



The economic impact of hurricanes on bananas: A case study of Dominica using synthetic control methods



Preeya Mohan

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

ARTICLE INFO

Article history:

Received 24 May 2016

Received in revised form 1 December 2016

Accepted 29 December 2016

Keywords:

Exports

Hurricanes

Natural disasters

ABSTRACT

This paper investigates the impact of hurricanes on bananas exports, using a documented case study of Hurricanes David and Frederick which struck Dominica in 1979. To this end synthetic control estimation methods were employed which entailed creating a comparable control group of the Caribbean with characteristics similar to Dominica prior to 1979 that were not affected by the storms and comparing their banana exports to those of Dominica. The estimation results show that the hurricanes had an immediate and sizeable negative impact on banana exports in Dominica in the year of the strike which lasted up to two years thereafter. However, there was no long term impact on banana exports in Dominica due to the storms.

© 2016 Elsevier Ltd. All rights reserved.

1. Introduction

Bananas are among the top ten crops grown globally in area, yield and calories and are a major source of income, employment, food security and dietary diversity for millions of rural and urban households (Calberto et al., 2015). Bananas are also a major export crop and therefore an important generator of foreign exchange. For instance, world banana production amounted to 106 million tonnes in 2013 with approximately 20 million tonnes or 19% of total production being exported globally (FAO 2016). The crop is produced in more than 100 countries in tropical and subtropical regions including Africa, Asia, Latin America and the Caribbean where the climatic conditions are suitable for growth. Most of these regions are exposed to tropical cyclones and bananas are particularly susceptible to damage from high winds compared to other crops, where even weak tropical storms can cause significant damage (World Bank, 2012; Ahmed, 2001). Moreover, unlike most crops, which have cycles of 3–5 months, bananas are a semi-perennial crop with a cycle of nearly a year under optimum conditions and even longer under sub-optimal conditions (Calberto et al., 2015), and thus large negative shocks, like tropical storms, can be particularly detrimental compared to crops with shorter cycles. Nevertheless, there is essentially no study which specifically examines the economic impact of hurricanes on bananas.

Winds from tropical cyclones may cause both direct and indirect damage to bananas. Direct damage occurs through leaf tearing, whole plant blowdown, uprooting, damage to shoots and flowers

and crop shedding (Turner, 1998). Indirect damage on crop yield results from a reduction in the rate of net photosynthesis and reduced gas exchange by torn leaves, which is further compounded by the fact that new leaves are not produced after flowering (Turner, 1998). In a study by Eckstein (1994) a 33% reduction in photosynthesis was found when banana leaves were torn into fine strips. Also, damage to leaf lamina may have a negative effect on banana bunch growth (Parra et al., 2001). Moreover, to achieve maximum bunch growth at least 9 leaves are required at harvest (Robinson, 1996). High winds can also reduce banana quality by increasing leaf and dust abrasion (Robinson, 1996). Bananas are also highly perishable which makes storage in preparation for a hurricane difficult and increases the risk of spoilage. The typical pattern of storm damage is believed to be up to a complete loss of the crop followed by recovery over 9–12 months, provided that farmers have access to finance and insurance (Ahmed, 2001). Furthermore, in cases where bananas may become completely defoliated, they will usually re-sprout from their base and begin to produce fruit relatively quickly (Calberto et al., 2015). An investigation into the short and long term economic impact of hurricanes on bananas is therefore critical given the extreme vulnerability of bananas accompanied by a seemingly speedy recovery period.

This study uses the synthetic control method for comparative case studies, as developed by Abadie and Gardeazabal (2003) and Abadie et al. (2010), to investigate the impact of Hurricanes David and Frederick which struck Dominica in 1979 to quantify the effect of tropical storms on bananas. The synthetic control technique essentially simulates conditions after an exogenous event based on the relationship of the treatment unit to a control group. It is

E-mail address: Preeya.Mohan@sta.uwi.edu

based on the idea that the impact of an intervention on an outcome variable can be inferred by comparing the evolution of the variable of the unit affected by the event to a group of units that are similar to the exposed unit but were not affected. This approach allows the researcher to find a more appropriate control group and controls for the differential trends across units by controlling for unit specific trends and extrapolating those trends in the post-disaster period. Also, the synthetic control method can estimate unbiased coefficients with a modest amount of data before the disaster strikes. The approach also accounts for time varying unobservable confounders and can deal with endogeneity from omitted variable bias. It also allows for heterogeneous treatment effects and time-varying fixed effects and provides unit specific estimates of an intervention, unlike panel data models which estimate average effects.

As of date, there are a small but growing number of papers on natural disasters that employ the synthetic control method to estimate the economic impact of natural disasters. Most of these tend to focus on whether natural disasters can have a long term economic effect. For instance, [Coffman and Noy \(2012\)](#) investigated the total economic impact of Hurricane Iniki on the Hawaiian island of Kauai and concluded that the population and employment took 6 and 13 years respectively to recover, while real per capita income was affected in a relatively shorter time period and personal income was not affected. In another study [duPont and Noy \(2012\)](#) investigated the Kobe earthquake of 1995 and found a persistent and lasting negative impact in that GDP per capita in 2007 was 13% lower than what it would have been had the earthquake not occur. Lastly, [Cavallo et al. \(2010\)](#) found that in extremely large natural disasters there was a long term negative impact on economic growth, but only in cases where the disasters were associated with radical political revolutions. The mixed results from these studies thus are anything but conclusive on whether there is indeed a long term impact of natural disasters. A result that is echoed in studies using other econometric techniques; see Noy and Nualsri for details on such studies ([2007](#)).

In contrast to the previous literature, the focus here is on a specific sector in a region that is known to be potentially very vulnerable to tropical storms. More precisely, much of the Caribbean is located in the storm active Atlantic Hurricane belt, and is a major producer and exporter of bananas. While the economic and social destructive effects of hurricanes in the region have in general been considerable ([Heger et al., 2008](#); [Rasmussen, 2004](#); [Crowards, 2000](#)), the banana sector is believed to have been particularly victimized. For example, in 2007 Hurricane Dean obliterated 80–100% of the crop in St. Lucia, Martinique, Dominica and Guadeloupe. Added to its vulnerability, banana production in the region takes place mainly on a small scale basis in family run farms by the poorest segments of society ([World Bank, 2009](#)), where farmers have little or no natural disaster insurance ([ECLAC, 2004](#)).

The case study of Hurricane David and Frederick on banana exports in Dominica allows for the use of the synthetic control method since an appropriate control group of banana exporters can be created using the other Caribbean islands that belong to Caribbean Community (CARICOM) that also export bananas but were not affected.¹ The banana sector is measured using export data from the United Nation's Food and Agriculture Organization (UNFAO). Export data arguably provide a better measure of banana activity as it is more comprehensive and reliable than production data since it must be compiled for customs purposes. CARICOM countries share similar characteristics of a common historical experience of colonization which has shaped economic and social

institutions, small land area and population, remoteness, limited resource base, economic and environmental vulnerability and are guided by the Revised Treaty of Chaguaramas. Also, each island shares a general reliance on agriculture as an important economic activity and bananas are an important export crop.

The case study of Hurricane David and Frederick and their impact on Dominica also allows for an ideal examination of the short and long term impact of hurricanes on bananas since it provides sufficient data pre and post disaster to make a statistical comparison. However, while the two hurricanes undoubtedly have, at least to some extent, hurt Dominica's banana sector, the industry had already been on the decline. More precisely, in the 1960–1970s banana export was as high as 50,000 tonnes and contributed 80% of Dominica's total agriculture exports, but in contrast only 10,000 tonnes, or 12% of agriculture exports ([UNFAO, 2013](#)), are being exported today. Many reasons besides hurricanes have been proposed for the long term decline of bananas, including the erosion of trade preferences to Europe (the largest market), volatile international prices, high cost of production, use of outdated technology, lack of technical expertise and increasing competition from cheaper producers in Latin America and the United States (US) ([Ahmed, 2001](#); [Benson and Clay, 2001](#)). The synthetic control method allows for a reliable construction of what both the short and long run trend in banana exports in Dominica after 1979 would have been in the absence of Hurricane David and Frederick by constructing an appropriate control group, and comparing its trends to the actual path observed for Dominica.

While the choice of Dominica is in part chosen by the suitable context for the methodology employed, Dominica arguably serves as a suitable example of the banana sector in the Caribbean for which hurricane activity provides an important threat to the economy. In Dominica agriculture plays a particularly vital role, where agriculture's value added to GDP is 16% and the sector employs 21% of the labour force (WDI 2015). In this regard bananas are the main export crop and are believed to have been completely wiped out after the hurricanes struck in 1979. Furthermore, since Dominica's independence in 1978 Hurricane David has been the most devastating tropical cyclone in terms of its economic and social impact ([Benson and Clay, 2001](#)), and its devastation was further exacerbated by Hurricane Frederick which struck later on in the same year. According to [Benson and Clay \(2001\)](#) no other hurricane sequence has done comparative damage to the island. Moreover, during this time Dominica was in a political crisis with an interim government and was not prepared politically or operationally to deal with the destruction ([Benson and Clay, 2001](#)). In addition, the hurricanes increased fiscal pressure as government expenditure increased for clean-up, relief and reconstruction activities and Dominica had to enter into a Structural Adjustment Program (SAP) ([Benson and Clay, 2001](#)). The investigation here explores whether there was a long term effect on the island's banana exports.

To proxy the actual hurricane destruction in Dominica the study took the actual track data of Hurricanes David and Frederick and used a wind field model and a cropland exposure map to derive an approximation of the severity of winds experienced at the potential banana plantation areas. The destruction proxy was then combined with banana export data. The results from the synthetic control method estimation demonstrate that the 1979 hurricanes had an immediate and large negative impact on banana exports in Dominica in the year of the strike which lasted up to two years after. The size of the estimates suggests that the storms also had more general strong implications on Dominica's total merchandise exports and GDP. However, beyond the two years after the strike there was no statistically discernable impact on banana exports in the island.

The remainder of the paper is organized as follows. Section 2 discusses the case of the 1979 hurricanes and bananas in

¹ CARICOM member countries include Antigua and Barbuda, The Bahamas, Barbados, Belize, Dominica, Grenada, Guyana, Haiti, Jamaica, Montserrat, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Suriname, and Trinidad and Tobago.

Download English Version:

<https://daneshyari.com/en/article/5070166>

Download Persian Version:

<https://daneshyari.com/article/5070166>

[Daneshyari.com](https://daneshyari.com)