

**Bougie, Evelyne (StatCan)** - 9:13 AM

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**Bougie, Evelyne (StatCan)** - 9:14 AM

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**Ball, Keith (AAFC/AAC) (he - him - his / il)** - 9:29 AM

If you are going to update to 2021 how are you going to account for the impact that COVID might have had on firms investments, income, employment, etc.? (I do not need an answer today but I look forward to a response when you respond to questions in the Q&A.)

A. **Willcox, Michael (StatCan)** - 3:05 PM

Good question! If firms have identical characteristics, I might be able to assume that firms in the treatment and control groups will have the same response to the economic impacts of the

pandemic. However, that might be a strong assumption. I could have included time-fixed effects in my DID regression to address the potential differences in impact between firms in the treatment and control groups. I could also have included macroeconomic variables in my DID regression, like GDP growth rates, unemployment rates, and inflation rates. I could also use a dynamic regression model with lagged treatment variables. A more advanced approach might be to use panel econometric methods, like varying coefficient models, that would allow for the effect of the pandemic to differ across firms or over time.

**Minougou, Joël JW [NC]** - 9:49 AM

You talked about the DID assumptions. What about the matching assumptions like the conditional independence assumption?

A. **Wilcox, Michael (StatCan)** - 3:05 PM

Conditional Independence Assumption (CIA) is important for applying PSM for matching because PSM is estimating the probability of treatment. If the PSM model is mis-specified, the treatment and control groups won't have good balance and overlap. This is why examining the covariate balance and overlap before proceeding with DID is important. It is still possible that some characteristics that are not observed in the data are important predictors of treatment, so checking balance and overlap is helpful but not perfect for confirming that CIA holds. Other methods that can further improve CIA (reduce "confounding") are using inverse probability weights (IPW) and regression adjustment. Combining these two approaches is called doubly robust estimation, which is easy to implement in most software. Here is a link with more information, [12 - Doubly Robust Estimation — Causal Inference for the Brave and True \(matheusfacure.github.io\)](https://matheusfacure.github.io).

**Masoud, Huda (StatCan)** - 9:51 AM

Just curious about the matching using Propensity Scores, can a firm be matched to itself and appear in both the treated and control group after matching?

A. **Luke, Jonathan** - 9:59 AM

No, every firm can only belong to one group (treated or control).

A. **Wilcox, Michael (StatCan)** - 3:05 PM

Johnathan is right. Ideally, treatment and control groups should always be mutually exclusive. In some circumstances, researchers may use "not-yet-treated" firms in the control group for firms that received treatment in an earlier period. But even in that situation, the same firm should never be in both the treatment and control groups for the same period. Most software packages that perform matching should make that situation next to impossible.

**Brendyn Johnson** - 10:06 AM

If the DID model is a regression, could we not add many of the variables used for matching in the regression model to hold the variation constant and isolate the effects of treatment? I suppose my question is what are the benefits of using control variables in a regression versus matching?

A. **Wilcox, Michael (StatCan)** - 3:05 PM

Yes. The model I presented was quite simple. More sophisticated models include covariates in the DID regression. We sometimes refer to this as regression adjustment. Other methods include adding the inverse of the propensity scores as a weight to the DID regression to further reduce

differences between treatment and control groups. This is called inverse probability weighting (IPW). These two methods can be combined to correct for misspecification in one, but not both, of the PSM or DID regressions. This combined approach is called doubly robust estimation. Here is a link with more information, [12 - Doubly Robust Estimation — Causal Inference for the Brave and True \(matheusfacure.github.io\)](#).

**Ward, Alicia** - 10:07 AM

I might have missed this detail. What type of statistical test was used to generate the p-values? WSRT?

A. **Wilcox, Michael (StatCan)** - 3:05 PM

In linear regression analysis, the standard errors of the coefficients are used to calculate the t-statistics for their corresponding coefficients. The p-values are then derived from these t-statistics and are used to assess the statistical significance of the coefficients. The Wilcoxon Signed-Rank Test (WSRT) is a non-parametric test used for comparing paired samples, which is different from testing the significance of regression coefficients.

**Hadziavdic, Sadia (TC/TC)** - 10:08 AM

Are there other studies on the same subject? And how is this study standing in comparison with those?

A. **Wilcox, Michael (StatCan)** - 3:05 PM

I haven't found any studies that look at the impact of tax incentives to encourage cleantech investment on firm growth or firm performance. One that I have yet to read but may be helpful is Siedschlag and Yan (2023) [Do green investments improve firm performance? Empirical evidence from Ireland - ScienceDirect](#), but it does not seem to focus on tax incentives. The lack of information about how corporate tax incentives designed to encourage better environmental outcomes is an important reason why I think policymakers might find this kind of analysis useful.

**Lawrence, Lola (StatCan)** - 10:08 AM

Thank you for this insightful case study for this outward facing program evaluation, I am just wondering what would be the best tool to use given the assumptions/limitations of either of the two methods explained here that can be used to evaluate an inward facing program or policy targeted towards government employees for example to evaluate EAP performance using common measures like sick days, team morale, absenteeism or other KPIs to determine its ROI? Given that employees who use this program are very diverse with intersectional characteristics.

A. **Wilcox, Michael (StatCan)** - 3:05 PM

You can use DID and PSM for either internal or external evaluations. If the EAP is available to everyone in your organization, you would need to access information on individuals that predict employees' use of the program. This may be difficult because the characteristics that best predict employees' choice to use the program are not collected by the organization. For example, employees' home environment or mental and physical medical histories may be important predictors to which an organization does not have access. The researcher would need information about any important characteristics like these that predict employees' use of the program for treatment (participants) and control (non-participants) groups before and after recipients of the treatment access the program.

By combining your program data with Statistics Canada's data, you can create a control group that gathers information not already available to your organization. However, collecting

information about employees to which your organization does not already have the right to access may be a very sensitive issue for employees. While this approach may resolve technical issues for evaluating your program, it may create larger ones that greatly outweigh the benefits of improving the efficiency of your program.

Qualitative approaches, like stakeholder interviews, expert panels and client satisfaction surveys may be a better alternative.

**Shen, Jing (StatCan)** - 10:11 AM

So, is "T" the treatment effect or the "Treated\*post" the treatment effect - ATT? In your example, you didn't emphasize "T" but only "Treated\*post", so we should just focus on the interaction term?

A. **Luke, Jonathan** - 10:14 AM

The coefficient on the treated \* post interaction is the treatment effect. The coefficient on the treated indicator alone is generally not of interest.

A. **Wilcox, Michael (StatCan)** - 3:05 PM

Johnathan is right. The T represents a group indicator. It equals 1 for program participants and 0 for non-participants. In the regression equation (2) on slide 19, it appears twice. In the first instance, it is multiplied by the coefficient beta\_1. If that coefficient were statistically significant and large (what you consider large is subjective), then we would have an indication that even after matching, there are some differences between the treatment and control groups' employment levels that are not related to the time period or the program. The purpose of including T is to help correct for any persistent differences between the treatment and control groups that the matching did not resolve. The period indicator, P, has a similar role, measuring how changes in employment are associated with changes in time regardless of which group firms belong to. In the second instance, T is multiplied by (interacted with) the period indicator. Its coefficient, beta\_3, is the estimate of ATT. It captures any variation in employment (Y) not already measured by the coefficients for T and P and, therefore, can only be explained by the influence of the program.

**Laliberté, Danièle DL [NC]** - 10:49 AM

The health outcome measures included diagnosed mental health conditions which makes sense.

However access to diagnostic is often limited or is often delayed while some people face mental health conditions but don't have any diagnostic, so they are unobserved. Isn't that a methodology limitation?

A. **Arim, Rubab (StatCan)** - 1:44 PM

This is an excellent point. Yes, this is certainly a limitation of administrative health data, which is acknowledged as a general challenge of using health administrative data in research. And this is in a similar vein with access issues to healthcare services in general and/or in certain jurisdictions/for some vulnerable populations in addition to not covering "out of pocket expenses" (e.g., counseling provided privately).

**Lawrence, Lola (StatCan)** - 11:42 AM

Thank you Derek for this great presentation. Is there a logical reason for this behaviour (low take-up) by this age group despite the expected benefits? Will this approach if applied to a different age group or both spouses have very high income, will the behaviour be different?

A. **Messacar, Derek (StatCan)** - 10:04 AM (April 4<sup>th</sup>)

Thank you for the kind words on the presentation. I believe your question applies to the first-stage (“bunching”) analysis since you refer to low take-up. On the contrary, the large amount of bunching that we see indicates that there is high take-up. There are a few reasons why that may not have occurred, both rational and irrational. For example, it would be rational to not use pension income splitting if both spouses have incomes that are in the same tax bracket anyway. Low take-up may also arise for irrational reasons, such as poor tax literacy. Given that income splitting is a notional income transfer and does not involve real cash transfers, my expectation is that take-up would be high if we extended this tax planning provision to the whole population. An exception may be elderly tax filers when there is cognitive decline, but these sorts of exceptions would be uncommon.

**Vaters, Lisa** - 11:45 AM

Did you consider gender as a variable?

A. **Messacar, Derek (StatCan)** - 10:04 AM (April 4<sup>th</sup>)

Distinguishing by gender is a bit tricky because the model includes variables for both individuals and their spouses so both genders are included simultaneously.

**Al-Azzam, Mohammad MS [NC]** - 11:47 AM

What are the interpretations for the coefficients estimates  $-1.773$ ,  $-0.005$  given values are negative and value greater than 1 especially the regression is OLS?

A. **Messacar, Derek (StatCan)** - 10:04 AM (April 4<sup>th</sup>)

Given the time constraints, I focused my discussion on sign and significance in order to show how the IV estimator addresses the reverse-causality problem. I agree that it would have been interesting to spend a bit more time discussing the magnitudes of the estimates. Formally, the estimates are elasticities and indicate the percentage change in earnings or probability of employment for each percentage change in the net-of-tax rate or after-tax income. Here is a link (<https://ire.hec.ca/en/wp-content/uploads/sites/3/2023/12/LABOUR-SUPPLY-RESPONSES-TO-INCOME-TAX-REFORM-AMONG-OLDER-COUPLES.pdf>) to a policy briefing that we put together, which includes a few bullet points on how to interpret a few of the most relevant point estimates from the study.