The Effect of Hurricane Maria and La Crisis Boricua on Healthcare Supply in Puerto Rico

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Introduction

Puerto Rico was devastated by Hurricane Maria, a category 4 storm, in September 2017. It took 11 months to completely restore power to the island. The US Census estimates the population of Puerto Rico decreased by 4 percent after the hurricane as a result of migration by residents to the United States mainland (Schachter and Bruce 2020). This paper considers the effects of out-migration on the supply of healthcare workers.

Prior to the hurricane landing, Puerto Rico was already experiencing a financial crisis due to the phasing out of IRS Section 936 at the end of 2005. Puerto Rico enjoyed a special tax status due to IRS Section 936, which exempted corporate profits from federal taxes for US corporations located in US territories. In 2005, US companies located in Puerto Rico received 98 percent of these tax exemptions (Feliciano 2018). The bulk of the tax credits were enjoyed by the manufacturing sector, especially pharmaceutical manufacturing (Holik 2009). Feliciano and Green (2017) find the removal of Section 936 reduced average manufacturing wages by 16.7% and the number of manufacturing establishments by 18.7% to 28.0%. Feliciano (2018) finds that manufacturing jobs decreased by nearly 100,000 jobs.

In February 2014, two out of three credit rating agencies changed Puerto Rico's public bonds status to junk bonds. This event accelerated debt payment amounts, which eventually forced Puerto Rico to default on its debt to bond holders on July 2016. The US Congress passed the

Puerto Rico Oversight, Management and Economic Stability Act, or PROMESA, to allow Puerto Rico to enter bankruptcy and restructure the island nation's debt.

The economic crisis (also known as La Crisis Boricua) led to a decade of mass out-migration. Mora, Dávila, and Rodríguez (2017) estimate that 719,000 residents left the island between 2006 and mid-2017, which translates into 18.3 percent reduction in the population. Approximately, 77 percent of the 719,000 residents migrated to the United States mainland, particularly in Florida and New York (Mora, Dávila, and Rodríguez 2018).

As part of PROMESA, taxes were increased, and government spending was reduced. However, a special tax exemption known as Act 14 was passed in early 2017 to reduce out-migration of physicians and potentially attract new healthcare providers to Puerto Rico. This tax policy extended favorable tax protection to general practice physicians including medical residents in training. Act 14 applies a flat income tax of 4 percent, an allowance of 25 percent of net income for individual retirement plans, and up-to $250,000 in tax free dividends per tax year. In return, the physician must become a resident of Puerto Rico, commit to 180 hours of community service, and establish a full-time medical practice in Puerto Rico. Before the amendment, only medical specialists, dentists and veterinarians were eligible for the tax incentive benefits provided by the Act. Prior to the Act 14 amendment, general practitioners could seek employment in a Medically Underserved Area (MUA) and could receive partial/full student loan forgiveness. This point is relevant because almost the entire island of Puerto Rico has been designated a MUA since 1978. In this paper, I consider if this tax policy aided the government to mitigate out-migration from healthcare providers stemming from the economic crisis.

Data

I collect data from three sources to assess the effects of La Crisis Boricua and Act 14 on the supply of medical providers. Information about medical residents' location choice after completion of residency is gathered from the AAMC Report on Residents for the years 2015 to 2019. I collect state level data reporting the number of residents who remain in the state after graduating residency and the number of residents who practice in Medically Underserved Areas. Next, I collect state level employment data from the May State Occupational Employment and Wage Estimates of the Occupational Employment Statistics maintained by the US Bureau of Labor Statistics for the years 2000 to 2019. I specifically collect data on the employment level of Family Medicine Physicians, Internal Medicine, Pediatrics, Registered Nurses, and Other Physicians and Surgeons, which primarily constitutes specialists. Lastly, the number of physician offices by county by quarter between the years 2000 to 2019 are collected from the Quarterly Census of Employment and Wages of the US Bureau of Labor Statistics.

I report descriptive statistics of the collected variables in Table 1. There are stark differences between Puerto Rico and the rest of the US. Puerto Rico has more physicians' offices per capita than the average US state, but has fewer providers per capita in every other measure of healthcare employment and in many cases less than half than the average US state. These differences are statistically significant at the 1 percent level. For example, Puerto Rico has 22 family medicine physicians per 100,000 people compared to 44 family medicine physicians per 100,000 people on average in US states. Puerto Rico retains over 74 percent of the medical residents they train and over 89 percent practice in a MUA after graduation. Both statistics are higher than any other US state, with Oregon having the second highest retention rate at 60 percent and Alabama having the second highest MUA percentage at 64 percent.

Some of these differences in labor supply are driven by financial concerns. According to the American Community Survey, 62 percent of Puerto Rico's population is covered by either Medicaid or Medicare. The federal medical assistance percentage (i.e. Medicaid reimbursement) is capped in US territories at 55 percent. If Puerto Rico were a state, the percentage would increase to 83 percent (Buderi and Park 2019). Additionally, Puerto Rico and other US territories were not included in the Affordable Care Act. Since residents of Puerto Rico are US citizens and have free passage to the US mainland, there exists a financial incentive for Puerto Rican physicians to leave the island.

Model and Results

I estimate the following difference in differences model

$$y_{it} = \beta_1 Act14_{it} + \beta_2 junkbond_{it} + \alpha_i + \theta_t + e_{it}$$

where Act14 is a dummy variable equal to 1 for Puerto Rico after 2017 and zero otherwise, junkbond is a dummy variable equal to 1 for Puerto Rico after 2014 and zero otherwise, α_i is a state specific fixed effect, θ_t is the time specific fixed effect, and e_{it} is assumed to be an idiosyncratic error with mean zero. The Act14 variable captures both the tax incentives to physicians as well as the effects of Hurricane Maria. The dependent variables of interest are all count in nature and are converted into rates when dividing by the area population. I consider the number of family medicine physicians, internal medicine physicians, pediatricians, registered nurses, physician and surgeon specialists, as well as all healthcare providers. I estimate the

model using a fixed effects Poisson model and estimate robust standard errors clustered by state to account for possible over-dispersion (Wooldridge 1999).[1]

For each of the dependent variables, I estimate two specifications. First, I consider the level effect on the employment count. Second, I utilize the exposure value to convert the level counts into per capita population rates. These two specifications allow us to study how the individual variables evolve and how changes in migration affect their per capita rate. I report the estimated coefficients in Table 2.

In general, Hurricane Maria reduced the number of healthcare providers by 6.5 percent as seen in the first panel of Table 2. These effects were experienced strongest by family medicine physicians (-17.5 percent), pediatricians (-65 percent), as well as other physician and surgeon specialists (-8.4 percent). These reductions are statistically significant at the 5 percent level. However, the per capita rate of these variables often indicates increases as seen in the second panel of Table 2. These increases are caused by a stronger out-migration pattern among non-physicians in the population. Only family medicine physicians experience a decrease in both levels and rates. The rate of family medicine physicians per capita decreased by 9.6 percent as a result of Hurricane Maria and decreased by 26 percent due to the austerity measures that followed the declaration of junk bond status. Local healthcare establishments substitute the loss of family medicine physicians by utilizing more internal medicine physicians and registered nurses.

[1] I also estimated linear fixed effects models of the level and rate variables and find no qualitative differences between OLS and Poisson. Although not reported in the tables, I do control for the Great Recession with a separate dummy variable for Puerto Rico post 2008.

Next, I consider how Hurricane Maria affected the choice of medical residents to practice medicine in Puerto Rico after graduation. Using annual counts of medical residents, I find the number of residents remaining in Puerto Rico after Hurricane Maria reduced by 4.12 percent, but the share practicing medicine in a MUA increased by 3.98 percent. Potentially, the presented results are being driven exclusively by unobserved state differences. I use county level data on the number of physician office counts with fixed effects to control for more unobserved differences between areas. I find the number of physician offices per county reported by the QCEW declined by 2.5 percent, but the per capita ratio increased by 5.7 percent. Interestingly, the number of physician offices did not decline in a statistically significant manner throughout La Crisis Boricua. I report these estimates in Table 3. I previously reported the population of Puerto Rico declined by 4 percent immediately after the hurricane. Therefore, this estimate suggests that Act 14 may have mitigated the reduction in physician offices.

Conclusion

In this paper, I find consistent estimates indicating the number of healthcare workers declined both during La Crisis Boricua as well as in the immediate aftermath of Hurricane Maria. In the short run, Act 14 has done little to stem the decrease in the employment of healthcare workers, but may have mitigated the reduction in the number of physician offices. These results are important as Puerto Rico continues to recover from the financial crisis, but there still exists a large disparity in the supply of health care providers when compared to US states.

Table

Table 1: Descriptive Statistics

Variables	Puerto Rico	US States
Percent in MUA	89.9	22.0
	(.483)	(.821)
Percent in State	74.4	51.6
	(.577)	(.533)
Physician offices per capita	100.3	64.0
	(.982)	(.243)
Family Medicine per capita	22.83	44.28
	(1.16)	(1.14)
Internal Medicine per capita	7.25	16.1
	(1.42)	(.526)
Pediatrics per capita	3.60	10.4
	(.331)	(.430)
Other Physicians and Surgeons per capita	29.8	93.4
	(.786)	(1.93)
Registered Nurses per capita	463.3	889.7
	(17.3)	(5.69)
Population (100,000)	3.64	6.02
	(.0455)	(.2066)

Standard Errors of the mean are found in parentheses. All per capita variables are in 100,000 people.

Table 2: Poisson Regression of Employment Counts by Specialty

VARIABLES	(1) All Healthcare Providers	(2) Family Medicine	(3) Internal Medicine	(4) Pediatrics	(5) Other Physicians & Surgeons	(6) Registered Nurses
Levels						
Act14/Hurricane	-0.0651***	-0.175***	-0.0369	-0.620***	-0.0843**	0.0275***
	(0.00340)	(0.0463)	(0.0530)	(0.0446)	(0.0338)	(0.00748)
Junk Bond Status	0.00905	-0.369***	1.270***	0.438***	-0.119***	-0.0576***
	(0.00671)	(0.0433)	(0.101)	(0.0525)	(0.0257)	(0.00726)
Rates						
Act14/Hurricane	0.0110***	-0.0965**	0.0407	-0.545***	-0.0110	0.103***
	(0.00355)	(0.0449)	(0.0536)	(0.0463)	(0.0313)	(0.00823)
Junk Bond	0.116***	-0.262***	1.377***	0.548***	-0.0166	0.0493***
	(0.00340)	(0.0417)	(0.0990)	(0.0551)	(0.0265)	(0.00509)
Observations	1,092	1,063	976	945	867	1,092
No. of States	52	52	52	52	52	52
State FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES

Robust standard errors clustered by state in parentheses. States include Puerto Rico and Washington DC. State population is used as the exposure variable in the Rate Poisson regressions. *** p<0.01, ** p<0.05, * p<0.1

Table 3: Poisson Fixed Effect Regression of Physician Offices and Medical Resident Counts

VARIABLES	(1) Physician Offices Level	(2) Physician Offices Rate	(3) No. of Resident in MUA	(4) No. of Residents remain in State
Act14/Hurricane	-0.0253***	0.0573***	0.0398**	-0.0412***
	(0.00773)	(0.00810)	(0.0198)	(0.00286)
Junk Bond	-0.000411	0.124***		
	(0.0146)	(0.0111)		
Observations	236,015	236,015	260	260
Number of Groups	3,102	3,102	51	51
County FE	YES	YES	NO	NO
Year Quarter FE	YES	YES	NO	NO
State FE	NO	NO	YES	YES
Year FE	NO	NO	YES	YES

Robust standard errors in parentheses clustered by county for physician offices and clustered by state for Residents. County population is used as the exposure variable in column 2. Physician office counts are measure by county by quarter from 2000-2019. Residents counts are measured annually by state between 2015-2019

*** p<0.01, ** p<0.05, * p<0.1

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