

Dear all,

Currently I am running a OLS Difference and Difference regression on Nigerian DHS data (2008 and 2018) and am trying to estimate the effect of terror (Boko Haram in this case) on childmarriage and teenage childbirth/pregnancy. In this regard I also want to estimate the effect on age at childmarriage and age at teenage childbirth/pregnancy for the women who did actually face these circumstances.

My questions are: How would you judge the effects on attacknumber and attacknumber*BH in both the cases 1) age at childmarriage and 2) age at teenage childbirth. From my understanding this would mean an additional attack in a non-BH area raises the age at childmarriage by +0.06years and the age at teenage childbirth by +0.07 years. If we now look at the interaction effects we see that these are pretty much the same amount but with the opposite sign (negative) (-0.06 years/-0.07 years). I would interpret it in this way, that the overall effect of an attack on a BH affected states is essentially zero as the two coefficients cancel out ($\beta_1 + \beta_3 = 0$) so the age stays the same with an increase in one attack. In non-BH states however an additional attack increases the age ($\beta_1 > 0$). Would this be the correct interpretation?

Another question would be: Why do my models omit the state Kaduna? One state is already omitted (Sokoto) as the baseline surveystate. Nonetheless, all my estimations omit Kaduna as well. Note: Kaduna is part of the BH coded group(surveystates: Borno, Yobe, Adamawa, Kano, Gombe, Bauchi, Kauna then BH=1). So could this be due to some colinearity etc? I checked and all observations and values for Kaduna are correctly coded as for all other states which do not seem to present this "omitted" issue.

Thank you very much in advance for any help!
Greetings

Running my final model using the following commands I get these results:

```
svy: reg agefirstunionCM i.BH c.attacknumberCM c.attacknumberCM#i.BH i.muslim i.urban  
i.kanuri i.hhheadmale i.literacy i.wealthindex i.edulevel c.eduyears i.edulevelpartner  
c.eduyearspartner i.largefamily i.polygamoushh i.surveystate  
Survey: Linear regression
```

| | | | | | |
|------------------|---|--------------|-----------------|--------|---------------|
| Number of strata | = | 146 | Number of obs | = | 7,825 |
| Number of PSUs | = | 1,640 | Population size | = | 7,693,726,278 |
| | | Design df | = | 1,494 | |
| | | F(53, 1442) | = | 10.67 | |
| | | Prob > F | = | 0.0000 | |
| | | R-squared | = | 0.0935 | |

| | Linearized | | | | | |
|---------------------|-------------|-----------|-------|-------|----------------------|-----------|
| agefirstunionCM | Coef. | Std. Err. | t | P> t | [95% Conf. Interval] | |
| 1.BH | .2678601 | .1535981 | 1.74 | 0.081 | -.0334307 | .5691509 |
| attacknumberCM | .0606883 | .0080648 | 7.53 | 0.000 | .0448688 | .0765078 |
| BH#c.attacknumberCM | | | | | | |
| 1 | -.0597985 | .008065 | -7.41 | 0.000 | -.0756184 | -.0439785 |
| 1.muslim | -.1875304 | .1036764 | -1.81 | 0.071 | -.3908971 | .0158363 |
| 1.urban | -.0253483 | .067249 | -0.38 | 0.706 | -.1572608 | .1065642 |
| 1.kanuri | -.093941 | .1311277 | -0.72 | 0.474 | -.3511549 | .163273 |
| 1.hhheadmale | -.0833878 | .0745814 | -1.12 | 0.264 | -.2296831 | .0629076 |
| 1.literacy | .0773257 | .0785068 | 0.98 | 0.325 | -.0766695 | .2313209 |
| wealthindex | | | | | | |
| poorer | .0855394 | .0556279 | 1.54 | 0.124 | -.0235776 | .1946564 |
| middle | .1246874 | .0750185 | 1.66 | 0.097 | -.0224653 | .2718401 |
| richer | .2579857 | .0921339 | 2.80 | 0.005 | .0772601 | .4387113 |
| richest | .302223 | .1318766 | 2.29 | 0.022 | .0435401 | .5609059 |
| 1.edulevel | .0766587 | .1100335 | 0.70 | 0.486 | -.1391778 | .2924952 |
| eduyears | .0187935 | .0120535 | 1.56 | 0.119 | -.00485 | .042437 |
| 1.edulevelpartner | -.1190187 | .1186531 | -1.00 | 0.316 | -.3517631 | .1137257 |
| eduyearspartner | .0193016 | .0103064 | 1.87 | 0.061 | -.0009149 | .0395181 |
| 1.largefamily | .0050871 | .0386496 | 0.13 | 0.895 | -.0707262 | .0809003 |
| 1.polygamoushh | -.1149114 | .0461247 | -2.49 | 0.013 | -.2053874 | -.0244355 |
| surveystate | | | | | | |
| zamfara | -.1567509 | .1577283 | -0.99 | 0.320 | -.4661433 | .1526415 |
| katsina | -.058353 | .1397715 | -0.42 | 0.676 | -.3325222 | .2158162 |
| jigawa | .6201046 | .1272395 | 4.87 | 0.000 | .3705176 | .8696916 |
| yobe | -.0515254 | .1592621 | -0.32 | 0.746 | -.3639265 | .2608758 |
| borno | -.7478194 | .205227 | -3.64 | 0.000 | -1.150383 | -.3452558 |
| adamawa | .2552234 | .1539995 | 1.66 | 0.098 | -.0468549 | .5573016 |
| gombe | .1744793 | .1335148 | 1.31 | 0.191 | -.0874171 | .4363757 |
| bauchi | -.0511485 | .1345675 | -0.38 | 0.704 | -.3151098 | .2128128 |
| kano | -.0184404 | .1325222 | -0.14 | 0.889 | -.2783897 | .2415089 |
| kaduna | 0 (omitted) | | | | | |
| kebbi | .5643663 | .1536166 | 3.67 | 0.000 | .2630391 | .8656934 |
| niger | .32048 | .1612237 | 1.99 | 0.047 | .0042311 | .6367289 |
| abuja | -.3547092 | .2775083 | -1.28 | 0.201 | -.8990565 | .1896382 |
| nasarawa | .4572007 | .1733962 | 2.64 | 0.008 | .1170748 | .7973266 |
| plateau | -.065136 | .2224453 | -0.29 | 0.770 | -.5014744 | .3712023 |
| taraba | .5864252 | .1233278 | 4.76 | 0.000 | .3445111 | .8283393 |
| benue | .5949883 | .1740201 | 3.42 | 0.001 | .2536386 | .9363379 |
| kogi | .1937181 | .1784986 | 1.09 | 0.278 | -.1564164 | .5438526 |

| | | | | | | | |
|-------------|--|----------|----------|-------|-------|-----------|----------|
| kwara | | .7585649 | .2532547 | 3.00 | 0.003 | .2617923 | 1.255338 |
| oyo | | .9811194 | .1860203 | 5.27 | 0.000 | .6162307 | 1.346008 |
| osun | | .8110708 | .2348476 | 3.45 | 0.001 | .3504048 | 1.271737 |
| ekiti | | .9938482 | .2102819 | 4.73 | 0.000 | .581369 | 1.406327 |
| ondo | | 1.057972 | .2461233 | 4.30 | 0.000 | .5751884 | 1.540756 |
| edo | | .5724927 | .3749659 | 1.53 | 0.127 | -.1630229 | 1.308008 |
| anambra | | .5366899 | .2776328 | 1.93 | 0.053 | -.0079017 | 1.081281 |
| enugu | | .0549801 | .3721721 | 0.15 | 0.883 | -.6750553 | .7850155 |
| ebonyi | | .6244667 | .2307461 | 2.71 | 0.007 | .171846 | 1.077087 |
| cross river | | .1285754 | .3151316 | 0.41 | 0.683 | -.489572 | .7467227 |
| akwa ibom | | .6034849 | .2663215 | 2.27 | 0.024 | .0810811 | 1.125889 |
| abia | | .3807716 | .2884868 | 1.32 | 0.187 | -.1851106 | .9466537 |
| imo | | .795596 | .2736021 | 2.91 | 0.004 | .2589111 | 1.332281 |
| rivers | | .3901126 | .3199313 | 1.22 | 0.223 | -.2374497 | 1.017675 |
| bayelsa | | .2268694 | .2062523 | 1.10 | 0.272 | -.1777054 | .6314442 |
| delta | | .4423073 | .2656391 | 1.67 | 0.096 | -.078758 | .9633726 |
| lagos | | .1382112 | .4069651 | 0.34 | 0.734 | -.6600724 | .9364948 |
| ogun | | .7265004 | .2636357 | 2.76 | 0.006 | .2093649 | 1.243636 |
| | | | | | | | |
| _cons | | 14.4783 | .1604158 | 90.25 | 0.000 | 14.16363 | 14.79296 |

Note: Strata with single sampling unit centered at overall mean.

svy: reg agefirstbirthpregTP c.attacknumberTP i.BH c.attacknumberTP#i.BH i.muslim i.urban
i.kanuri i.hhheadmale i.literacy i.wealthindex i.edulevel c.eduyears i.edulevelpartner
c.eduyearspartner i.largefamily i.polygamoushh i.surveystate
Survey: Linear regression

Number of strata = 148 Number of obs = 9,375
Number of PSUs = 1,892 Population size = 9,144,835,358
Design df = 1,744
F(53, 1692) = 12.96
Prob > F = 0.0000
R-squared = 0.0901

| ----- | | | | | | |
|---------------------|--|-----------|-----------|--------|-------|----------------------|
| Linearized | | | | | | |
| agefirstbirthpregTP | | Coef. | Std. Err. | t | P> t | [95% Conf. Interval] |
| ----- | | | | | | |
| attacknumberTP | | .071027 | .006938 | 10.24 | 0.000 | .0574193 .0846346 |
| 1.BH | | -.1112492 | .126494 | -0.88 | 0.379 | -.3593451 .1368466 |
| | | | | | | |
| BH#c.attacknumberTP | | | | | | |
| 1 | | -.0699279 | .0069386 | -10.08 | 0.000 | -.0835368 -.0563191 |
| | | | | | | |
| 1.muslim | | -.0973278 | .0873922 | -1.11 | 0.266 | -.2687322 .0740766 |

| | | | | | | | |
|-------------------|--|-------------|----------|-------|-------|-----------|-----------|
| 1.urban | | .0955667 | .0632548 | 1.51 | 0.131 | -.0284964 | .2196298 |
| 1.kanuri | | -.1299689 | .1442185 | -0.90 | 0.368 | -.4128283 | .1528905 |
| 1.hhheadmale | | -.0782056 | .0865481 | -0.90 | 0.366 | -.2479547 | .0915434 |
| 1.literacy | | .151714 | .0776939 | 1.95 | 0.051 | -.0006691 | .3040971 |
| | | | | | | | |
| wealthindex | | | | | | | |
| poorer | | .060747 | .05595 | 1.09 | 0.278 | -.0489892 | .1704831 |
| middle | | -.0071219 | .0685636 | -0.10 | 0.917 | -.1415974 | .1273536 |
| richer | | .0532612 | .0824339 | 0.65 | 0.518 | -.1084185 | .2149409 |
| richest | | .010767 | .113259 | 0.10 | 0.924 | -.2113707 | .2329047 |
| | | | | | | | |
| 1.edulevel | | .1963236 | .104823 | 1.87 | 0.061 | -.0092684 | .4019156 |
| eduyears | | .0174825 | .0112269 | 1.56 | 0.120 | -.0045371 | .0395021 |
| 1.edulevelpartner | | -.1930564 | .1015509 | -1.90 | 0.057 | -.3922308 | .006118 |
| eduyearspartner | | .0318046 | .009385 | 3.39 | 0.001 | .0133975 | .0502117 |
| 1.largefamily | | .0303519 | .0405891 | 0.75 | 0.455 | -.0492565 | .1099602 |
| 1.polygamoushh | | -.1620505 | .0458664 | -3.53 | 0.000 | -.2520094 | -.0720917 |
| | | | | | | | |
| surveystate | | | | | | | |
| zamfara | | .0858908 | .1330291 | 0.65 | 0.519 | -.1750224 | .3468041 |
| katsina | | -.5840868 | .1207941 | -4.84 | 0.000 | -.8210034 | -.3471702 |
| jigawa | | .2658763 | .1246078 | 2.13 | 0.033 | .0214798 | .5102728 |
| yobe | | -.0821049 | .1665512 | -0.49 | 0.622 | -.408766 | .2445562 |
| borno | | -.8917408 | .213171 | -4.18 | 0.000 | -1.309838 | -.4736431 |
| adamawa | | .3680567 | .139635 | 2.64 | 0.008 | .0941872 | .6419263 |
| gombe | | .2724548 | .1226303 | 2.22 | 0.026 | .0319369 | .5129728 |
| bauchi | | .072955 | .124723 | 0.58 | 0.559 | -.1716674 | .3175773 |
| kano | | .2036385 | .1214449 | 1.68 | 0.094 | -.0345544 | .4418315 |
| kaduna | | 0 (omitted) | | | | | |
| kebbi | | .1575467 | .1378783 | 1.14 | 0.253 | -.1128773 | .4279708 |
| niger | | -.2972779 | .1404352 | -2.12 | 0.034 | -.5727169 | -.0218389 |
| abuja | | -.6414893 | .2574665 | -2.49 | 0.013 | -1.146465 | -.1365138 |
| nasarawa | | .0675104 | .1564192 | 0.43 | 0.666 | -.2392784 | .3742992 |
| plateau | | -.6286565 | .2015918 | -3.12 | 0.002 | -1.024044 | -.2332694 |
| taraba | | .0477431 | .1239716 | 0.39 | 0.700 | -.1954055 | .2908918 |
| benue | | .0530447 | .1622574 | 0.33 | 0.744 | -.2651948 | .3712841 |
| kogi | | -.6367253 | .1727088 | -3.69 | 0.000 | -.9754634 | -.2979871 |
| kwara | | .3226968 | .1683973 | 1.92 | 0.055 | -.007585 | .6529785 |
| oyo | | .5029193 | .1618882 | 3.11 | 0.002 | .1854039 | .8204346 |
| osun | | .3371306 | .1697553 | 1.99 | 0.047 | .0041854 | .6700759 |
| ekiti | | .242641 | .2130414 | 1.14 | 0.255 | -.1752024 | .6604844 |
| ondo | | .0348621 | .2134846 | 0.16 | 0.870 | -.3838506 | .4535748 |
| edo | | .3004096 | .2602866 | 1.15 | 0.249 | -.210097 | .8109162 |
| anambra | | .0860519 | .2592354 | 0.33 | 0.740 | -.4223929 | .5944968 |
| enugu | | -.2526511 | .2600984 | -0.97 | 0.332 | -.7627886 | .2574864 |
| ebonyi | | -.0645027 | .2070343 | -0.31 | 0.755 | -.4705643 | .3415589 |
| cross river | | .0781527 | .2246077 | 0.35 | 0.728 | -.3623761 | .5186815 |
| akwa ibom | | -.2286795 | .2535716 | -0.90 | 0.367 | -.7260158 | .2686568 |

| | | | | | | | |
|---------|--|-----------|----------|--------|-------|-----------|-----------|
| abia | | .6430127 | .2656633 | 2.42 | 0.016 | .1219606 | 1.164065 |
| imo | | .2211599 | .2873089 | 0.77 | 0.442 | -.3423463 | .7846662 |
| rivers | | -.3946292 | .2624022 | -1.50 | 0.133 | -.9092852 | .1200268 |
| bayelsa | | -.4284522 | .1931851 | -2.22 | 0.027 | -.807351 | -.0495534 |
| delta | | -.0722554 | .2312345 | -0.31 | 0.755 | -.5257815 | .3812707 |
| lagos | | .409688 | .2699203 | 1.52 | 0.129 | -.1197135 | .9390894 |
| ogun | | .2558986 | .1929527 | 1.33 | 0.185 | -.1225443 | .6343416 |
| | | | | | | | |
| _cons | | 16.46443 | .152316 | 108.09 | 0.000 | 16.16569 | 16.76317 |

 Note: Strata with single sampling unit centered at overall mean.

Subject: Re: Diff in Diff OLS Estimation and Interpretation

Posted by [Liz-DHS](#) on Fri, 29 May 2020 14:39:30 GMT

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Dear User, a response from Dr. Tom Pullum:

Quote:

I would say much the same thing. The effect of an additional attack in a non-BH area is .061 (or .071). The effect of an additional attack in a BH area is effectively zero. However, in a BH area the coefficient of .268 (or -.111) cannot be ignored. For the first outcome, the effect of BH is equivalent to $.268/.061 = 4.4$ attacks in a non-BH area. However, and this is important, the coefficient of BH is not statistically significant. For the second outcome, it's harder to interpret--the effect of a BH area is equivalent to $-.111/.071 = -1.6$ attacks in a non-BH area. But that coefficient of BH also is not significant, so it's not a good idea to try to interpret it.

You have taken the first state in the entire list of states, Sokoto, as the reference state. Apparently the coefficient for Kaduna is so close to that of Sokoto that Stata has in effect grouped Kaduna with Sokoto, by giving it a coefficient of 0.

You might consider restricting to the northern zones of Nigeria, because I believe most of the states have no Boko Haram and no attacks. However, you know more about the context than I do!

Subject: Re: Diff in Diff OLS Estimation and Interpretation

Posted by [Goethe2014](#) on Fri, 29 May 2020 15:25:55 GMT

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Dear Tom,

Thank you very much for the reassuring answer.

Regarding the omitted Kaduna state dummy. Is there anything I can do to change that? Kaduna is part of my BH treatment group (BH=1) while Sokoto is not (BH=0) so if Stata groups them this would work against the overall specification of my treatment groups somehow - I hope this makes sense.

With regard to the northeastern region you mean that instead of comparing the affected states to the non/less-affected states in Nigeria I run an usual OLS regression on the BH affected states only - so make use of the attacknumber as a typical continuous independent variable similar to education years and only analyze the effects of an additional attack on my dependent variables in the conflict region?

Thank you very much in advance.

Greetings

Caspar
