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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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Preeya S. Mohan

Sir Arthur Lewis Institute of Social and Economic Studies, University of the West Indies, St Augustine

Eric Strobl

University of Bern



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Why study COVID-19 and innovation?



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- **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.**



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Why study COVID-19 and innovation?



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- **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.**



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Objective



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- **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.**



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Data



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- **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**



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Methodology



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- **Twofold methodology:**

1. **Stochastic Frontier Analysis (SFA) provides comparative estimates of firm production function and technical efficiency pre- and during COVID-19.**
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.**



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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:

$i = 1, \dots, N$ 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



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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):

$$TE_{PC} = \alpha_0 + \alpha_1 INNOV + \alpha_2 GREEN + \alpha_Z Z + \varepsilon_i$$

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

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

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



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Results



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- **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.**



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Policy implications and conclusions

- **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.**



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Thank you

Preeya.Mohan@sta.uwi.edu



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