Displacement effects in PIPA

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Contents

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To do

- [x] Divide pipa vessels by type of boat (longline vs. purse seine)
- [x] Identify two counterfactuals:
  - [x] A: PNA, similar vessel, never fished inside PIPA
  - [ ] B: Taiwan, Never in PNA, Similar region
- [x] Change in fishing hours before vs after
- [ ] ~~Change in total hours before vs after~~
- [ ] Change in distance before vs after
- [ ] Where do PIPA vessels go?
- [ ] Make sure I have full tracks of all mmsis

Methods

Data

The Global Fishing Watch (GFW) data contain 233 vessels that have fished within PIPA waters. From these, 217 did so at least once before 2015, but only 183 continued to fish after 2015. The 34 missing vessels might tell us something about the impact of PIPA. However, they might have gone to other areas (i.e. outside of PNA countries). I must dig deeper into this.

Accounting for the fact that vessels that fished within PIPA before implementation might stop fishing afterwards, or that vessels entered the fishery after PIPA closure, I define my treatment and control groups as follows. The treatment group contains all vessels that fished within PIPA at least once before the closure, and that continued to fish elsewhere afterwards. The Control group has vessels that never fished within PIPA waters, belong to other PNA countries, and have fished in surroinding areas before and after PIPA closure. Tables 1, 2, and 3 show the number of vessels, number of vessels following a BACI design, and fishing hours, respectively. Tables show data grouped by gear (longlines, purse seines), group (treated, control), and period (before, after). The relative change (After / Before) is also shown. Table 1 shows information for all fishing vessels in the dataset, while Tables 2 and 3 show information for vessels that meet the BACI design (i.e. excludes vessels that only appear at one point in time).

Table 1: Number of fishing vessels (identified by mmsi) for each gear before and after PIPA implementation.

Gear	Treatment	Before	After	Change (A / B)
drifting_longlines	FALSE	105	218	2.0761905
drifting_longlines	TRUE	139	118	0.8489209
purse_seines	FALSE	49	89	1.8163265
purse_seines	TRUE	78	81	1.0384615

Table 2: Number of fishing vessels (identified by mmsi) for each gear before and after PIPA implementation.

Gear	Treatment	Before	After	Change (A / B)
drifting_longlines	FALSE	88	88	1
drifting_longlines	TRUE	115	115	1
purse_seines	FALSE	38	38	1
purse_seines	TRUE	68	68	1

Table 3: Mean fishing hours for each gear before and after

Gear	Treatment	Before	After	Change (A / B)
drifting_longlines	FALSE	481.42502	473.5823	0.9837094
drifting_longlines	TRUE	548.22580	524.8121	0.9572919
purse_seines	FALSE	66.50483	172.3775	2.5919548
purse_seines	TRUE	56.87322	146.2015	2.5706563

Analysis

The current approach is to estimate what percentage of fishing effort from the PNA was displaced by PIPA and use this to infer something about Palau. While this provides a measure of the displacement, it does not fully address the possibility of costs increasing. I believ we can use individual tracks (as opposed to just the gridded effort) and obtain show how their behavior changed (*i.e.* are they fishing further away, are they fishing more, where are they now?).

Model specifications

Our model specification uses a DiD approach. In this case, we interact the before-after dummy with a treatment dummy. The treatment and control groups follow our definition in the data description. The model takes the form of:

$$H_{ijkl} = \alpha + \beta Post_i \times Treat + \mu_j + \phi_k + \gamma_l + \epsilon_{ijk}$$

Where μ_j, ϕ_k, and γ_l represent month-, year-, and flag-level fixed effects. I use total hours at the vessel-month level.

Results

Fig. 1 shows that mean fishing hours for purse seiners have an abrupt increase, just before January 1st, 2015. This trend is observed for both treated and control groups. Longliners, however, show a more stable trend. The number of mmsi codes increases through time. This can largel be explained by the addition of more satellits, which increasedetectability of vessels. As expected total fishing hours follow a similar trend to that of mmsi numbers. Results of the regressions for each gear type are shown in Tables 4 and 5. Column (1) presents the DiD regression with no fixed effects, column (2) includes month fixed effects, column (3) includes month and year fixed effects, and column (4) includes month, year, and flag fixed effects. Figures 2 and 3 represent the same coefficient estimates.

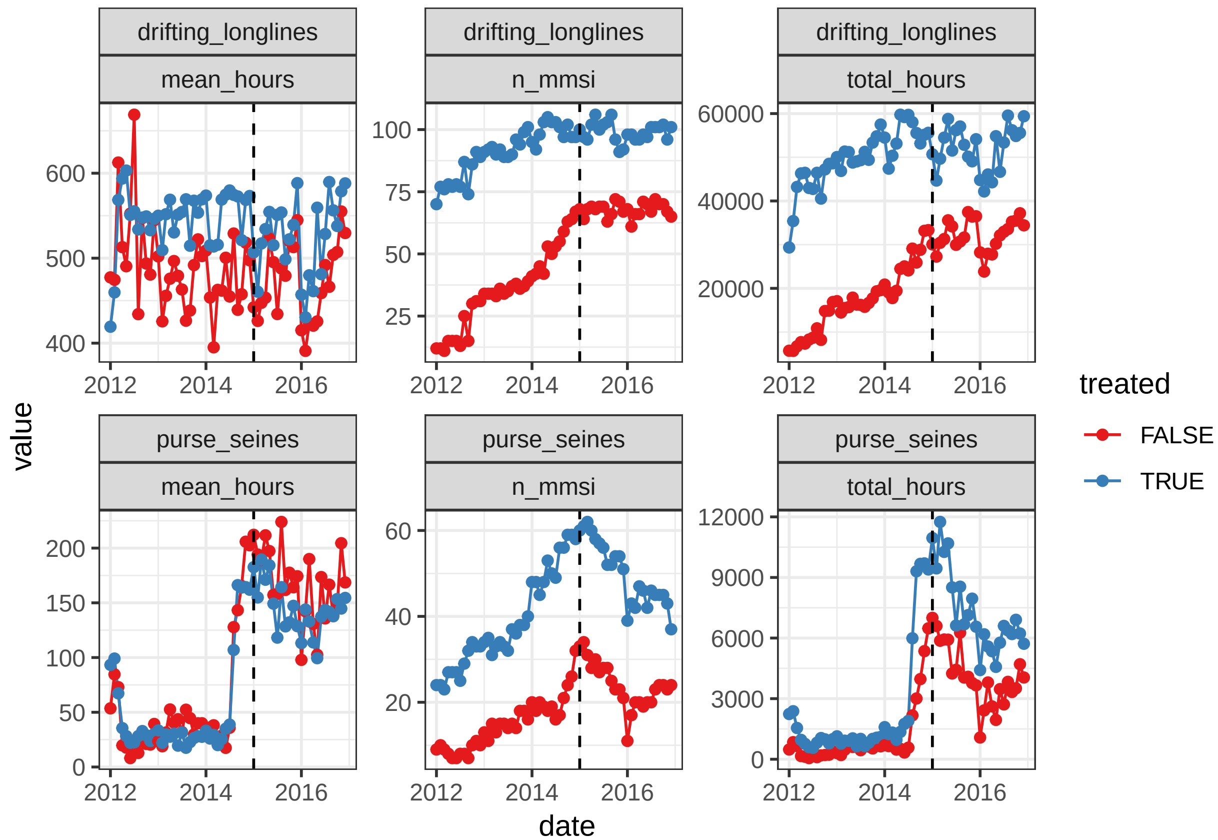

Figure 1: Fishing hours and number of vessels by month for all vessels. Vertical dashed line indicates PIPA closure.

Purse seiners

Table 4: Fishing hours from GFW for purse seiners (n = 106; 38 control, 68 treatment). Asterisks indicate significance levels. Numbers in parenthesis represent heteroskedastic-robuste standard errors.

	Dependent variable:			
	hours			
	(1)	(2)	(3)	(4)
post	105.873***	107.859***	113.466***	102.890***
	(5.532)	(5.364)	(5.887)	(6.076)
treated	−9.632**	−8.924**	−8.334**	−3.076
	(4.257)	(4.023)	(3.725)	(4.540)
post:treated	−16.544**	−16.889***	−17.235***	−11.150*
	(6.481)	(6.358)	(6.126)	(6.162)
Constant	66.505***	61.758***	40.085***	61.569***
	(3.780)	(5.352)	(5.699)	(9.753)
Month FE	No	Yes	Yes	Yes
Year FE	No	No	Yes	Yes
Flag FE	No	No	No	Yes
Observations	3,692	3,692	3,692	3,692
R^2	0.238	0.262	0.312	0.339
Note:		*p<0.1; **p<0.05; ***p<0.01		

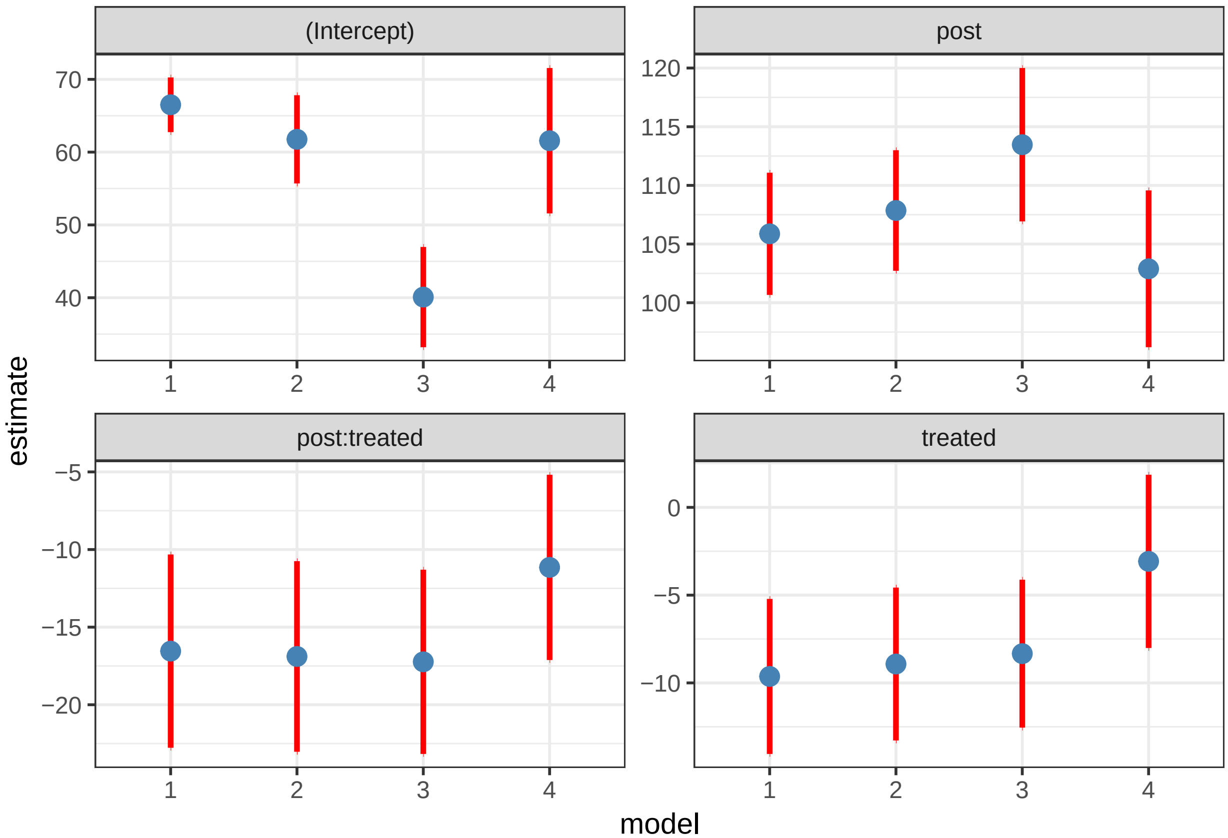

Figure 2: Coefficient estimates for each model. Top pannel indicates variable, x-axis represents model specification, and y-axis coefficient estimate.

Longliners

Table 5: Fishing hours from GFW for longliners (n = 203; 88 control, 115 treatment).. Asterisks indicate significance levels. Numbers in parenthesis represent heteroskedastic-robuste standard errors.

	Dependent variable:			
	hours			
	(1)	(2)	(3)	(4)
post	−7.843	−4.894	−7.580	24.708***
	(7.514)	(7.480)	(9.336)	(9.315)
treated	66.801***	69.434***	69.959***	18.878***
	(6.541)	(6.549)	(6.603)	(7.257)
post:treated	−15.571*	−17.806**	−18.340**	−25.775***
	(8.958)	(8.899)	(8.936)	(8.743)
Constant	481.425***	450.475***	447.866***	430.947***
	(5.733)	(9.239)	(10.280)	(24.476)
Month FE	No	Yes	Yes	Yes
Year FE	No	No	Yes	Yes
Flag FE	No	No	No	Yes
Observations	8,558	8,558	8,558	8,558
R^2	0.026	0.044	0.044	0.107
Note:			*p<0.1; **p<0.05; ***p<0.01	

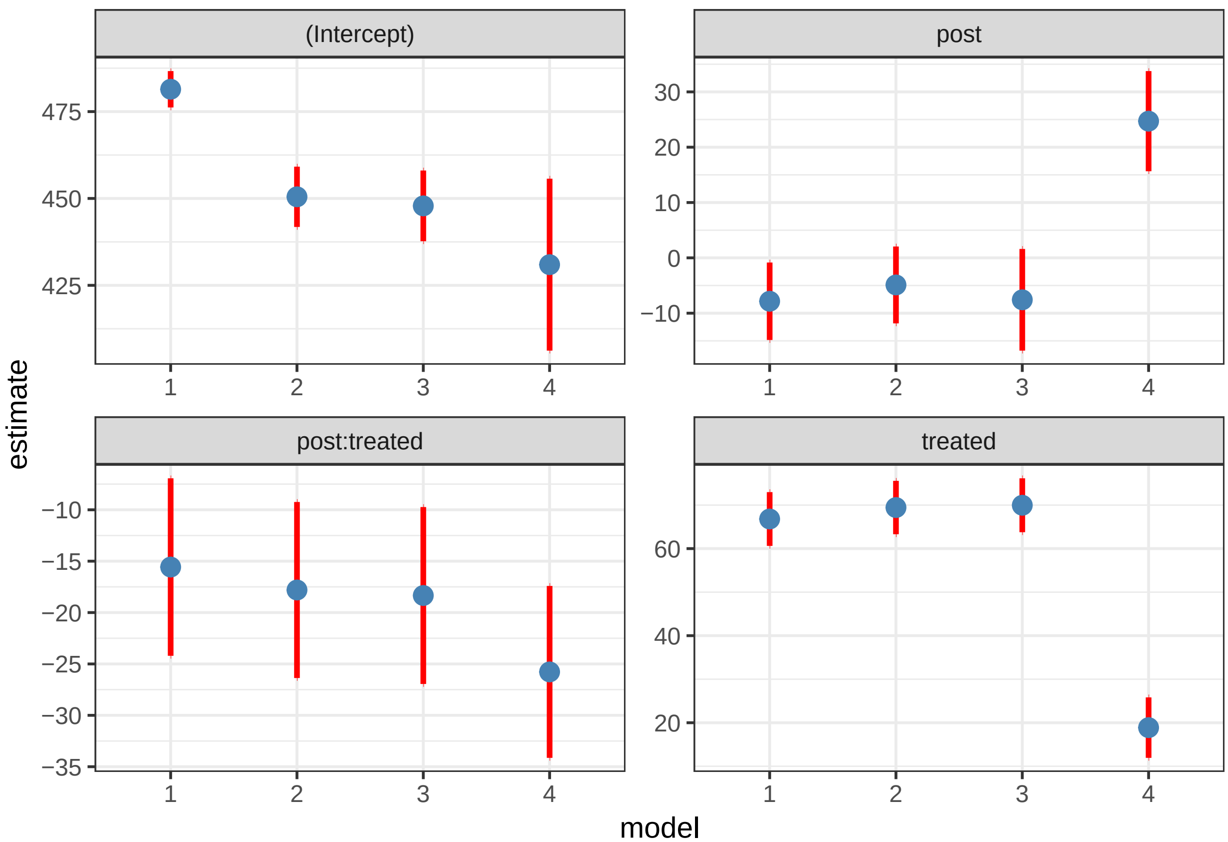

Figure 3: Coefficient estimates for each model. Top pannel indicates variable, x-axis represents model specification, and y-axis coefficient estimate.