Answers to Homework for Chapter 18: Difference-in-Differences

*How Does It Work?*

1. In no-control-group event studies we must assume that there was not a general change from before to after that would have changed the outcome anyway. In DID it’s okay if there are other before-to-after changes as long as they affect the treated and control groups similarly.
2. B
3. Parallel trends violation
   1. Parallel trends means that the gap between the groups would have stayed the same if no treatment had occurred. So a violation here means that, even though there was no gap pre-treatment, there would have been a gap post-treatment even if no treatment had occurred. Perhaps something changed in one of the groups at the same time treatment happened to go into effect.
   2. The effect would be off by how much the gap would have changed without treatment. So for example, if the gap would have changed from 0 to 2, then we would estimate an effect of treatment that is 2 too positive.
4. Parallel trends graph:
   1. The prior trends are definitely not the same, and so it seems unlikely that parallel trends holds.
   2. The control group is trending upwards, whereas the treated group seems flat. In the absence of treatment, we’d expect those trends to probably continue, and so the treated group would look worse relative to the control group after treatment. So we’d underestimate the effect of treatment.
5. This probably would not work well. If nothing else, the US was enacting different restrictions at the same time (as described in the problem), so they’re not really a “control” so much as a “different treatment.” Second, the question also describes random spiking. This makes parallel trends less likely – how can we be sure that any before-after change was a result of treatment and not just a random spike that happens to coincide with treatment?
6. (9-5)-(7.5-6) = 4-1.5 = 2.5. (or, (9-7.5)-(5-6) = 1.5 – (-1) = 2.5)

*How is it Performed?*

1. Running a regression:
   1. Iv
   2. The coefficient on the interaction
2. “Assuming that parallel trends between the treated and untreated groups holds, the effect of laptops on test scores was 5.034, and this effect was statistically significant at the 95% level.”
3. This test is performed to get a sense of whether parallel trends is likely to hold. Specifically, it tests whether *prior* trends are equal. If they are not equal, it’s still possible that parallel trends holds, but it seems unlikely, since it would require that the differences in prior trends would conveniently go away just in time.
4. Dynamic DID:
   1. The large nonzero effect in period 1 is concerning, since there shouldn’t really be an effect there. This might indicate some parallel trends violations.
   2. We’d say that treatment caused the treated group’s Y to increase by 3 relative to the untreated group in the first period after treatment, but the effect of treatment decayed quickly to 1 in the second period after treatment, and a statistically insignificant .5 in the third period.
5. If the effect of treatment changes over time (treatment effect is dynamic), then we’d expect parallel trends to be violated because the control is an already-treated group. Taking a two-group example, imagine the true effect of treatment is 1 in the first period after treatment and 0 afterwards (dynamic effect). Both newly-treated and already-treated groups have average outcomes of exactly 2 in all periods except the one just after being treated. If we do a DID comparing just-before treatment to just-after treatment, the just-before difference is -1 (2 for newly-treated group, 3 for already-treated). Then just-after treatment difference is 1 (3 for newly-treated group, 2 for already-treated, as the effect fades away). We get a DID estimate of 2 (1 - -1 = 2) instead of the correct value of 1.