COVID-19, Firm Innovation Strategy and Production Efficiency: A Stochastic Frontier Analysis of Caribbean Firms

The impact of COVID-19 on the innovation decisions, economic resilience, and gender dimensions of Caribbean businesses series

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Why study COVID-19 and innovation?

- COVID-19 represents the largest economic shock experienced globally in decades.

- Caribbean SIDS pre-COVID-19 characterized by a less than dynamic private sector that hindered innovation.

- Caribbean firms tend to be micro and small and concentrated in the retail and tourism sectors.

- Caribbean macroeconomic environment pre-COVID-19 characterized by low growth and high debt.
  - Social distancing measures reduce demand and supply- economic contraction, job losses, income reduction, and increased poverty.
Why study COVID-19 and innovation?

• Firms forced to innovate to adjust to the new normal and survive.

• Post-COVID-19 private sector is an important partner to boost innovation, economic value added, economic participation, and new growth opportunities.

• There is a lack of understanding of Caribbean firm innovation strategy and production efficiency during external shocks in general and COVID-19 in particular.
Objective

• The objective of this paper is to contribute to a better understanding of firm innovation practices and production efficiency in times of crisis.

• It investigates the effect of COVID-19 on firm innovation and technical efficiency for 13 Caribbean SIDS.
Data

• 2021 Innovation, Firm Performance and Gender (IFPG) firm-level dataset.

• The data set is a representative cross-sectional enterprise survey covering 1,979 firms across 13 Caribbean countries and across all sectors, conducted in 2020 during COVID-19.

• The study focused on three groups of variables:
  • Firm production function in order to estimate technical efficiency
  • Innovation- product, process and green
  • General firm features possibly related to technical efficiency
Twofold methodology:


2. Ordinary Least Squares (OLS) examines whether innovations implemented prior to and during COVID-19 had an effect on technical efficiency- controlling for firm characteristics and sector and country effects.
Methodology

- SFA used to calculate firm inefficiency- allows for the measurement of inefficiency and external shocks- like COVID-19 outside the control of the firm to affect output level.

\[ \ln Y_i = \beta_0 + \beta_1 \ln(K_i) + \beta_2 \ln(L_i) + \beta_3 \ln(M_i) + \beta_x X_i + (V_i - U_i) \]

where:

- \( i = 1, ..., N \) are the number of firms in the sample
- \( Y_i \) = sales from firm \( i \)
- \( K_i \) = net value of fixed assets for firm \( i \)
- \( L_i \) = total expenditure on labor for firm \( i \)
- \( M_i \) = total value of other inputs \( i \)
- \( X_i \) = vector of country and sector of operation indicator variables
- \( V_i \) = error term for firm \( i \)
- \( U_i \) = a non-negative random variable for firm \( i \), accounting for technical inefficiency in the production function
Methodology

• To determine whether COVID-19 induced innovation (general and green) affected firm technical efficiency the following was estimated using OLS (clustering standard errors at the country-sector level):

\[ TE_{PC} = \alpha_0 + \alpha_1 INNOV + \alpha_2 GREEN + \alpha_2 Z + \varepsilon_i \]

• Expected technical efficiency due to COVID-19 estimated with additional determinants related to COVID-19:

\[ TE_{PC} = \alpha_0 + \alpha_1 INNOV + \alpha_2 GREEN + \alpha_3 INNOVAFF + \alpha_4 GREENAFF + \alpha_5 INNOVCOV + \alpha_6 GREENCOV + \alpha_2 Z + \varepsilon_i \]

• Difference between technical efficiency before COVID-19 and the expected technical efficiency because of COVID-19 estimated.
Results

• Firms expect their technical efficiency to fall (over 100%)- fall in output (23%) and increased input costs (over 70% of labor costs) because of COVID-19.

• Prior to COVID-19 firms implemented general (40%) and green (50%) innovations- significant proportion of these innovations were negatively affected by COVID-19 (40%).

• Small number of firms were innovative during COVID-19 (11% general innovations and 17% green innovations).

• General innovations implemented before COVID-19 helped to improve technical efficiency. Similar innovations employed during COVID-19 did not improve technical efficiency.

• Green innovations implemented before and during COVID-19 did not improve technical efficiency and even negatively affected it. Green innovations improved environmental performance.
• Governments should provide credit support and financial assistance to firms given the negative impact on technical efficiency from COVID-19.

• Banks and other financial institutions should offer measures to help businesses with their financial obligations- waiving late fees and offering short-term payment deferrals.

• Government incentives to increase firm innovation and to remove barriers to innovation not just in bad times since innovative firms stand a better chance during crises.

• Firms should continue to implement innovations not just in bad times.
  • Firms implementing innovations before COVID-19 experienced an improvement in their technical efficiency and were better able to adapt to challenges imposed by COVID-19.
Thank you

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