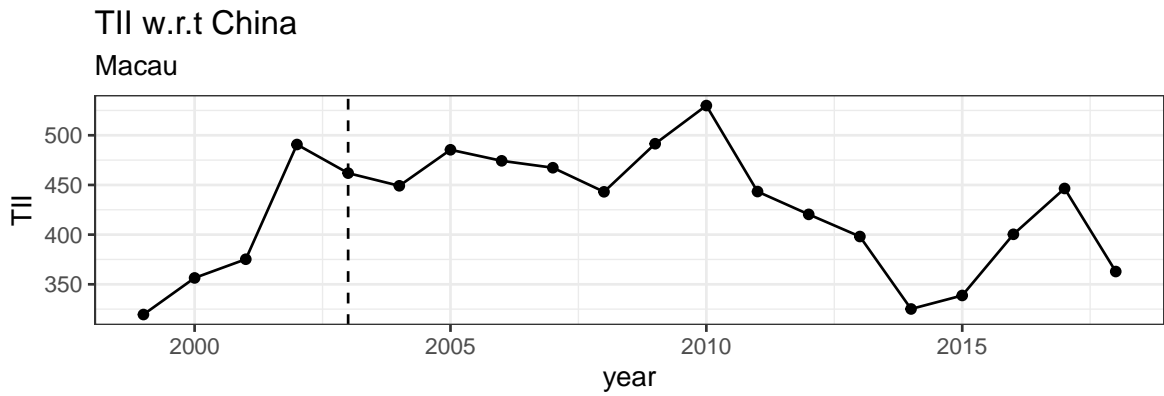
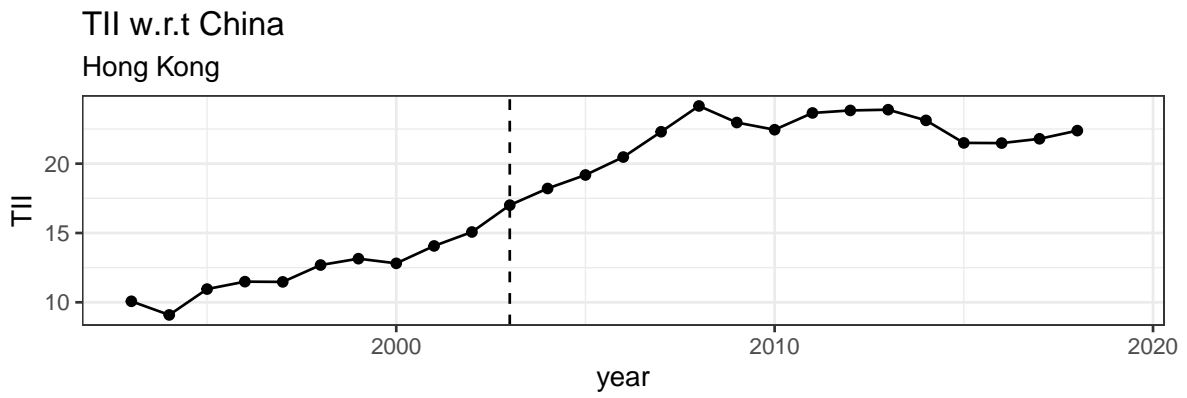


Figure 2: Trade Intensity Index with regards to China, 1994-2018

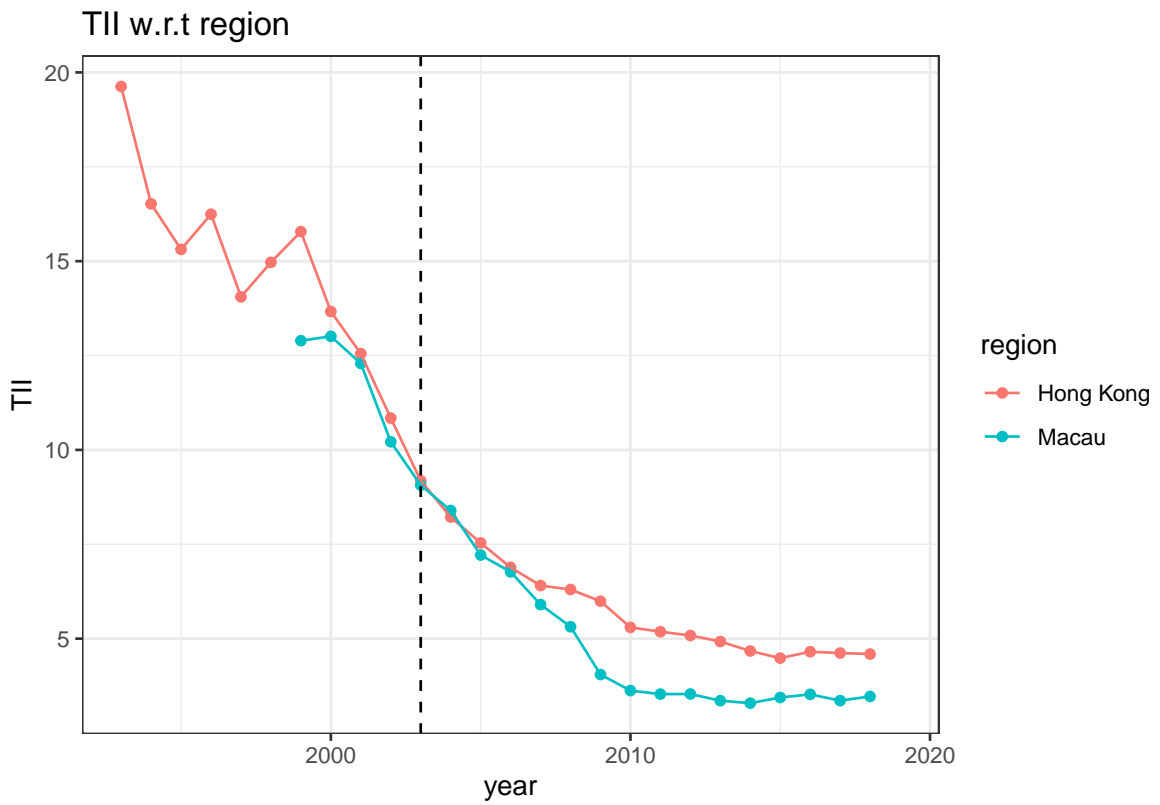


Figure 3: Trade Intensity Index with regards to Hong Kong and Macau, 1997-2019

A3 : Frequentist Estimation with Panel (Fixed Effects) Estimators

Table 4: Estimation by multivariate regression

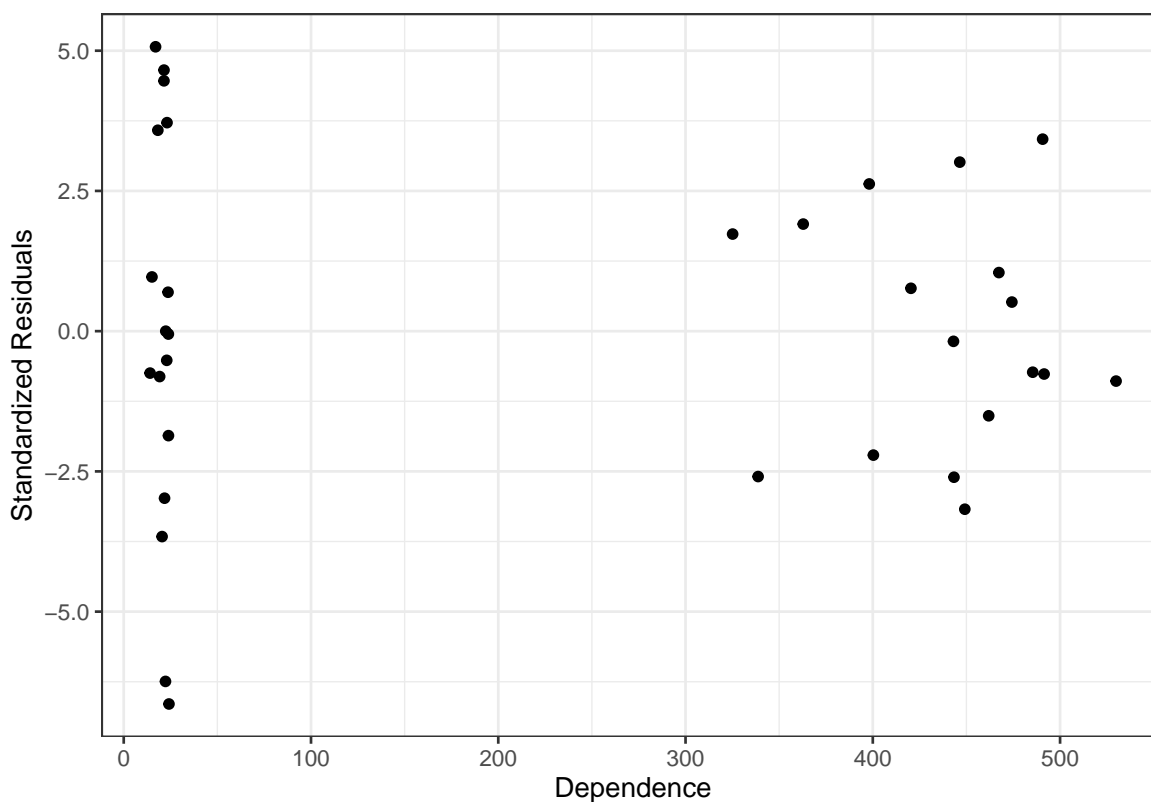
	Percentage of people not confident in the 1C2S		
	(1)	(2)	(3)
UEI	0.197 (0.395)	2.345*** (0.560)	3.653* (1.627)
Dependence	-0.060* (0.027)	-0.014 (0.024)	-0.022 (0.039)
Trade Volume	0.00002* (0.00001)	0.0001*** (0.00001)	0.0001*** (0.00002)
FDI			-0.023 (0.019)
Stock Market Joint Movement			-0.0003 (0.001)
HZMB			1.397 (4.052)
HK-Shenzhen ERL			3.288 (6.599)
Hengqin Island Joint Development			-2.523 (4.722)
Dependence * UEI		-0.008*** (0.002)	-0.010* (0.004)
Observations	46	46	34
R ²	0.296	0.545	0.656
Adjusted R ²	0.227	0.488	0.507
F Statistic	5.741** (df = 3; 41)	11.981*** (df = 4; 40)	4.879** (df = 9; 23)

Note:

*p<0.05; **p<0.01; ***p<0.001
 Presented are the results estimated by the one-way Fixed Effects Model.
 Standard errors are in parentheses.

A4: Diagnostics of the Frequentist Models

Distribution of Residuals:

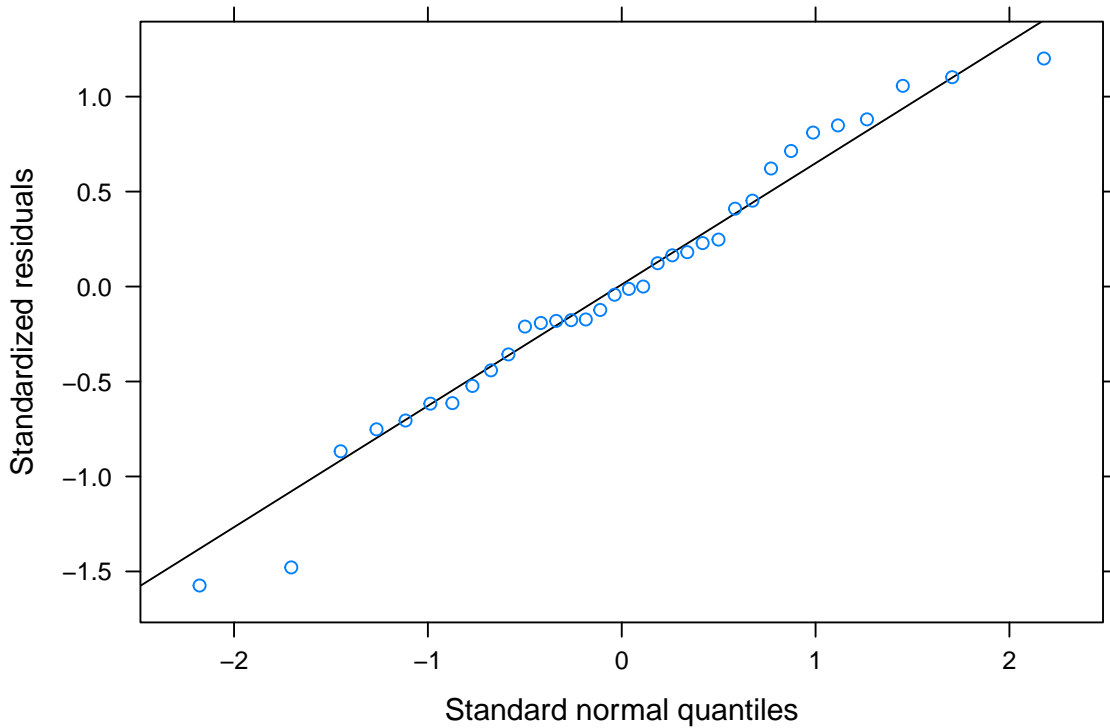


Homogeneity of variance:

```
## Analysis of Variance Table
##
## Response: residuals_abs2
##           Df Sum Sq Mean Sq F value Pr(>F)
## region    1  550.4  550.36  5.2258 0.02902 *
## Residuals 32 3370.1  105.32
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

The only clear pattern emerging from the residuals is that the residual distributions are quite different between the Hong Kong observations and Macau observations due to Macau having extremely high dependence. The Levene Test also shows that the distribution of variance is dependent on the region. While this may damage the robustness of our estimates in the multi-level models, note that we have acquired the same results from the panel models reported in section A3. The panel model is only looking at within-case fixed effects, so the estimated effect is not dependent on the region. Therefore, we can still say the results are robust to case selection, as well as estimation technique.

Normality of residuals:



Overall the standardized residuals almost form a straight diagonal line to standard normal quantiles. This suggests that the residuals resemble a normal distribution.

A5. Diagnostics of the Bayesian Model

The Model

When fitting this multi-level zero-inflated negative binomial model (ZINB), we assume the following:

$$y_i \sim N(\mu, \sigma_i^2)$$

$$\mu = \eta + \mathbf{X}\beta$$

$$\eta_{year} \sim N(0, 1)$$

$$\eta_{region} \sim N(0, 1)$$

$$\gamma \sim \text{Gamma}(.01, .01)$$

$$\tau \sim \text{Beta}(1, 1)$$

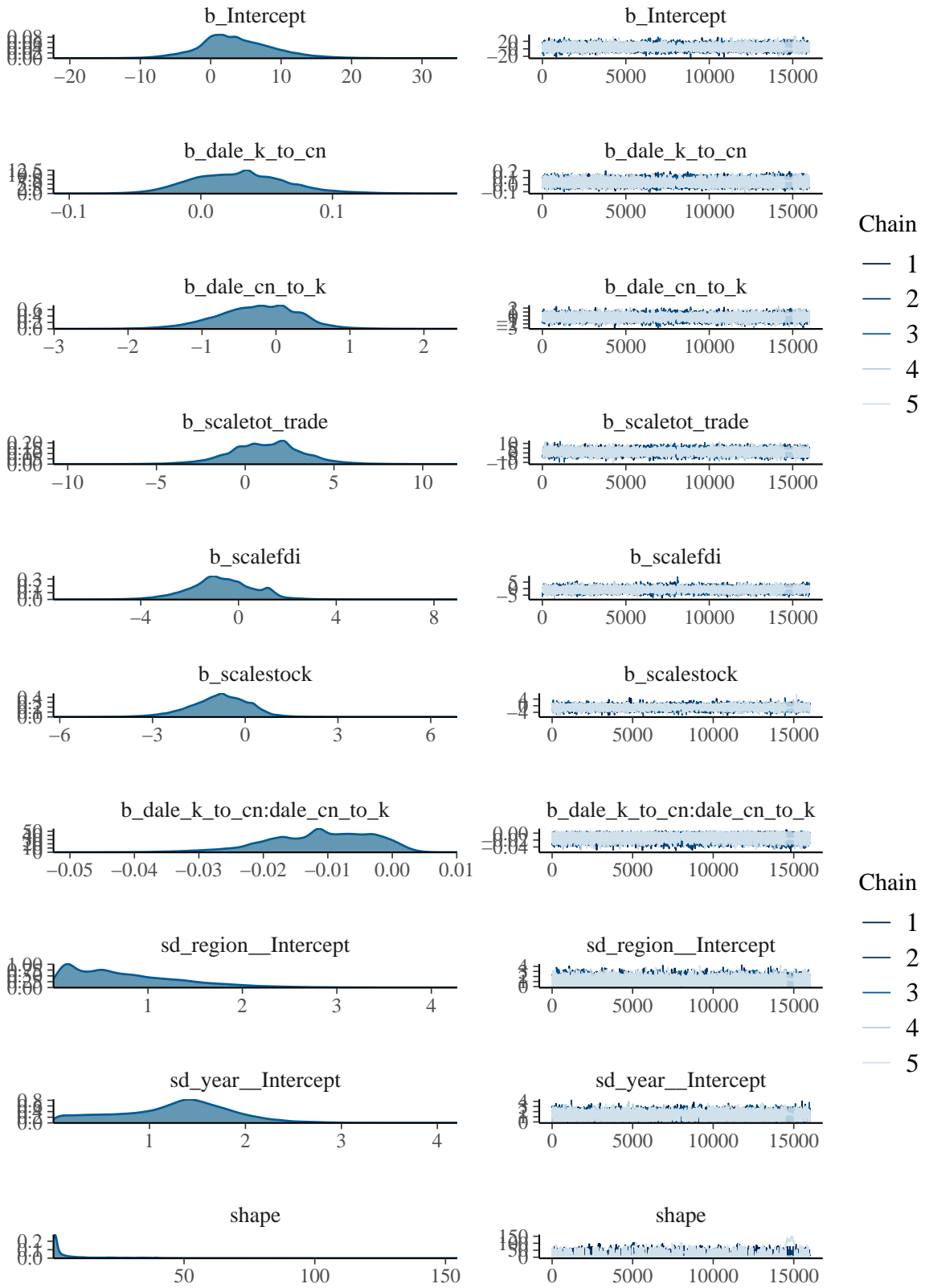
where the two η s refer to the random intercepts for region and years respectively, γ refers to the zero inflation parameter of the ZINB, and τ refers to the probability of success. A strong prior of $\eta \sim N(0, 1)$ is imposed for computational purposes, as in prior runs the η s tend to drift around very large numbers.

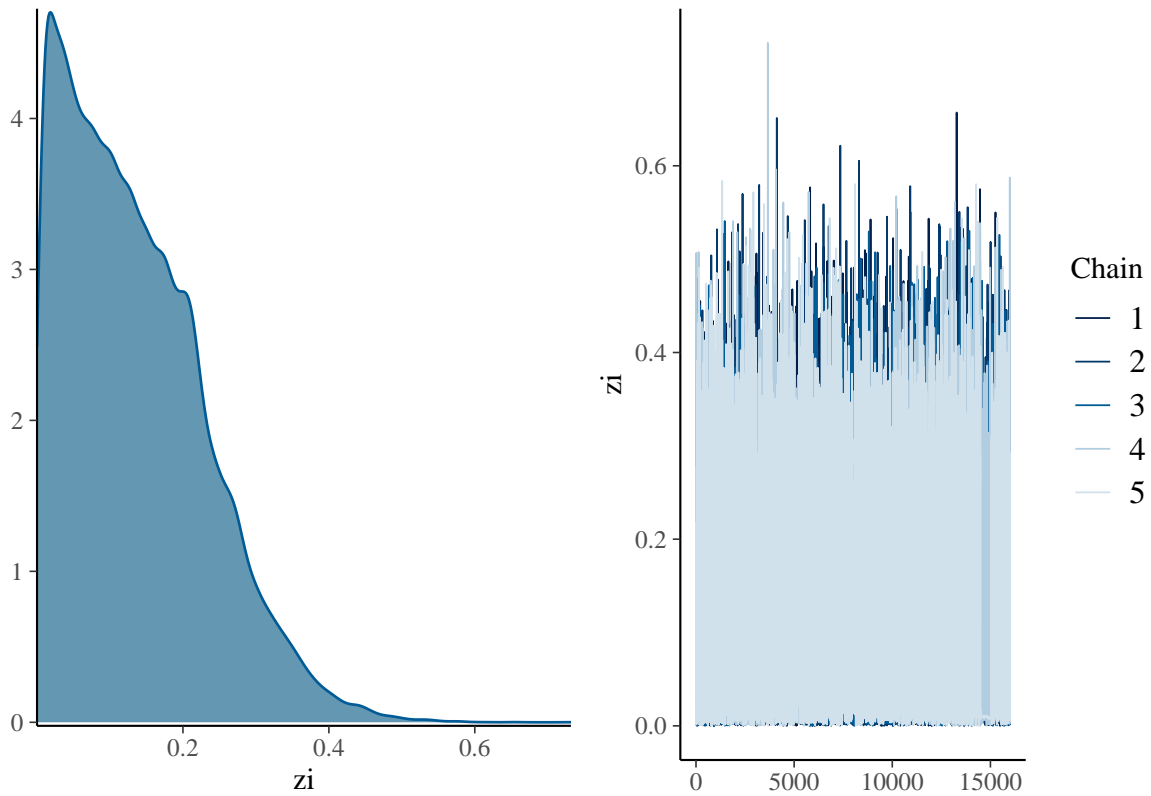
I also had to drop the event dummies because they would lead to the problem of complete separation. Both Frequentist and Bayesian estimation failed after including the event dummies. Considering that from the frequentist estimation none of the event dummies achieved statistical evidence, dropping these should not affect effect estimation.

Point Estimates and Critical Intervals

Predictors	Mean Number of Protests	
	Incidence Rate Ratios	CI 95%
Intercept	23.51	0.00–3350298.55
Dependence	1.03	0.97–1.11
UEI	0.80	0.25–2.09
Trade Volume	3.37	0.05–195.38
FDI	0.49	0.03–5.82
Stock Market Integration	0.46	0.06–2.28
Dependence * UEI	0.99	0.97–1.00
Random Effects		
σ^2	677.90	
τ_{00}	243.32	
ICC	0.80	
N region	2	
N year	18	
Observations	34	
Marginal R2 / Conditional R2	0.119 / 0.628	

Coefficient Distribution and MCMC Convergence

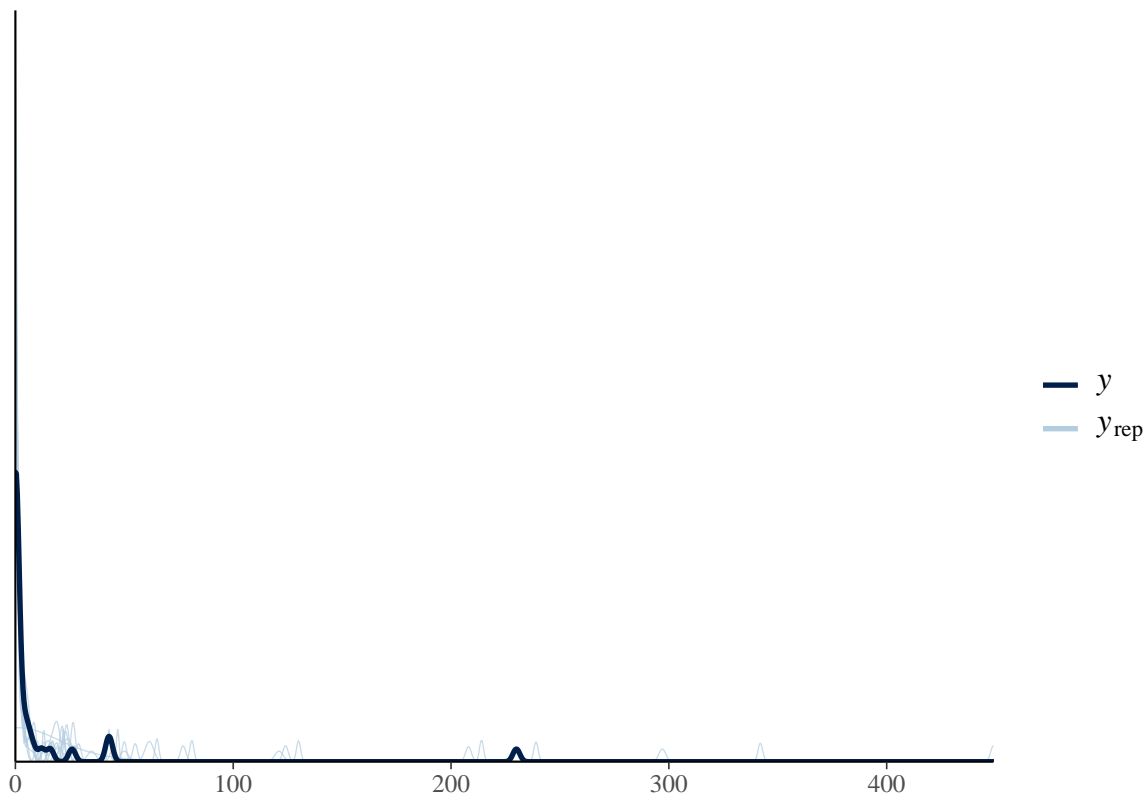




Note that the ZINB would run into computational issues if we variables are measured on drastically different scales. This is particularly the case for total trade volume, FDI and stock market joint movement which are measured in large quantities. To avoid this, I mean-centered these variables. Here, `dale_k_to_cn` refers to the Trade Intensity Index (TTI) for a region towards China; `dale_cn_to_k` refers to the TTI for China towards a peripheral region; `scaletot_trade` refers to the total trade volume in goods at the regional level; `scalefdi` refers to the FDI volume at the regional level; `scalestock` refers to the stock market joint movement in a particular region.

In this model, the MCMC chains have converged and remained stationary in the last 10000 samples from the posterior. This suggests that the model has converged well.

Posterior Predictive Check



The Posterior Predictive Check allows us to compare the predicted mean numbers of protest drawn from the posterior (y_{rep}) to the observed value y . In this plot we can see the posterior behaved quite well, with a minor exception that it tends to predict the mean number to be around 50 whereas the observed distribution has no cases in which this is true.

A6: Models including GDP

The above table presents the results of table 2 when we include log GDP per capita, using data from the Penn's World Table 7.1.

It is true that in model 5, our interaction variable between dependence and UEI lost statistical significance, but note that the effect is still in the expected direction. In addition, I suspect the lost significance is due to high multicollinearity between Log GDP per capita and total trade. The following Variance Inflation Factor (VIF) values suggest that this is true, as log GDP per capita has a highly inflated VIF value at 18.475, which far surpasses the rule of thumb for no multicollinearity at 10. Furthermore, the correlation between log GDP per capita and total trade volume is at a whopping 0.808, which suggests that we would not be able to acquire accurate estimates if we were to control for GDP simultaneously having total trade volume as one of our covariates. Given that in the literature the theory is about trade volume with international partners, I decided to go with trade volume instead of log GDP per capita.

dale_k_to_cn	dale_cn_to_k	tot_trade
71.303261	12.576585	45.403527
fdi	stock	bridge_pulse
21.184734	1.925483	1.442674
railway_pulse	henqin_pulse	I(log(rgdpe))
1.365854	1.363824	18.475142

dale_k_to_cn:dale_cn_to_k 22.857222

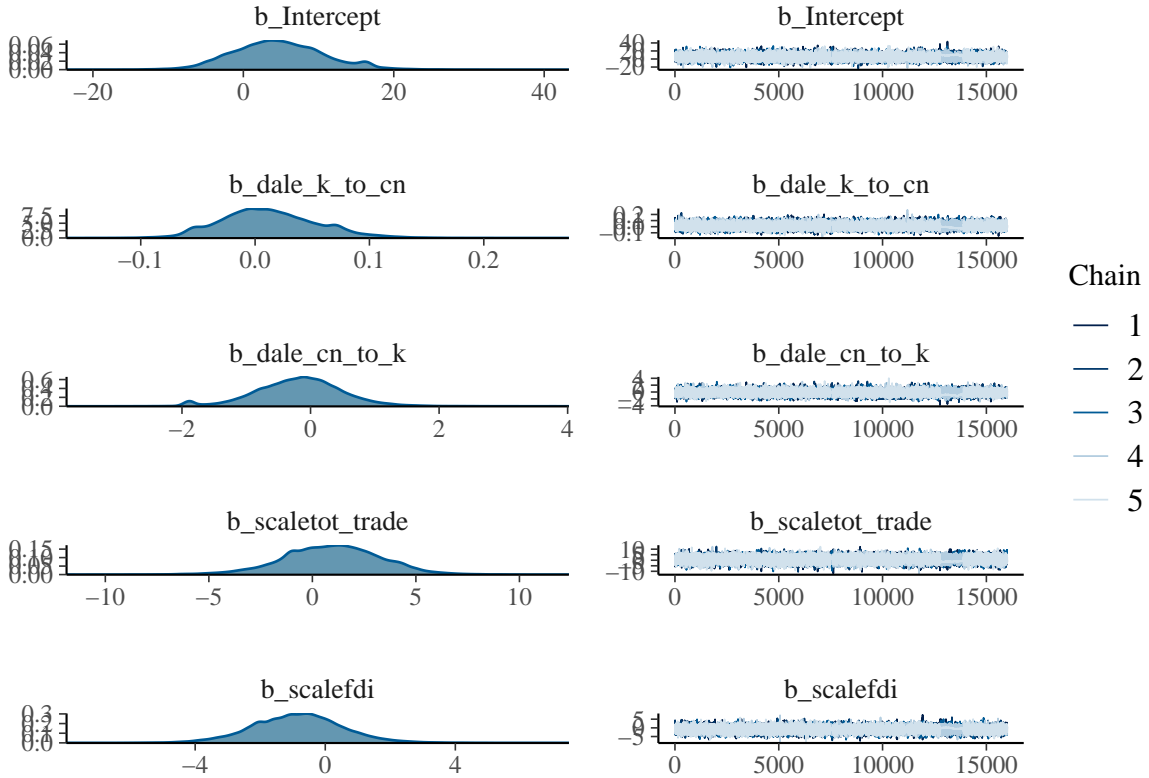
Table 6: Estimation by multivariate regression

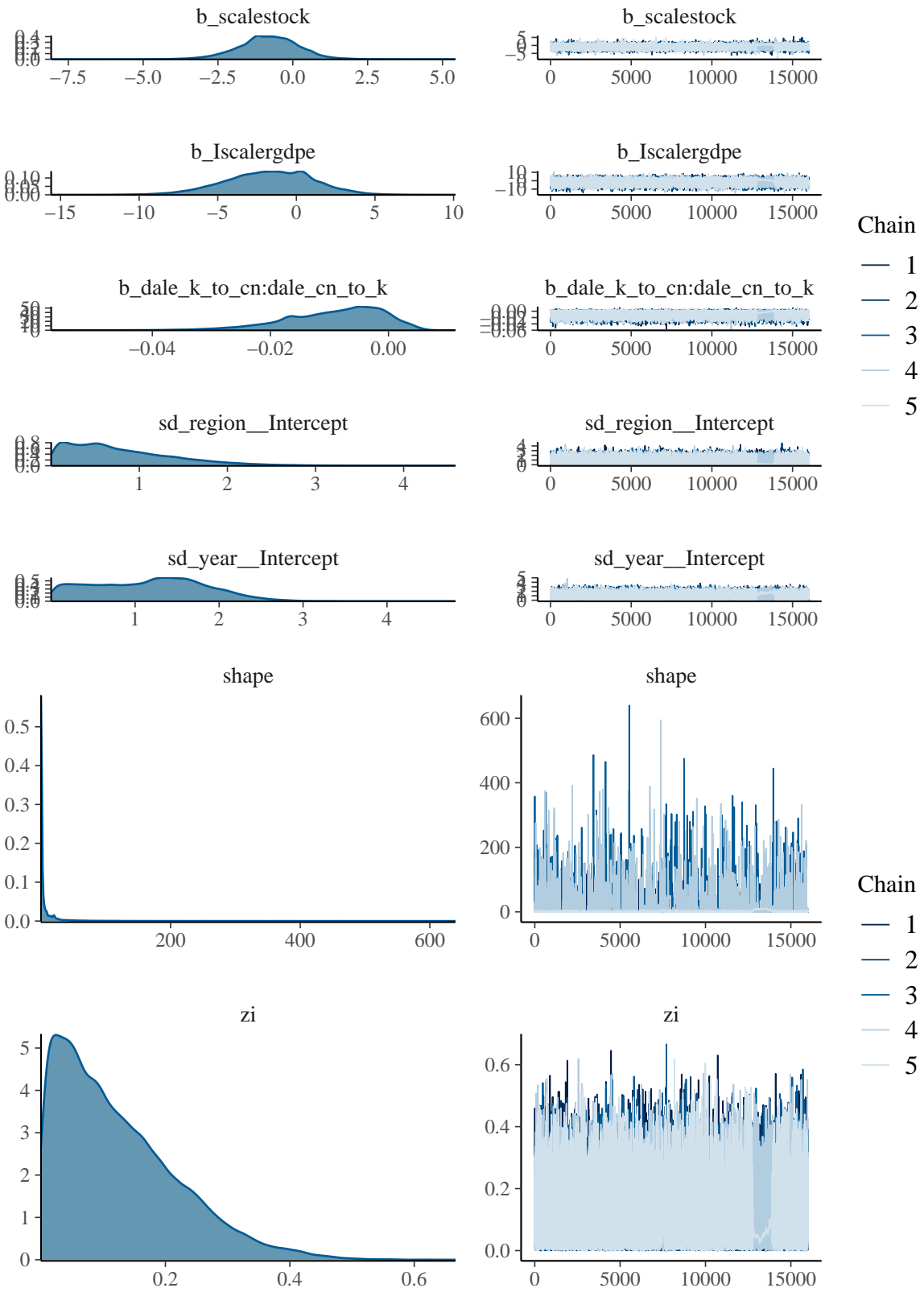
	Percentage of people not confident in the 1C2S		
	(1)	(2)	(3)
Dependence	-0.023 (0.019)	0.001 (0.018)	0.024 (0.034)
UEI	1.209** (0.466)	1.703** (0.565)	3.343* (1.324)
Trade Volume	0.00003*** (0.00001)	0.00004*** (0.00001)	0.0001*** (0.00001)
FDI			-0.020 (0.017)
Stock Market Joint Movement			-0.001 (0.001)
HZMB			0.564 (3.777)
HK-Shenzhen ERL			2.167 (6.002)
Hengqin Joint Development			-2.334 (4.302)
Log GDP	-10.333*** (2.676)	-8.016*** (2.241)	-11.390*** (3.024)
Dependence * UEI		-0.003* (0.001)	-0.005 (0.003)
Intercept	125.265*** (26.806)	91.308*** (23.170)	114.440*** (29.307)
Observations	43	43	34
Log Likelihood	-142.828	-146.582	-118.114
Akaike Inf. Crit.	301.655	311.164	264.228
Bayesian Inf. Crit.	315.745	327.015	285.597

Note:

*p<0.05; **p<0.01; ***p<0.001

Presented are the results estimated by linear mixed-effects regression with random intercepts varying by region and year of the observation. Standard errors are in parentheses.





A7: Models Including Gini Coefficient

Table 7: Estimation by multivariate regression

	Percentage of people not confident in the 1C2S		
	(1)	(2)	(3)
Dependence	-0.026** (0.008)	-0.003 (0.018)	0.029 (0.034)
UEI	0.236 (0.326)	2.115*** (0.538)	2.794* (1.400)
Trade Volume	0.00002*** (0.00000)	0.00005*** (0.00001)	0.0001*** (0.00002)
FDI			-0.021 (0.016)
Stock Market Joint Movement			0.00003 (0.001)
HZMB			3.756 (4.431)
HK-Shenzhen ERL			4.046 (6.077)
Hengqin Joint Development			-5.037 (4.162)
Gini Coefficient			-168.029* (73.461)
Dependence * UEI		-0.007*** (0.002)	-0.005 (0.003)
Intercept	21.302*** (5.158)	1.012 (19.616)	59.949* (26.477)
Observations	46	46	34
Log Likelihood	-163.822	-163.573	-116.261
Akaike Inf. Crit.	341.644	343.145	260.523
Bayesian Inf. Crit.	354.445	357.774	281.892

Note:

*p<0.05; **p<0.01; ***p<0.001

Presented are the results estimated by linear mixed-effects regression.
with random intercepts varying by region and year of the observation.

Standard errors are in parentheses.

Observed Value Prediction of Dissent towards 1C2S

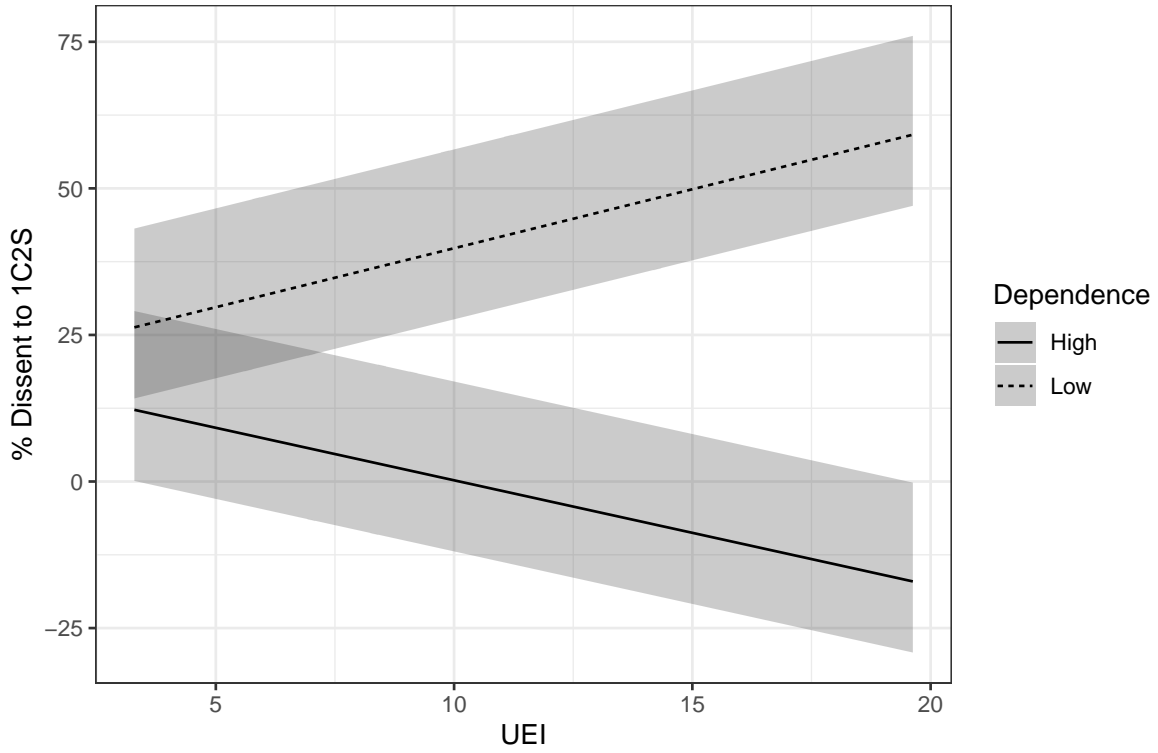
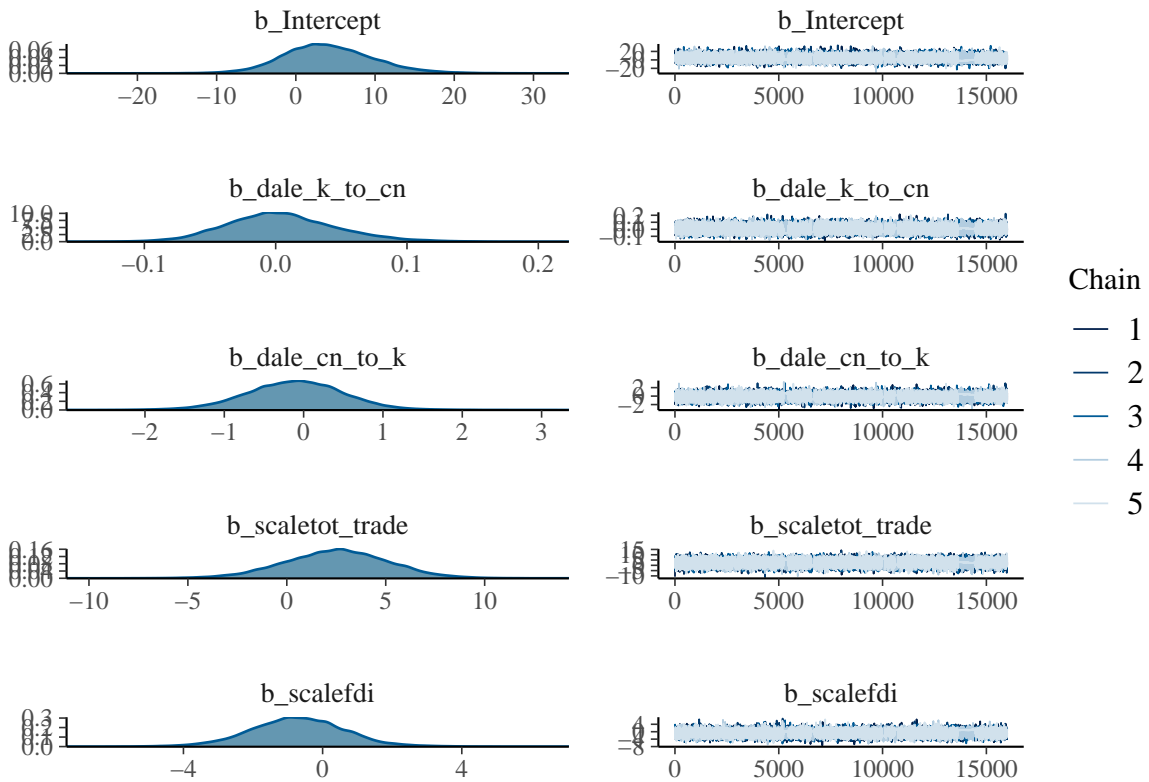
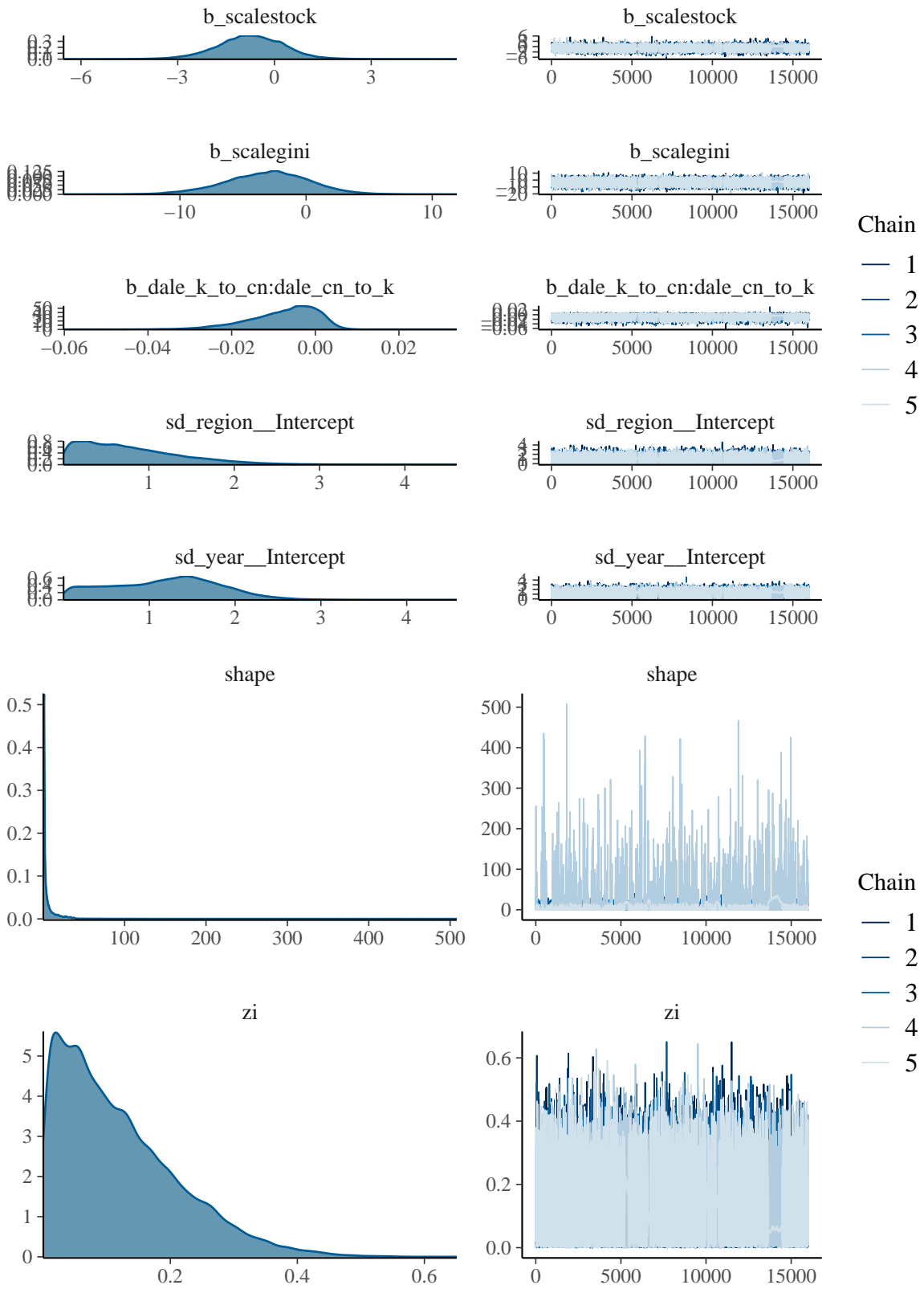


Figure 4: Predicting dissent towards 1C2S





B. Fiscal Decentralization, Economic Dependence and Protests in China, 2000-2019

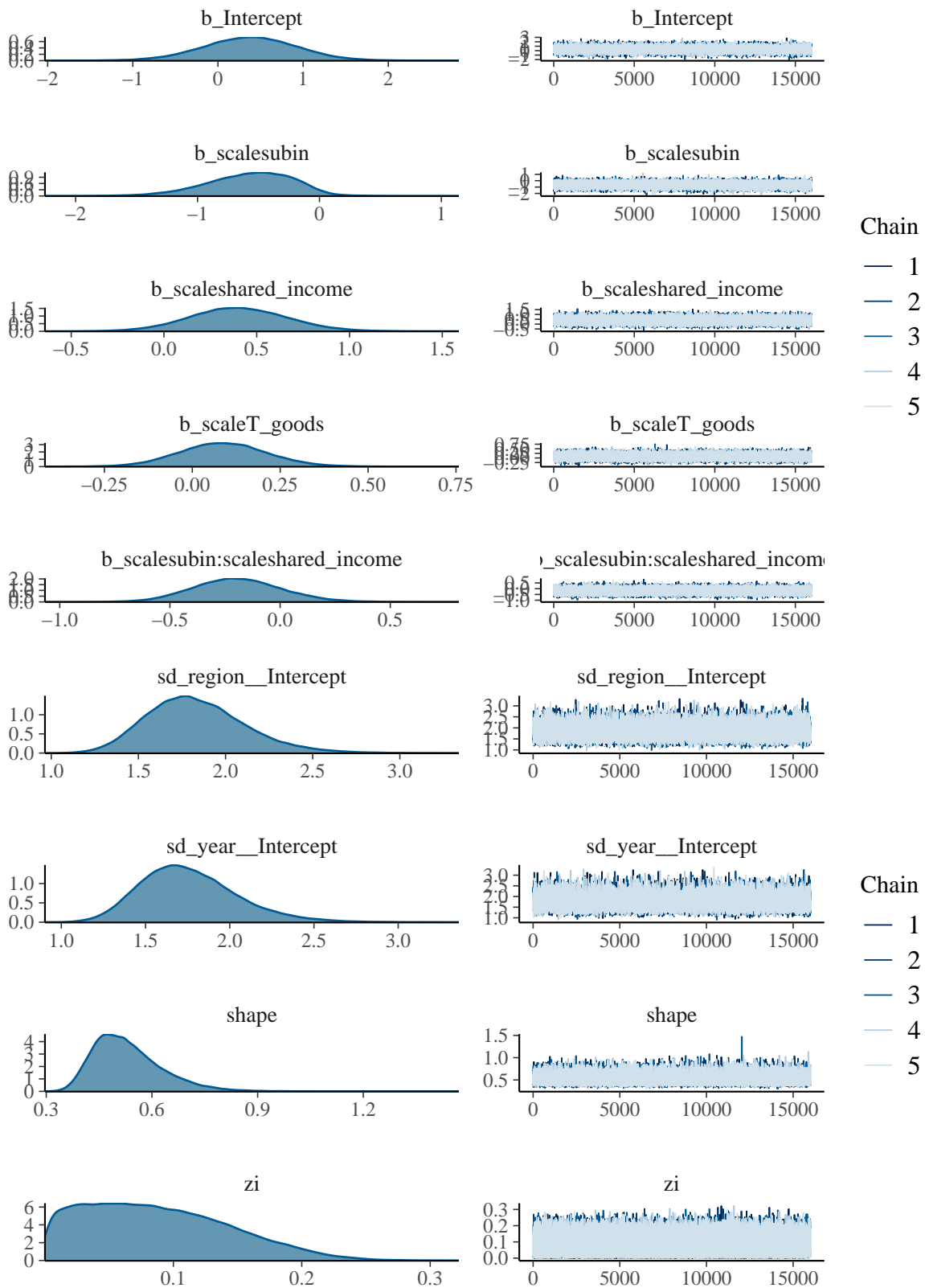
B1: The Model

See Section A5

B2: Point Estimates and Critical Intervals

	Mean Number of Protests	
Predictors	Incidence Rate Ratios	CI 95%
Intercept	1.46	0.49 – 4.23
UEI	0.58	0.27 – 1.03
Dependence	1.49	0.91 – 2.52
Trade Volume	1.09	0.86 – 1.40
UEI * Dependence	0.82	0.57 – 1.23
Random Effects		
σ^2	2868.98	
τ_{00}	7.36	
ICC	1.00	
N year	19	
N region	31	
Observations	588	
Marginal R2 / Conditional R2	0.000 / 0.640	

B3: Coefficient Distribution and MCMC Convergence

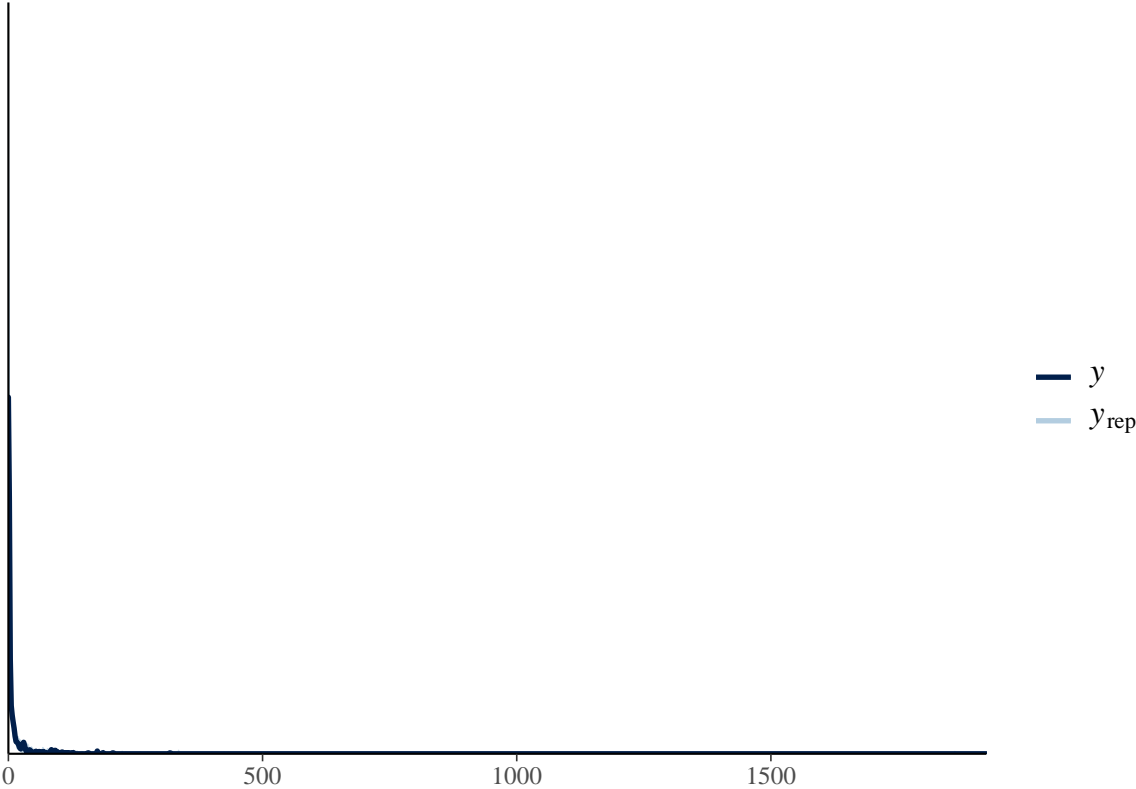


Again, I mean-centered all variables to ease the computational difficulty for the model. Here, `scalesubin` refers to the subsidies provided by the central government; `scaleshared_income`

refers to the total amount of shared income at the provincial level with the central government, `scaleT_goods` refers to the total trade volume in goods at the provincial level.

Again, the MCMC chains have achieved stationarity around 10000 samples from the posterior, suggesting that the model has converged.

B4: Predictive Posterior Check



This model has almost correctly predicted all observed counts of protest, thus we should be confident in the accuracy of the posterior draws.

B5: Conditional Effects for Subsidies

