China's Energy Diplomacy:

Does Chinese Foreign Policy Favor Oil-Producing Countries?

Lee, Chia-yi (2019)

Foreign Policy Analysis, 15(4), 570–588

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Replication Study

Applied Statistical Analysis II

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Original Study: Overview

- ‘Due to its rapid economic growth and increasing demand for energy, China has engaged in numerous efforts to sustain its energy supplies and enhance its energy security’.
- **How does China’s energy concern affect its foreign policy preferences (esp. in Africa)?**
- *Dependent variables:* three foreign policy instruments:
  - **partnerships** (p., strategic p., comprehensive strategic p.);
  - **foreign aid** ($ (millions, logged), 2000-2013);
  - **leadership visits** (1998-2013).
- *Independent variables:*
  - country’s annual **oil production,** barrels (thousands);
  - **country’s oil reserves,** barrels (thousands)

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Original Study: Data & Replication

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Version 1.0

Lee, Chia-yi, 2023, "Replication data for "China's Energy Diplomacy: Does Chinese Foreign Policy Favor Oil Producing Countries?"", https://doi.org/10.7910/DVN/7E3O5P, Harvard Dataverse, V1, UNF:6:x+exuF4WVfknqWQhUWz4MQ== [fileUNF]

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Data

data_aid	51 obs. of 15 variables	*African states (51)*
data_part	159 obs. of 21 variables	*UN states (159), -OECD states (129)*
data_TSCS	3332 obs. of 17 variables	*UN states (162)*
data_visit	160 obs. of 18 variables	*UN states (160)*

Original Study: Main Findings

1. *H:* China is more likely **to build partnerships** with countries abundant in energy resources. ✓
2. *H:* China is more likely **to give aid** to countries abundant in energy resources. ✓
3. *H:* Top Chinese leaders are more likely **to pay leadership visits** to countries abundant in energy resources. ✓

Table 2. Energy production and Chinese foreign policy preferences

Dependent variable	Partnership Model 1	Strategic partnership Model 2	Chinese aid to Africa Model 3	Chinese aid to Africa Model 4	Leadership visits Model 5
Oil production	0.131	0.184	0.050	0.316	0.074
	(0.058)**	(0.069)***	(0.080)	(0.151)**	(0.025)***
GDP per capita	−0.335	−0.525	−0.108	−0.673	−0.232
	(0.270)	(0.322)	(0.356)	(0.683)	(0.110)**
GDP growth	−0.033	−0.003	0.041	0.068	0.009
	(0.089)	(0.088)	(0.035)	(0.170)	(0.034)
FDI inflows	0.261	0.305	0.129	0.090	0.121
	(0.081)***	(0.096)***	(0.235)	(0.134)	(0.031)***
Trade importance	1.302	1.825	3.186	2.582	1.194
	(0.826)	(0.879)**	(2.096)	(5.063)	(0.249)***
Level of democracy	−0.007	−0.046	0.145	0.298	−0.025
	(0.051)	(0.059)	(0.066)**	(0.108)***	(0.021)
Domestic conflict	0.201	0.166	0.111	0.222	−0.030
	(0.138)	(0.159)	(0.064)*	(0.327)	(0.061)
US ally	−0.921	−0.505	0.734	−1.132	−0.099
	(0.777)	(0.891)	(2.704)	(3.435)	(0.315)
Lagged Chinese aid			0.203		
			(0.040)***		
Number of observations	125	125	603	49	125
Number of countries	125	125	49	49	125
Log likelihood	−55.55	−44.35	−1778.55	−123.23	−191.22
AIC	129.09	106.70	3583.10	266.46	400.44
BIC	154.55	132.16	3640.33	285.38	428.72

Notes: Standard errors are in parentheses. *$p < .1$; **$p < .05$; ***$p < .01$.

Table 3. Energy production and Chinese foreign policy preferences: robustness checks

Dependent variable	Partnership Model 6	Strategic partnership Model 7	Chinese aid to Africa Model 8	Chinese aid to Africa Model 9	Leadership visits Model 10	Number of days spent on leadership visits Model 11	Number of days spent on leadership visits Model 12
Oil reserves	0.106	0.137	0.016	0.273	0.055		0.051
	(0.050)**	(0.059)**	(0.072)	(0.119)**	(0.022)***		(0.028)*
Oil production						0.073	
						(0.033)**	
GDP per capita	−0.321	−0.462	−0.143	−0.615	−0.209	−0.196	−0.164
	(0.268)	(0.310)	(0.353)	(0.646)	(0.112)*	(0.145)	(0.146)
GDP growth	−0.027	0.004	0.050	0.067	0.014	0.012	0.019
	(0.092)	(0.092)	(0.036)	(0.168)	(0.035)	(0.046)	(0.046)
FDI inflows	0.261	0.306	0.149	0.131	0.122	0.149	0.149
	(0.080)***	(0.095)***	(0.240)	(0.136)	(0.031)***	(0.038)***	(0.039)***
Trade importance	1.327	1.830	3.574	3.122	1.235	1.558	1.645
	(0.823)	(0.873)**	(2.112)*	(4.890)	(0.252)***	(0.392)***	(0.396)***
Level of democracy	−0.005	−0.050	0.125	0.301	−0.024	−0.020	−0.019
	(0.052)	(0.060)	(0.067)*	(0.106)***	(0.022)	(0.028)	(0.029)
Domestic conflict	0.198	0.179	0.104	0.206	−0.024	−0.019	−0.014
	(0.139)	(0.157)	(0.065)	(0.322)	(0.062)	(0.080)	(0.081)
US ally	−0.914	−0.475	0.579	−0.999	−0.127	−0.320	−0.352
	(0.772)	(0.871)	(2.683)	(3.402)	(0.318)	(0.406)	(0.409)
Lagged Chinese aid			0.196				
			(0.040)***				
Number of observations	125	125	588	49	125	125	125
Number of countries	125	125	49	49	125	125	125
Log likelihood	−55.85	−45.33	−1736.43	−122.76	−192.34	−281.43	−282.20
AIC	129.69	108.66	3498.87	265.51	402.69	580.86	582.40
BIC	155.14	134.11	3555.76	284.43	430.97	609.14	610.69

Notes: Standard errors are in parentheses. *$p < .1$; **$p < .05$; ***$p < .01$.

Full replication by MS available here: https://github.com/skrypnykm/StatsII_Spring2024/tree/main/replication/my_replication

*Original Study: Main Findings (repl.)

Table 2

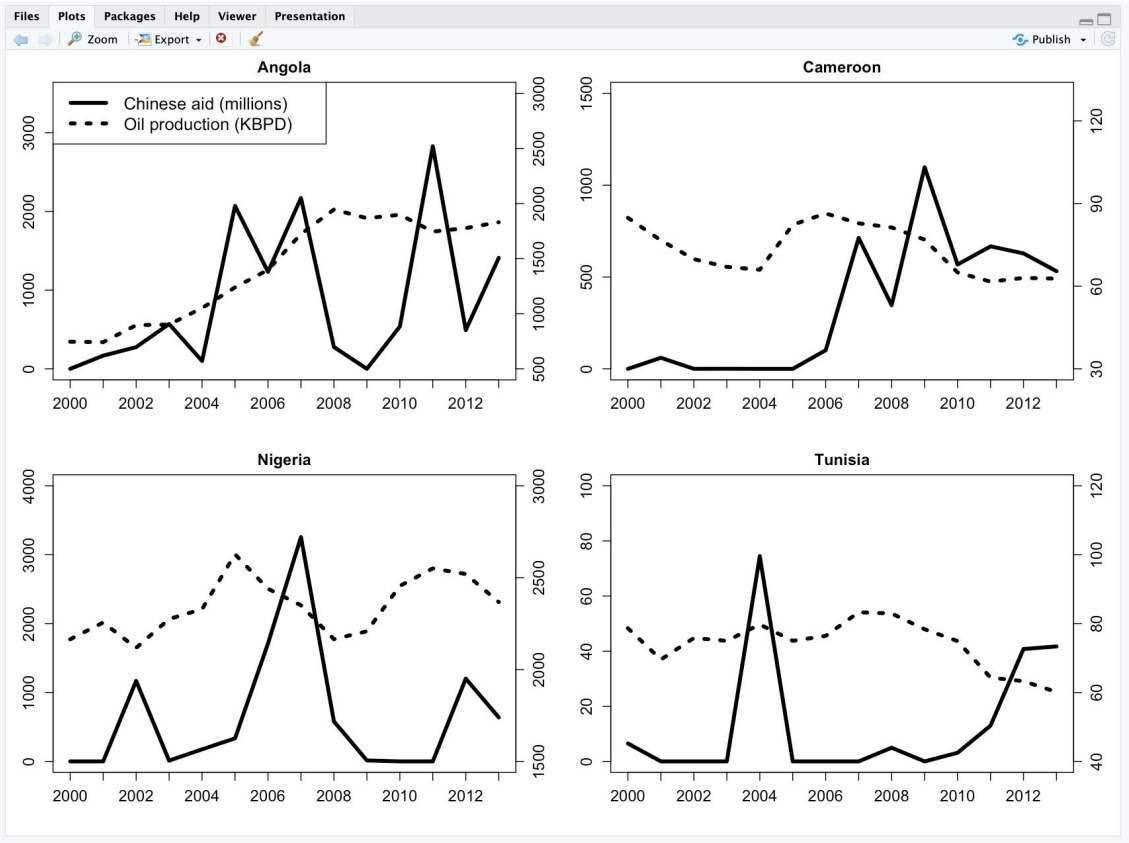
	Dependent variable:				
	partner *logistic*	partner2 *logistic*	lnaid *linear mixed-effects*	lnaid2 *OLS*	visit *negative binomial*
	(1)	(2)	(3)	(4)	(5)
prod2	0.131**	0.184***		0.316**	0.074***
	(0.058)	(0.069)		(0.151)	(0.025)
GDPpc2	-0.335	-0.525		-0.673	-0.232**
	(0.270)	(0.322)		(0.683)	(0.110)
growth2	-0.033	-0.003		0.068	0.009
	(0.089)	(0.088)		(0.170)	(0.034)
FDI2	0.261***	0.305***		0.090	0.121***
	(0.081)	(0.096)		(0.134)	(0.031)
trade.de2	1.302	1.825**		2.582	1.194***
	(0.826)	(0.879)		(5.063)	(0.249)
polity2	-0.007	-0.046		0.298***	-0.025
	(0.051)	(0.059)		(0.108)	(0.021)
dom2	0.201	0.166		0.222	-0.030
	(0.138)	(0.159)		(0.327)	(0.061)
usally2	-0.921	-0.505		-1.132	-0.099
	(0.777)	(0.891)		(3.435)	(0.315)
lnaid.1			0.203***		
			(0.040)		
lnprod1			0.050		
			(0.080)		
lnGDPpc.1			-0.108		
			(0.356)		
growth.1			0.041		
			(0.035)		
I(lnFDI.1/10)			0.129		
			(0.235)		
trade.de.1			3.186		
			(2.096)		
polity.1			0.145**		
			(0.066)		
lndom.1			0.111*		
			(0.064)		
usally.1			0.734		
			(2.704)		
Constant	-4.416**	-4.817*	5.289**	13.537***	-0.810
	(2.226)	(2.611)	(2.380)	(4.767)	(0.939)
Observations	125	125	603	49	125
R^2				0.314	
Adjusted R^2				0.176	
Log Likelihood	-55.546	-44.352	-1,778.551		-191.219
theta					2.152*** (0.818)
Akaike Inf. Crit.	129.091	106.704	3,583.102		400.438
Bayesian Inf. Crit.			3,640.327		
Residual Std. Error				3.312 (df = 40)	
F Statistic				2.284** (df = 8; 40)	
Note:					*p<0.1; **p<0.05; ***p<0.01

Table 3

	Dependent variable:						
	partner *logistic*	partner2 *logistic*	lnaid *linear mixed-effects*	lnaid2 *OLS*	visit *negative binomial*	day *negative binomial*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
reserve2	0.106**	0.137**		0.273**	0.055**		0.051*
	(0.050)	(0.059)		(0.119)	(0.022)		(0.028)
prod2						0.073**	
						(0.033)	
GDPpc2	-0.321	-0.462		-0.615	-0.209*	-0.196	-0.164
	(0.268)	(0.310)		(0.646)	(0.112)	(0.145)	(0.146)
growth2	-0.027	0.004		0.067	0.014	0.012	0.019
	(0.092)	(0.092)		(0.168)	(0.035)	(0.046)	(0.046)
FDI2	0.261***	0.306***		0.131	0.122***	0.149***	0.149***
	(0.080)	(0.095)		(0.136)	(0.031)	(0.038)	(0.039)
trade.de2	1.327	1.830**		3.122	1.235***	1.558***	1.645***
	(0.823)	(0.873)		(4.890)	(0.252)	(0.392)	(0.396)
polity2	-0.005	-0.050		0.301***	-0.024	-0.020	-0.019
	(0.052)	(0.060)		(0.106)	(0.022)	(0.028)	(0.029)
dom2	0.198	0.179		0.206	-0.024	-0.019	-0.014
	(0.139)	(0.157)		(0.322)	(0.062)	(0.080)	(0.081)
usally2	-0.914	-0.475		-0.999	-0.127	-0.320	-0.352
	(0.772)	(0.871)		(3.402)	(0.318)	(0.406)	(0.409)
lnaid.1			0.196***				
			(0.040)				
lnreserve1			0.016				
			(0.072)				
lnGDPpc.1			-0.143				
			(0.353)				
growth.1			0.050				
			(0.036)				
I(lnFDI.1/10)			0.149				
			(0.240)				
trade.de.1			3.574*				
			(2.112)				
polity.1			0.125*				
			(0.067)				
lndom.1			0.104				
			(0.065)				
usally.1			0.579				
			(2.683)				
Constant	-4.529**	-5.229**	5.678**	12.359***	-0.975	-0.727	-0.939
	(2.215)	(2.571)	(2.359)	(4.441)	(0.944)	(1.193)	(1.196)
Observations	125	125	588	49	125	125	125
R^2				0.327			
Adjusted R^2				0.192			
Log Likelihood	-55.845	-45.328	-1,736.433		-192.343	-281.428	-282.201
theta					2.028*** (0.753)	0.564*** (0.114)	0.549*** (0.110)
Akaike Inf. Crit.	129.689	108.656	3,498.866		402.687	580.856	582.402
Bayesian Inf. Crit.			3,555.764				
Residual Std. Error				3.280 (df = 40)			
F Statistic				2.427** (df = 8; 40)			
Note:							*p<0.1; **p<0.05; ***p<0.01

Full replication by MS available here: https://github.com/skrypnykm/StatsII_Spring2024/tree/main/replication/my_replication

Original Study: (Tiny) Twist 1

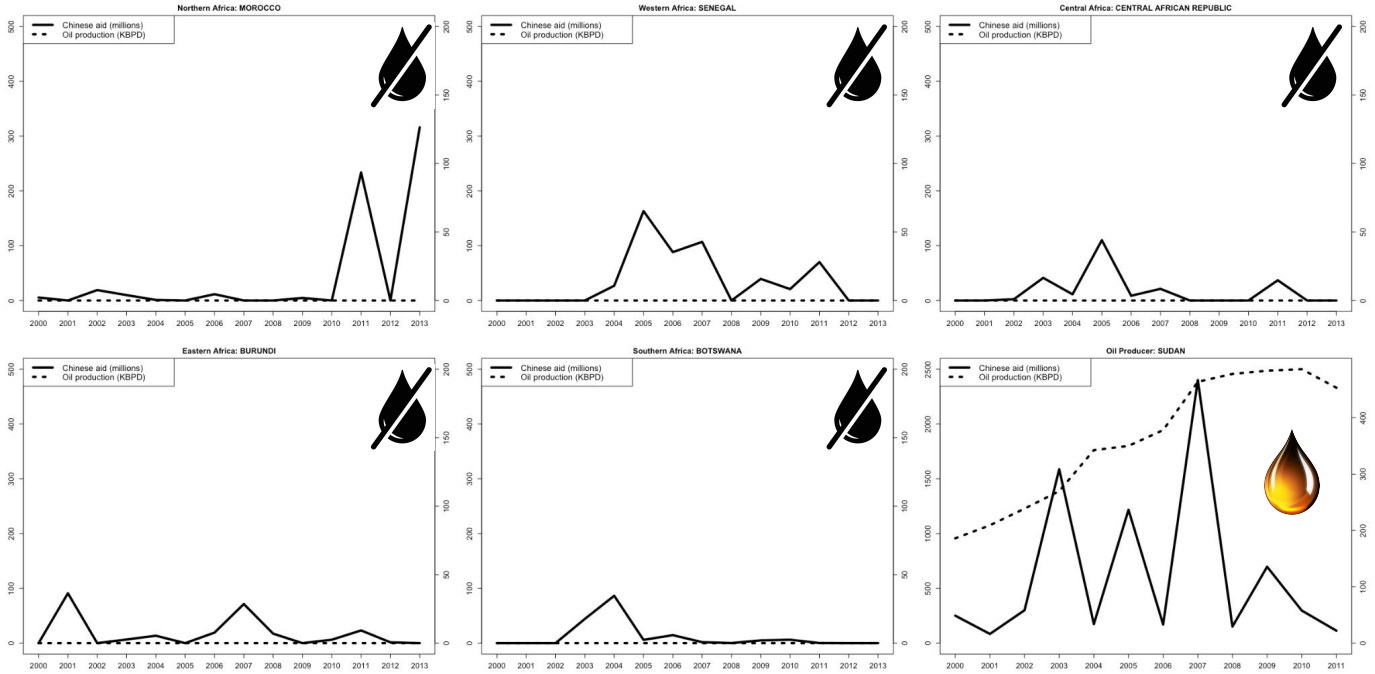


'I select four African oil-producing countries that have received Chinese aid, [...] from 2000 to 2013 [...]. **Chinese aid** (denoted by the solid line) **fluctuates** from year to year, whereas oil production (denoted by the dashed line) is relatively stable over time'.

'In other words, if the time-serial variation is taken into account, the results may be confounded by **the volatility of Chinese aid.** Because the annual aid amount is subject to the Chinese government's yearly budget, it is less likely that it will clearly follow aid recipients' oil production every year'.

'When I only focus on the variation across African countries, however, it is observed that **African oil producers in general receive more Chinese aid than non–oil producers'**.

Contribution: (Tiny) Twist 1



- 5 **non-oil producing** states from each of the 5 African regions: *Morocco, Senegal, Central African Republic, Burundi, Botswana*
- One additional **oil-producer:** *Sudan*

The idea has been tested and proven accurate

If focused on the variation across African countries, it is observed that **African non-oil producers in general receive less Chinese aid than oil producers**

Contribution: Ordered/Unordered Model for Partnerships

- **Original Model 1:** binomial ordered logit, DV: Partnership (0 for no partnership, 1 for any kind of partnership)

```
model1 <- glm(partner~prod2+GDPpc2+growth2+FDI2+trade.de2+polity2+dom2+usally2, family=binomial, data = data_part125)
```

- But the dataset includes more detailed data on the types of partnerships…
- … **Fit ordered/unordered models for partnership types.** ***Is any of them more suitable and insightful than Model 1?***

```
#Combining partnership levels (dummy variables) into one column
data_part125$partlevel[data_part125$part == 1] <- "Partnership"
data_part125$partlevel[data_part125$part2 == 1] <- "Strategic Partnership"
data_part125$partlevel[data_part125$part3 == 1] <- "Comprehensive Strategic Partnership"
data_part125$partlevel[is.na(data_part125$partlevel)] <- "No Partnership"
```

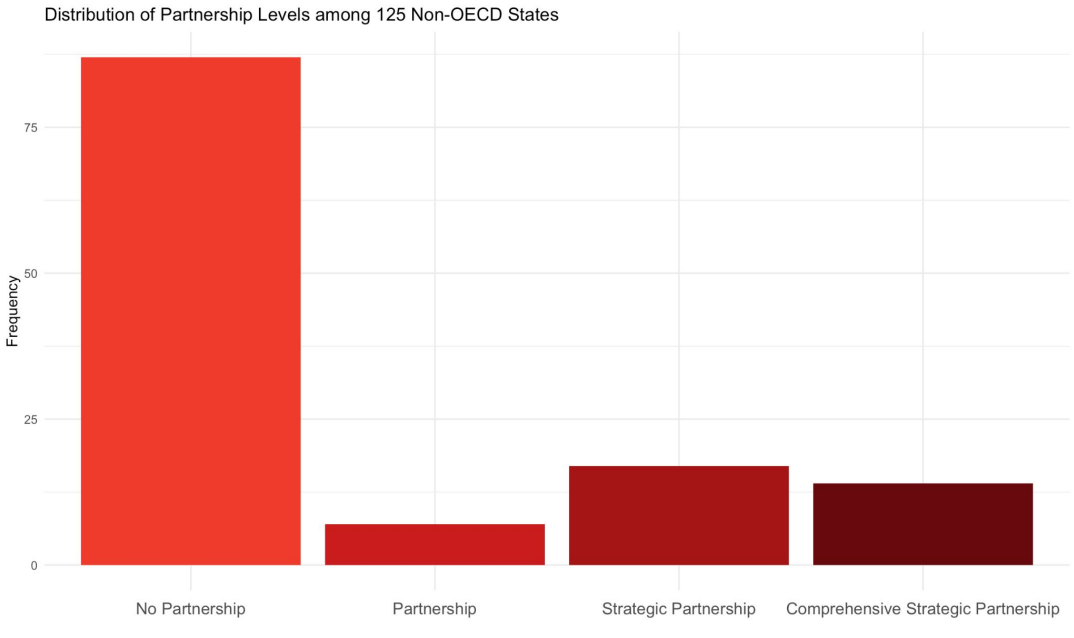
- Unordered model:

```
data_part125$partlevel <- relevel(factor(data_part125$partlevel),
                                  ref = "No Partnership")
unordmodel <- multinom(partlevel~prod2+GDPpc2+growth2+FDI2+
                         trade.de2+trade.de2+polity2+dom2+usally2,
                       data_part125)
```

- Ordered model:

```
data_part125$partlevel <- factor(data_part125$partlevel,
                                 ordered = TRUE,
                                 levels = c("No Partnership",
                                            "Partnership",
                                            "Strategic Partnership",
                                            "Comprehensive Strategic Partnership"))

ordmodel<- polr(partlevel~prod2+GDPpc2+growth2+FDI2+
                  trade.de2+trade.de2+polity2+dom2+usally2,
                  data_part125)
```



Contribution: Ordered/Unordered Model for Partnerships

Original Model 1 (exp.)

	Dependent variable:
	Partnership
Oil production	1.139**
	(0.058)
GDP per capita	0.715
	(0.270)
GDP growth	0.968
	(0.089)
FDI inflows	1.299***
	(0.081)
Trade importance	3.678
	(0.826)
Level of democracy	0.993
	(0.051)
Domestic conflict	1.223
	(0.138)
US ally	0.398
	(0.777)
Constant	0.012**
	(2.226)
Observations	125
Log Likelihood	−55.546
Residual Deviance	111.09
AIC	129.091
BIC	154.5459
Note:	*p<0.1; **p<0.05; ***p<0.01

Unordered Model (exp.)

	Dependent variable:		
	Comprehensive Strategic Partnership	Partnership	Strategic Partnership
	(1)	(2)	(3)
Oil production	1.221**	1.013	1.197**
	(0.104)	(0.105)	(0.083)
GDP per capita	0.347**	1.004	0.756
	(0.520)	(0.490)	(0.363)
GDP growth	1.003	0.864	0.980
	(0.157)	(0.227)	(0.103)
FDI inflows	1.885**	1.133	1.266**
	(0.284)	(0.148)	(0.097)
Trade importance	10.218**	0.153	2.253
	(1.189)	(4.021)	(1.083)
Level of democracy	0.944	1.095	0.973
	(0.087)	(0.106)	(0.067)
Domestic conflict	0.957	1.308	1.337
	(0.239)	(0.236)	(0.177)
US ally	1.536	0.230	0.288
	(1.268)	(1.281)	(1.047)
Constant	0.000	0.008	0.003**
	(5.576)	(3.694)	(2.928)
Observations	125		
Log Likelihood	-83.263		
Residual Deviance	166.526		
AIC	220.526		
BIC	296.89		
Note:			*p<0.1; **p<0.05; ***p<0.01

Ordered Model (exp.)

	Dependent variable:
	Partnership Level
Oil production	1.124**
	(0.057)
GDP per capita	0.694
	(0.256)
GDP growth	0.958
	(0.086)
FDI inflows	1.324***
	(0.078)
Trade importance	6.095**
	(0.745)
Level of democracy	0.953
	(0.050)
Domestic conflict	1.155
	(0.131)
US ally	0.841
	(0.678)
Intercepts	
No Partnership—Partnership	77.138**
Partnership—Strategic Partnership	118.238**
Strategic Partnership—Comprehensive Strategic Partnership	513.783**
Observations	125
Log Likelihood	−90.19376
Residual Deviance	180.3875
AIC	202.3875
BIC	233.499
Note:	*p<0.1; **p<0.05; ***p<0.01

Contribution: Ordered/Unordered Model for Partnerships

	LogLik	Residual Deviance	AIC	BIC	Brant Test library(brant) brant(ordmodel)	Accuracy Score confusionMatrix (predictions, data$y)
Original Model 1	-55.546	111.09	129.091	154.546		78.4%
Unordered Model	-83.263	166.526	220.526	296.89		74.4%
Ordered Model	-90.193	180.386	202.388	233.499	PRA holds	75.2%

- New models confirmed the initial findings that China is **more likely to build partnerships** with countries **abundant in energy resources** + it is also driven by **economic considerations** (significant coefficients for *Oil production*, *FDI inflows*, *Trade importance*).
- Both new models performed reasonably efficiently as compared to the initial binomial model, though the **ordered model** achieved a higher accuracy score and coefficients more similar in value.
- Parallel Regression Assumption (PRA) holds for the **ordered model,** which makes it a more adequate fit for the data.
- Interesting experiment overall, BUT: **the original binomial logit Model 1 is still the most accurate** → we might assume that being China's partner versus not being China's partner at all carries greater significance compared to being involved in a specific type of partnership.