

Article

The Impact of the Stimulus Packages on the Economy during COVID-19 in Bangladesh: A Mixed-Method Approach

Ruhul Amin *, Nahian Rahman, Samira Tasnim, Sima Rani Dey and Mohammad Tareque

Supplementary Materials

Detailed Methodological Background

Propensity Score Matching (PSM):

The proposed impact assessment study used quantitative approaches to ascertain the impact of these incentive measures on the Bangladeshi stimulus package receiver during COVID-19 pandemic. This method developed by Rosenbaum & Rubin (1983), is a statistical matching method employed in the estimation of the effect of a treatment or any interference by accounting for the covariates that envisage receiving the treatment (Rosenbaum & Rubin, 1983). The critical issue for evaluating the impact/effectiveness of fiscal stimulus on socio-economic variables is handling selection bias. The PSM method reduces that bias in the estimation of treated effects, hence become an increasingly popular technique to evaluate different economic policy interventions (Becker & Ichino, 2002).

Applying the PSM to assess the impact of the stimulus, the study considered two types of recipients: stimulus-receivers (treatment group) and stimulus-non-receivers (control group). The observed covariates are automatically controlled for when a treated and a control subject has the same propensity score. By comparing how outcomes vary for the treatment group compared with the parallel control group, the method allows more likely to estimate the intervention impact. However, PSM can be applied to only two groups under consideration rather than more than two groups (Thapa & Acharya, 2017).

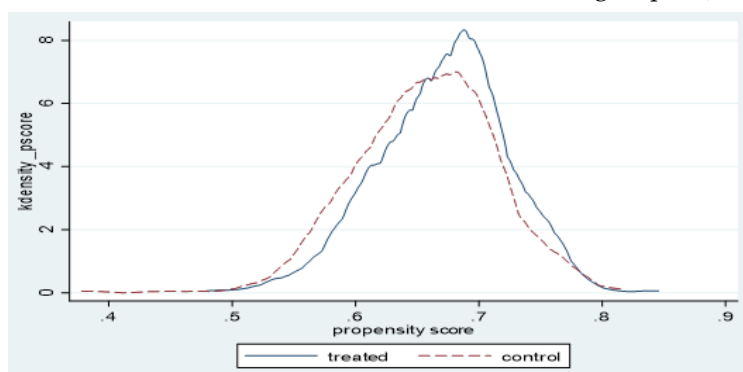


Figure S1. Area of Common Support; Source: Author's depictionSource: Thapa & Acharya, 2017.

In this regard, the study used all possible matching methods including nearest neighbors matching, kernel matching, stratification matching, and radius matching. The matching methods basically matched each treated individual with control individual that displays the closest propensity score and generate a common support region. That region of common support confirms that the propensity score of the treatment group has “adjacent” comparable observations in the control group. Later on, correcting the selection bias through the matching methods, average treatment effect (ATE) can be estimated. ATE measures the impact of stimulus package on a range of socio-economic indicators of recipient households.

The estimated average treatment effect (ATE) can be defined as follows. The treatment denoted by T_i equals 1 if the receiver i receives a stimulus and 0 otherwise. The interested outcome of receiver i is Y_{i1} if the receiver i receives stimulus and Y_{i0} otherwise. Therefore, the treatment T_i impact on stimulus i is given by:

So, the average treatment effect (ATE) is defined as:

$$ATE = E(Y_{i1} - Y_{i0} | T = 1) * P(T = 1) + E(Y_{i1} - Y_{i0} | T = 0) * P(T = 0) \quad (S1)$$

Where $P(T=1)$ and $P(T=0)$ are the probabilities of belonging to the treatment and comparison group respectively.

Difference-in-Differences (DID)

In brief, DID estimates are based on the difference in the changes in the outcome between treatment and control groups over time. The change in the outcome of control group is taken as what would have happened to the treatment group before the intervention. The DID, impact estimate is the difference between the changes over time for the two groups (received vs did not receive). In other words, it is based on subtracting the changes from before intervention outcome to the intervention outcome for the control group from the changes from before intervention to after intervention for the treatment group:

$$DID = (Y_{after}^1 - Y_{before}^1) - (Y_{after}^0 - Y_{before}^0) \quad (S2)$$

Applying the DID to assess the impact of the stimulus, the study considered two types of recipients: stimulus-receiving (treatment group) and stimulus-non-receiving (control group) over time. It appears that if the indicator's treated and control group values are the same at a base level, then it becomes equivalent to a single difference estimate.

The DID model equations for estimating the impact of the stimulus support on the entities financial performance are as follows:

$$Y_i = \beta_0 + \beta_1 * Time\ Period_i + \beta_2 * Stimulus\ Support\ Disbursement_i + \beta_3 * (Time\ Period_i * Stimulus\ Support\ Disbursement_i) + \epsilon_i \quad (S3)$$

Where Y_i is the dependent variable (financial variables), β_1 , time specific effect, β_2 Depends on stimulus receiving effects, β_3 depends on stimulus receiving effect over time.

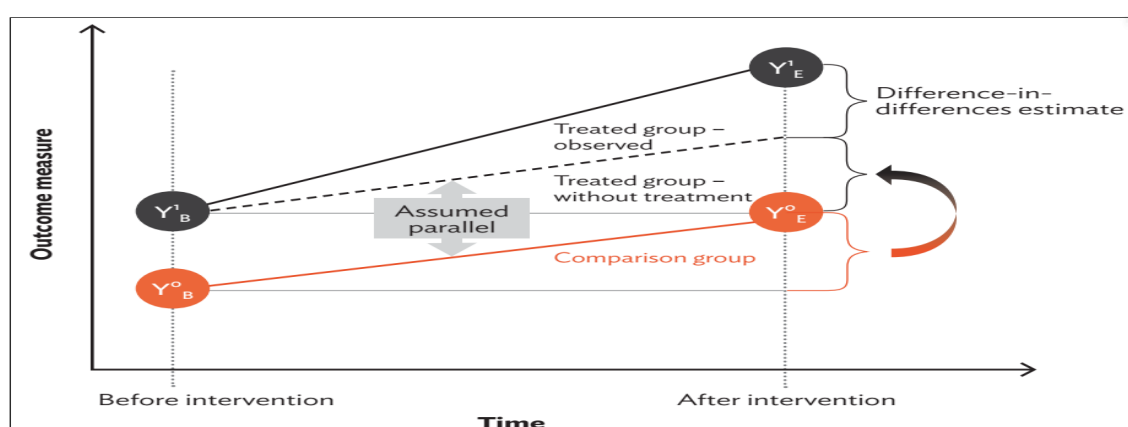


Figure S2. Graphical Illustration of Difference-in-Differences. Source: White and Raitzer, 2017.

In this study, we did not control any confounding variables, since time-varying confounder is affected by treatment and recovering an unbiased causal effect using difference-in-differences is difficult (Zeldow & Hatfield, 2021).

Purchasing Managers' Index (PMI):

Purchasing Managers' Index (PMI) is an index that is used to compare business performance in a particular period against another period. In this study, industries and service sectors' performance is based on before and after COVID-19 scenarios based on the specific well-structured questionnaire (Annex D). The PMI equation is as follows:

$$PMI = (P1 * 1) + (P2 * 0.5) + (P3 * 0)$$

P1 = percentage of answers reporting an improvement

P2 = percentage of answers reporting no change

P3 = percentage of answers reporting a deterioration

Value 1 is multiplied by the percentage number of answers that reported an improvement, 0.5 is multiplied by the percentage number of answers that reported no change, and 0 is multiplied with the percentage number of answers that reported deterioration.

Outcome variables descriptions:

To assess the impact of the stimulus support using DID model, the financial performance of the industry and service sector organization is a key issue that needs to be assessed. The variables that are widely used to measure financial performance of an entity are Total Asset (TA), Return on Asset (ROA), Debt-to-equity Ratio (DER), Net Profit before tax (NBT), Net Profit before tax (NBT), Number of Employees (NE), and Earnings per Share (EPS) (Burky & Suriawinata, 2020; Kurniawan, 2021; Patin et al., 2020) respectively.

The PMI has been constructed for the treatment group i.e. the enterprises receiving the stimulus support. In this method, PMI has 5 components, which are:

New Orders: The number of new orders received

Output or Production: The amount of output produced

Employment: Number of staff working for the organization

Suppliers' Delivery Times: Time lag between order placement and delivery by the supplier

Stocks of Purchases/Inventory levels: Raw materials purchased and kept in a warehouse to be used for production.