

# **The Economic Impact of Migrants from Hurricane Maria**

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## **Online Appendix**

### *A. ACS Measurement of Puerto Rican Migrant Flows after Hurricanes Irma and Maria*

An alternative approach to measuring the size of the inflow to Orlando from Puerto Rico would be to compare data from the 2017 and 2018 American Community Survey (ACS), downloaded from IPUMS USA (Ruggles et al., 2021), to track the number of people who moved between Puerto Rico and the mainland during this time. The Census Bureau itself notes that there are significant issues with this approach and that the ACS figures should be treated with caution Schachter and Bruce (2020).<sup>1</sup> For example, obtaining survey responses from Puerto Rican migrants right after the hurricane was likely very difficult for several reasons, including the fact that they were often not technically eligible for participation in the ACS due to the survey's two-month residency requirement. Moreover, the hurricane didn't hit Puerto Rico until September of 2017, and those who migrated and stayed in Florida for several months may have returned at any point in 2018.<sup>2</sup> These factors make the ACS microdata quite imprecise in measuring the size of the migration event. Despite these issues, we show in [Figure A3](#) that the ACS data demonstrate an observable jump in migrants from Puerto Rico to the Orlando area in 2018 after the hurricane, as a proportion of the population. Particularly when compared to a city which saw many FEMA applications but where we can reasonably expect the new migrants to have been a much smaller share of the population—namely New York City—Figure A3 shows an increase of Puerto Rican immigrants between 0.2-0.3 percent of the population. While likely an underestimate of the inflow, this number confirms the sudden increase following Hurricane Maria. Thus previous research and our own analysis strongly indicate Orlando received a large inflow of Puerto Rican migrants in the months after Hurricane Maria hit Puerto Rico.

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<sup>1</sup> The note can be read at <https://www.census.gov/library/stories/2020/08/estimating-puerto-rico-population-after-hurricane-maria.html>

<sup>2</sup> In fact, the other estimates of Puerto Rican migration patterns following Maria suggest substantial numbers of migrants returned to Puerto Rico by the end of 2018. As the ACS provides only the year and not the month the participant was surveyed, it cannot capture temporary, mid-year migration patterns of the sort prompted by Hurricane Maria. The Schachter and Bruce (2020) note from the Census Bureau argues the ACS data need to be adjusted to accurately capture net migration from Puerto Rico to the mainland U.S., allowing them to arrive at the 123,399 number.

Using data collected through the Puerto Rican Community Survey (PRCS), downloaded from IPUMS USA (Ruggles et al., 2021), we observe normal to slightly above average levels of re-migration to PR from FL after 2018, compared to the few years just prior to the hurricane. Using the PRCS, we can study the composition of migrants flows during this period and compare pre and post-hurricane re-migration of Puerto Ricans from FL. [Table A1](#) compares the average age and educational attainment of return migrants in 2015 and 2016 to those returning from FL to the island in 2018 and 2019, we find no statistically significant difference in composition along those two important dimensions. The hurricane-induced migration event appears to have not driven any selection regarding return migration above and beyond the type observed before the hurricane.

### ***B. Cleaning Seasonal Variation from the Data***

We clean the data of seasonal variation prior to analysis. Specifically, for each observed outcome of interest,  $\tilde{Y}_{j,t}^{(s)}$ ,  $s \in \{1, \dots, S\}$ , in each CZ  $j$  and each period  $t$ , our LHS values are the residualized outcomes  $Y_{j,t}^{(s)} = \tilde{Y}_{j,t}^{(s)} - \hat{Y}_{j,t}^{(s)}$ . This is obtained from  $J$  individual OLS regressions of a model  $\tilde{Y}_{j,t}^{(s)} = \beta_j^{(s)} + \pi_{j,p}^{(s)} + \varepsilon_{j,t}^{(s)}$ , estimated separately for each  $j$  and each  $s$ , where  $p$  is the quarter (or month) associated with each  $t$ , as appropriate for each  $\tilde{Y}_{j,t}^{(s)}$  given the data source.  $\beta_j^{(s)}$  is the local intercept for each  $\tilde{Y}_{j,t}^{(s)}$  in commuting zone  $j$ , and  $\pi_{j,p}^{(s)}$  is the seasonal element of  $\tilde{Y}_{j,t}^{(s)}$  in  $j$  associated with  $t$ . That is,  $\pi_{j,p}^{(s)}$  is the quarterly (or monthly) fixed effect associated with  $t$  in  $j$ , for each  $\tilde{Y}_{j,t}^{(s)}$ . Then  $\hat{Y}_{j,t}^{(s)} = \hat{\beta}_j^{(s)} + \hat{\pi}_{j,p}^{(s)}$  is the sum of the values of the associated coefficient estimates, which are removed from the observed outcomes,  $\tilde{Y}_{j,t}^{(s)}$ , to obtain the residualized (natural logarithm of the) outcome values which we work with,  $Y_{j,t}^{(s)}$ .

### ***C. Regression-based estimates***

For each regression-based DD model we consider two ways of constructing the control groups. In [Table A8](#), columns (1) and (2), we include in the control group all commuting zones that are positively weighted in the synthetic control unit. In column (3), we instead only include the con-

structured synthetic control (the weighted composite) as the ‘control group’.<sup>3</sup> To implement the difference-in-differences estimate, we regress the outcome variable (alternatively [deseasonalized] log employment, log compensation per worker and log establishments) on a treatment dummy which equals to one for Orlando after September 2017 and zero otherwise, and on time fixed effects (column (1) of [Table A8](#)) or on time and unit fixed effects (column (2)). For column (3), where we have only a single treatment and a single control unit, we can include only time effects. In [Table A9](#), instead of one single ‘post-Hurricane’ Orlando treatment dummy, we include an Orlando dummy interacted with each half-year period, both before and after the hurricanes, and estimate against the composite synthetic control (showing results for employment and earnings). This serves to test whether there are deviations from zero in the pre-hurricane period, which would imply non-similar trends between Orlando and the control group. The latter half of 2017 is the period of the “treatment” (when the hurricanes hit Puerto Rico and the migration occurred) and is therefore treated as the reference period in the analysis.

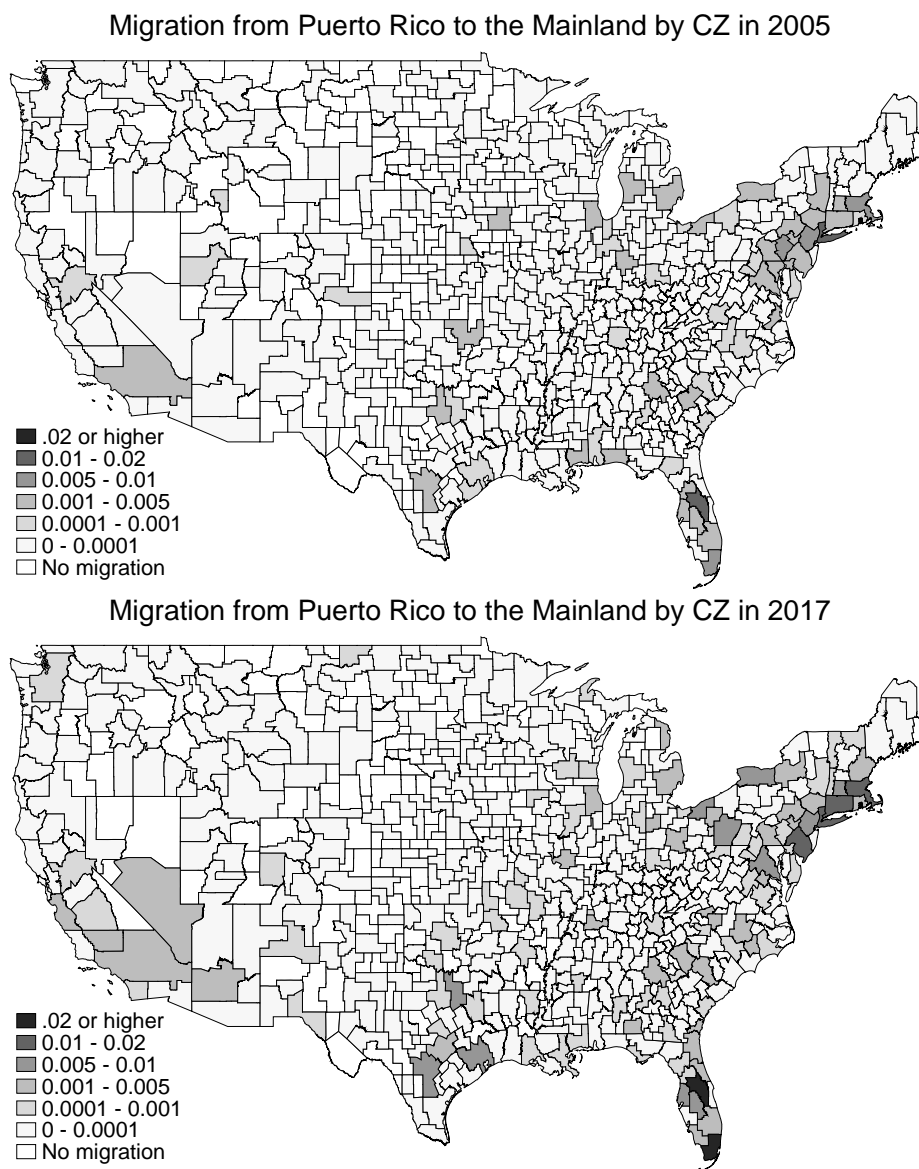
The estimates in [Table A8](#) mostly confirm the synthetic control results. Because the estimates in column (3) are most likely to be free of extrapolation and interpolation bias (see above), we focus primarily on these. First, aggregate employment exhibits a positive and significant treatment effect of 0.3 percent, and the construction sector shows the largest positive employment effect, although now it is only 1.5 percent rather than 4 percent (as this is an average over the entire post-hurricane period and there is evidence of temporary inflow only). Second, log earnings per worker show small effects, usually non-significant, that vary between positive and negative depending on which control group (column) one chooses. Third, these estimates show significantly positive effects on establishments, especially in the construction sector. In [Table A9](#) we show the estimates of the Orlando dummy interacted with each half-year period, showing employment (columns 1-4) and compensation per worker (columns 5-8). The four columns for each outcome variable

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<sup>3</sup> Thus the estimates in columns (1) and (2) of [Table A8](#) more likely suffer from bias realized through interpolation and extrapolation, while those in column (3) are free from extrapolation bias and less-likely to suffer from interpolation bias.

correspond, left to right, to the aggregate economy, and to the construction, retail, and hospitality sectors. In general, the deviations of Orlando from control, both in employment and per-worker earnings, are small in the pre-Hurricane period. However, there are small but significant deviations which may suggest modest *negative* pre-trends for construction and hospitality employment and for aggregate and hospitality earnings per worker, and possibly a modest positive pre-trend for retail employment. It is also clear that the post-Hurricane employment and earnings effects are positive and significant, especially by Q3 of 2018 (one year after the hurricanes) and the largest positive employment effect is in construction.

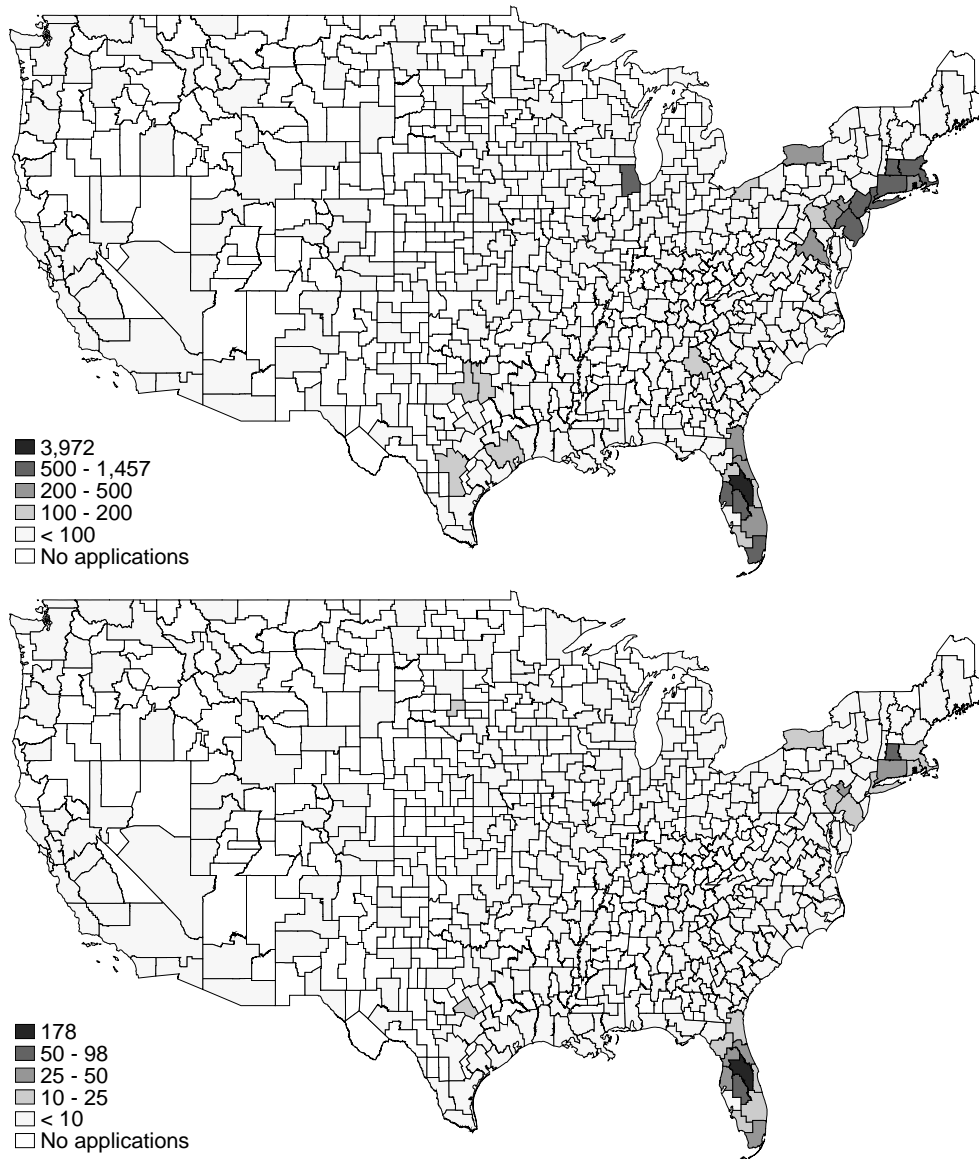
*D. Additional Figures and Tables*



**Figure A1**

*Concentration of Recent Puerto Rican Migrants, by Commuting Zone, in 2005 and 2017*

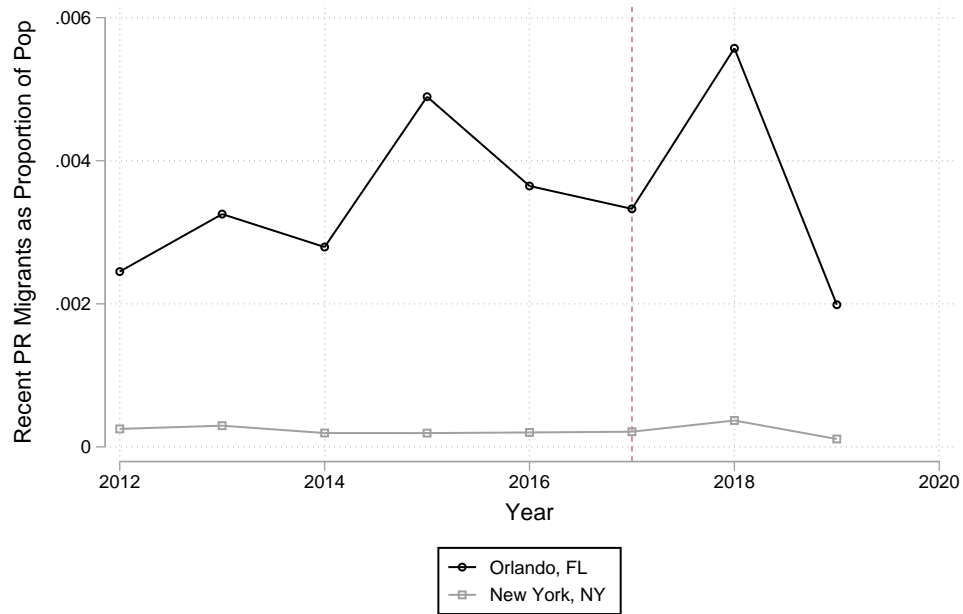
Notes: Numbers are calculated using data from the American Community Survey (2005 and 2017), and are the fraction of the total recent Puerto Rican migrant population.



**Figure A2**

*Puerto Rican FEMA Applications by Commuting Zone, in levels and per 100,000 population*

Notes: FEMA applications reflect mainland ZIP code of filing for Puerto Rican homes damaged in either Hurricane Irma or Maria. Data are aggregated to commuting zones to reflect local labor markets. Population figures taken from the 2010 Decennial Census.

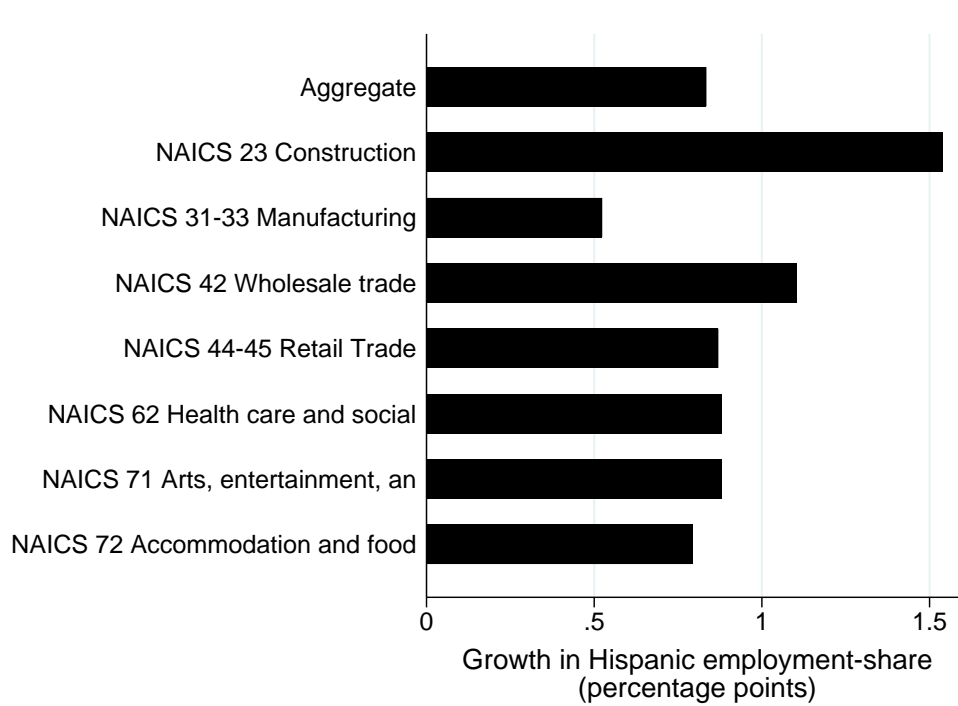


**Figure A3**

*Trends in Recent Migration from Puerto Rico to U.S. Mainland, Orlando and New York City*

Notes: Calculated using data from the 2012-2019 ACS. The y-axis measures the proportion of the population which recent Puerto Rican migrants comprise. We note certain design parameters for the ACS result in substantial under-estimates of the number of Puerto Rican migrants from Hurricane Maria, and make it effectively impossible to see the results, within that year, of any large in-migrations which occurred in the final quarter of any year. See the main text and Schachter and Bruce (2020) for details.





**Figure A4**

*Growth in Hispanic Share of Total Employment by Selected Sectors (Orlando, Q2 2017 - Q2 2018)*

Notes: Calculated using data from the QWI. Sector-selection reflects likelihood of absorbing English non-speaking workers.

**Table A1**  
*Characteristics of Return Migrants Pre/Post Maria*

	Age	Education
Post-Maria	-0.316 (2.157)	-0.0861 (0.317)
Constant	33.45*** (1.099)	5.336*** (0.162)
<i>N</i>	518	518

Notes: Data come from the Puerto Rican Community Survey (PCRS), years 2010 to 2019. Sample consists of Puerto Ricans who recently returned to Puerto Rico from Florida in the past year. Results show conditional mean of age and education level for Puerto Ricans returning from Florida after Hurricane Maria, relative to before the storm. Statistical tests compare the difference to the means from before the hurricane. Standard errors in parentheses.

**Table A2**  
*Top 10 Destinations of Recent Migrants from Puerto Rico, by Share of Population*  
*Average over 2013-2016*

Commuting Zone	Recent PR migrants, % of population
<b>Orlando, FL</b>	0.36478
<b>Springfield, MA</b>	0.25462
<b>Lakeland-Winter Haven, FL</b>	0.14697
Allentown-Bethlehem-Easton, PA	0.14656
Ocala, FL	0.12471
<b>Daytona Beach, FL</b>	0.12234
<b>Tampa-St. Petersburg-Clearwater, FL</b>	0.09751
Savannah, GA	0.07464
Columbia, SC	0.07202
Hartford-New Haven-Bridgeport-Stamford, CT	0.06815

Notes: Average population shares of recent Puerto Rican migrants to mainland Commuting Zones, 2013–2016. Commuting Zones which are in the top five of per-capita Hurricane Maria FEMA applications are in bold. Calculated using data from the ACS.

**Table A3**  
*Sector composition of various populations Orlando*

	Born in Puerto Rico	Natives	Hispanics (Born Abroad)	Hispanics
Wholesale	2.6%	2.4%	2.4%	2.4%
Construction	5.6%	5.6%	10.6%	8.5%
Retail	14.3%	12.0%	11.8%	12.8%
Information	1.8%	2.5%	1.5%	1.8%
Finance/Real Estate	7.0%	6.8%	6.1%	6.3%
Education/Health	17.0%	18.2%	15.9%	15.6%
Hospitality	17.4%	17.8%	16.5%	17.9%
Manufacturing	4.0%	4.3%	4.6%	4.1%
Transport	7.3%	3.7%	6.6%	5.7%
Other Services	4.8%	4.3%	5.0%	4.4%
Utilities	0.4%	0.1%	0.4%	0.3%
Management	10.0%	12.6%	11.7%	11.9%
Natural Resources	0.2%	0.4%	1.2%	0.8%
Mining	0.0%	0.1%	0.0%	0.0%
<i>N</i>	2,628	33,301	6,301	10,102

Notes: Share of labor force participants from each population working or looking for work in various sectors in Orlando. Numbers calculated using US Census and ACS.

**Table A4**  
*Synthetic control donor weights, Selected outcomes and sectors*

Aggregate		Construction	
Commuting Zone	Weight (%)	Commuting Zone	Weight (%)
<i>Panel A: Employment</i>			
Gainesville, GA	26.9	Provo-Orem, UT	24.3
Fayetteville-Springdale-Rogers, AR	18.6	Anniston, AL	20.6
Provo-Orem, UT	15.3	Reno, NV	14.1
Nashville, TN	11.0	Boise City, ID	12.3
El Paso, TX-Las Cruces, NM	7.0	Salem-Eugene-Springfield, OR	10.1
Boise City, ID	6.7	Norfolk-Virginia Beach-Newport News, VA-NC	7.6
Las Vegas, NV-AZ	6.5	Las Vegas, NV-AZ	7.4
Fresno-Visalia-Tulare-Parterville, CA	5.3	Lake Charles, LA	3.6
Fort Walton Beach-Pensacola, FL	2.7		
<i>Panel B: Earnings per worker</i>			
Modesto-Merced, CA	24.3	Chattanooga, TN-GA	33.6
Roanoke, VA	12.7	Reno, NV	20.0
San Diego, CA	12.3	Fort Worth-Arlington, TX	17.6
Reno, NV	10.4	Corpus Christi, TX	12.1
San Francisco-Oakland, CA	9.5	Las Vegas, NV-AZ	6.8
Lake Charles, LA	8.9	Santa Barbara-Santa Maria-Lompoc, CA	6.1
Lexington-Fayette, KY	8.6	Brazoria, TX	3.9
Las Vegas, NV-AZ	6.1		
Peoria-Pekin, IL	3.2		
Salem-Eugene-Springfield, OR	3.0		
Punta Gorda-Sarasota-Bradenton, FL	0.8		

Notes: Synthetic control donor CZs by weight for selected outcomes calculated using the QCEW. Weights rounded to nearest tenth of a percent. CZs with zero weight not shown. 1990 commuting zone definitions from IPUMS USA: <https://usa.ipums.org/usa/volii/1990lma.shtml>

**Table A5***Estimated Treatment Effects with Other Test Statistics, Non-Hispanic and Less-Educated Workers*

Sector	Non-Hispanic Workers				Less-Educated Workers			
	Log Employment		Log Earnings per Worker		Log Employment		Log Earnings per Worker	
	6 month TE	12 month TE	6 month TE	12 month TE	6 month TE	12 month TE	6 month TE	12 month TE
<i>Aggregate</i>	6 month TE	12 month TE	6 month TE	12 month TE	6 month TE	12 month TE	6 month TE	12 month TE
Treatment effect	-0.0003	0.0082	0.0001	0.0009	-0.0006	0.0080	0.0008	-0.0199
Andrews <i>p</i> -value	0.4000	0.0667	0.9333	0.4667	0.3333	0.0667	0.4000	0.0667
Moving block <i>p</i> -value	0.0000	0.0000	0.3750	0.1111	0.0000	0.0000	0.1875	0.0000
<i>N</i>	134	134	134	134	136	136	136	136
<i>Construction</i>	6 month TE	12 month TE	6 month TE	12 month TE	6 month TE	12 month TE	6 month TE	12 month TE
Treatment effect	0.0004	0.0068	0.0004	-0.0245	0.0082	0.0166	0.0007	-0.0147
Andrews <i>p</i> -value	0.4667	0.2000	0.6667	0.0667	0.2667	0.0667	0.5333	0.1333
Moving block <i>p</i> -value	0.0625	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<i>N</i>	128	128	128	128	133	133	133	133
<i>Retail</i>	6 month TE	12 month TE	6 month TE	12 month TE	6 month TE	12 month TE	6 month TE	12 month TE
Treatment effect	-0.0001	0.0009	0.0036	0.0205	-0.0004	0.0089	0.0060	0.0119
Andrews <i>p</i> -value	0.5333	0.4000	0.2667	0.0667	0.5333	0.1333	0.2000	0.1333
Moving block <i>p</i> -value	0.2500	0.1111	0.1875	0.0000	0.5625	0.5556	0.0000	0.0000
<i>N</i>	137	137	137	137	136	136	136	136
<i>Hospitality</i>	6 month TE	12 month TE	6 month TE	12 month TE	6 month TE	12 month TE	6 month TE	12 month TE
Treatment effect	-0.0016	0.0120	-0.0002	0.0028	-0.0041	0.0042	0.0003	0.0134
Andrews <i>p</i> -value	0.5333	0.1333	0.4667	0.3333	0.3333	0.3333	0.5333	0.2000
Moving block <i>p</i> -value	0.3125	0.2222	0.1250	0.0000	0.0625	0.2222	0.3125	0.0556
<i>N</i>	137	137	137	137	133	133	133	133

Notes: Synthetic control estimates of the impact of the immigration inflow on the residualized (after accounting for seasonal component and intercept) logarithms of the indicated outcomes in Orlando (6 and 12 months after Hurricane Maria hit Puerto Rico), using data from the QWI. Columns 1-4 show estimates for non-Hispanic workers. Columns 5-8 show estimates for less-educated workers. The donor pool is restricted to include only those commuting zones which are observed for four quarters after the Hurricane, allowing 12-month estimates of the treatment effects. *p*-values calculated using Andrews (2003) end-of-sample instability test and the moving block test statistic proposed in Chernozhukov, Wuthrich, and Zhu (2017).

**Table A6**  
*Estimated Treatment Effects, Workers in Transportation and Warehousing*

<i>Transportation &amp; Warehousing</i>	Log Employment		Log Earnings per Worker		Log Establishments	
	6 month TE	12 month TE	6 month TE	12 month TE	6 month TE	12 month TE
Treatment effect	-0.0057	0.0135	-0.0071	-0.0428	0.0079	0.0337
RMSPE	0.7571	0.7796	1.4217	4.4400	0.4662	2.2596
RMSPE p-value	0.7568	0.8784	0.5743	0.1824	0.8581	0.5068
<i>N</i>	148	148	148	148	148	148

Notes: Synthetic control estimates of the impact of the immigration inflow on the residualized (after accounting for seasonal component and intercept) logarithms of the indicated outcomes in Orlando (6 and 12 months after Hurricane Maria hit Puerto Rico), using data from the QCEW. Columns 1-6 show estimates for workers in the transportation and warehousing sectors.

**Table A7**  
*Estimated Treatment Effects, Workers with Less Than a High School Education*

Sector	Log Employment		Log Earnings per Worker	
	6 month TE	12 month TE	6 month TE	12 month TE
<i>Aggregate</i>				
Treatment effect	-0.0004	0.0106**	-0.0002	-0.0112
RMSPE	4.6320	12.4827	0.6374	5.1821
RMSPE p-value	0.1250	0.0441	0.7279	0.1324
<i>N</i>	136	136	136	136
<i>Construction</i>				
Treatment effect	0.0106	0.0186	0.0003***	-0.0148**
RMSPE	3.3473	3.0439	10.0007	7.6415
RMSPE p-value	0.1769	0.4154	0.0077	0.0385
<i>N</i>	130	130	130	130
<i>Retail</i>				
Treatment effect	-0.0001	0.0168	0.0027*	0.0134*
RMSPE	0.0146	1.3774	5.9664	5.5898
RMSPE p-value	0.9928	0.7899	0.0507	0.0725
<i>N</i>	138	138	138	138
<i>Hospitality</i>				
Treatment effect	-0.0037	0.0134	-0.0027	0.0100
RMSPE	0.4122	1.4557	0.6475	1.1035
RMSPE p-value	0.8169	0.7042	0.7394	0.7817
<i>N</i>	142	142	142	142

Notes: Synthetic control estimates of the impact of the immigration inflow on the residualized (after accounting for seasonal component and intercept) logarithms of the indicated outcomes in Orlando (6 and 12 months after Hurricane Maria hit Puerto Rico), using data from the QWI. Columns 1-4 show estimates for workers with less than a high school education. The donor pool is restricted to include only those commuting zones which are observed for four quarters after the Hurricane, allowing 12-month estimates of the treatment effects.

**Table A8**  
*DD Estimated TEs of Hurricane Maria on Orlando*

Outcome by Sector	(1)	(2)	(3)
<i>Aggregate</i>			
Log employment	0.0108*** (0.0026)	-0.0009 (0.0080)	0.0028** (0.0012)
Log earnings/worker	-0.0034 (0.0039)	-0.0047 (0.0083)	-0.0039* (0.0021)
Log establishments	0.0001 (0.0096)	0.0137 (0.0188)	0.0070*** (0.0016)
<i>Construction</i>			
Log employment	0.0097 (0.0081)	0.0303* (0.0158)	0.0148** (0.0058)
Log earnings/worker	-0.0009 (0.0092)	-0.0043 (0.0216)	0.0089 (0.0080)
Log establishments	0.0045 (0.0071)	0.0010 (0.0177)	0.0146*** (0.0027)
<i>Retail</i>			
Log employment	0.0064 (0.0041)	-0.0197 (0.0156)	0.0057*** (0.0014)
Log earnings/worker	-0.0028 (0.0031)	-0.0052 (0.0076)	0.0031** (0.0013)
Log establishments	0.0053 (0.0082)	-0.0143 (0.0162)	0.0089** (0.0038)
<i>Hospitality</i>			
Log employment	0.0097*** (0.0034)	0.0098 (0.0096)	0.0034** (0.0014)
Log earnings/worker	-0.0017 (0.0093)	-0.0043 (0.0138)	-0.0087 (0.0063)
Log establishments	-0.0059 (0.0065)	0.0175 (0.0179)	0.0059* (0.0028)

Notes: Difference-in-differences estimates of the impact of the immigration inflow on the residualized (after accounting for seasonal component and intercept) logarithms of the indicated outcomes in Orlando, in the post-treatment period, relative to the pre-treatment period. Estimated using the QCEW data. All positively-weighted CZs in the synthetic Orlando are individually included as controls in (1) and (2), and the composite synthetic Orlando for each outcome is the only control unit in (3). Authors own analysis using the QCEW. Robust standard errors in parentheses. \* Significance at the 10% level; \*\* significance at the 5% level; \*\*\* significance at the 1% level.



**Table A9***Difference-in-Differences pre-Trend Tests*

Year	Period	Employment				Earnings per Worker			
		All sectors	Construction	Retail	Hospitality	All sectors	Construction	Retail	Hospitality
<b>2014</b>	Q1 - Q2	-0.0006 (0.0007)	-0.0100** (0.0040)	-0.0019** (0.0008)	-0.0045** (0.0018)	0.0053 (0.0042)	0.0006 (0.0017)	-0.0010*** (0.0002)	0.0023 (0.0015)
	Q3 - Q4	-0.0015 (0.0011)	0.0006 (0.0020)	-0.0011 (0.0007)	0.0027 (0.0021)	0.0007 (0.0020)	0.0064 (0.0054)	-0.0062 (0.0051)	0.0010 (0.0011)
<b>2015</b>	Q1 - Q2	-0.0012* (0.0006)	-0.0066*** (0.0022)	-0.0030*** (0.0007)	-0.0050*** (0.0016)	0.0006 (0.0009)	-0.0039 (0.0037)	-0.0038 (0.0029)	0.0035 (0.0037)
	Q3 - Q4	-0.0001 (0.0008)	-0.0050 (0.0042)	-0.0082*** (0.0006)	-0.0085*** (0.0013)	0.0038*** (0.0007)	-0.0147*** (0.0013)	0.0032 (0.0035)	0.0098*** (0.0013)
<b>2016</b>	Q1 - Q2	-0.0006 (0.0007)	-0.0010 (0.0029)	-0.0020* (0.0011)	-0.0033** (0.0014)	0.0005 (0.0007)	-0.0010 (0.0023)	-0.0005 (0.0004)	0.0007 (0.0011)
	Q3 - Q4	0.0006 (0.0008)	-0.0014 (0.0024)	0.0009 (0.0008)	-0.0020 (0.0014)	0.0011 (0.0009)	0.0024* (0.0012)	-0.0003 (0.0004)	0.0004 (0.0005)
<b>2017</b>	Q1 - Q2	-0.0004 (0.0022)	-0.0125** (0.0049)	0.0001 (0.0030)	-0.0056* (0.0028)	-0.0048*** (0.0010)	-0.0076 (0.0098)	-0.0013 (0.0047)	-0.0173* (0.0078)
<b>2018</b>	Q1 - Q2	0.0026*** (0.0009)	0.0153*** (0.0044)	0.0022* (0.0011)	0.0035 (0.0025)	-0.0038 (0.0051)	0.0089*** (0.0005)	0.0029 (0.0027)	-0.0049 (0.0066)
	Q3	0.0033*** (0.0011)	0.0323*** (0.0050)	0.0080*** (0.0009)	0.0099** (0.0043)	0.0031*** (0.0006)	0.0353*** (0.0001)	0.0048*** (0.0002)	0.0149*** (0.0005)

Notes: Difference-in-differences estimates of the impact of the immigration inflow on the residualized (after accounting for seasonal component and intercept) logarithms of the indicated outcomes in Orlando, on two-quarter periods, relative to the last half of 2017 (when the hurricanes hit and the migration from Puerto Rico to Orlando occurred). Columns 1-4 show estimates for the employment. Columns 5-8 show estimates for per-worker earnings. Estimated using the QCEW data with the synthetic Orlando for each outcome as the only control unit. Robust standard errors in parentheses. \* Significance at the 10% level; \*\* significance at the 5% level; \*\*\* significance at the 1% level.

**Table A10**  
*Alternative Estimated Treatment Effects, All Workers*

Sector	Log Employment		Log Earnings per Worker		Log Establishments	
	6 months	12 months	6 months	12 months	6 months	12 months
<i>Aggregate</i>						
Treatment effect	0.0031***	0.0048***	0.0005	0.0027	0.0024	0.0032
RMSPE	12.1146	11.8642	2.5968	3.8824	0.0818	0.3295
RMSPE p-value	0.0061	0.0061	0.5030	0.3697	0.9576	0.9758
<i>N</i>	165	165	165	165	165	165
<i>Construction</i>						
Treatment effect	0.0218	0.0466**	0.0107	0.0347**	0.0089	0.0059
RMSPE	5.5539	15.4637	5.8046	11.1351	0.8709	1.0185
RMSPE p-value	0.1074	0.0134	0.1745	0.0403	0.6980	0.8792
<i>N</i>	149	149	149	149	149	149
<i>Retail</i>						
Treatment effect	0.0037**	0.0097**	0.0008	0.0036	0.0028	0.0150
RMSPE	5.8845	6.5179	0.4639	0.9479	0.0936	1.7757
RMSPE p-value	0.0353	0.0471	0.8471	0.8706	0.9882	0.7412
<i>N</i>	170	170	170	170	170	170
<i>Hospitality</i>						
Treatment effect	0.0008	0.0117	0.0013**	0.0140**	-0.0020	0.0031
RMSPE	1.6499	2.7406	17.5453	13.9232	0.1965	0.1950
RMSPE p-value	0.3378	0.2703	0.0270	0.0338	0.9257	0.9865
<i>N</i>	148	148	148	148	148	148

Notes: Alternative synthetic control estimates of the impact of the immigration inflow on the residualized (after accounting for seasonal component and intercept) logarithms of the indicated outcomes in Orlando (6 and 12 months after Hurricane Maria hit Puerto Rico), using data from the QCEW, unrestricted donor pool. Estimated treatment effects are normalized to the period immediately before Hurricane Maria hit Puerto Rico. Significance based on RMSPE p-values: \* significance at the 10% level; \*\* significance at the 5% level; \*\*\* significance at the 1% level.

**Table A11**  
*Estimated Treatment Effects, Extended pre-Treatment Period*

Sector	Log Employment		Log Earnings per Worker		Log Establishments	
	6 months	12 months	6 months	12 months	6 months	12 months
<i>Aggregate</i>						
Treatment effect	0.0010**	0.0065**	0.0012	0.0031	0.0066	0.0060
RMSPE	8.4606	6.9646	2.7467	5.2023	1.3026	2.2651
RMSPE p-value	0.0305	0.0488	0.6037	0.2683	0.7561	0.6524
<i>N</i>	164	164	164	164	164	164
<i>Construction</i>						
Treatment effect	0.0147*	0.0325**	0.0120	0.0293	0.0155	0.0113
RMSPE	6.5773	8.6288	3.0731	5.2201	4.7238	5.0628
RMSPE p-value	0.0816	0.0408	0.4694	0.1837	0.2313	0.2585
<i>N</i>	147	147	147	147	147	147
<i>Retail</i>						
Treatment effect	0.0055**	0.0067**	0.0094	0.0087	0.0097	0.0165
RMSPE	6.4951	6.3422	4.5573	4.5085	0.8796	2.6290
RMSPE p-value	0.0417	0.0417	0.2857	0.2262	0.8095	0.6310
<i>N</i>	168	168	168	168	168	168
<i>Hospitality</i>						
Treatment effect	-0.0016	0.0125	0.0074*	0.0141*	-0.0016	0.0053
RMSPE	2.4057	3.0052	11.2476	10.5380	0.1920	0.3771
RMSPE p-value	0.3333	0.2381	0.0748	0.0612	0.9864	0.9728
<i>N</i>	147	147	147	147	147	147

Notes: Synthetic control estimates of the impact of the immigration inflow on the residualized (after accounting for seasonal component and intercept going back to 2013) logarithms of the indicated outcomes in Orlando (6 and 12 months after Hurricane Maria hit Puerto Rico), using data from the QCEW, unrestricted donor pool. The pre-treatment period is extended back to the beginning of 2013. Significance based on RMSPE *p*-values: \* significance at the 10% level; \*\* significance at the 5% level; \*\*\* significance at the 1% level.

**Table A12**  
*Estimated Impact of Hurricane Irma on Orlando*

Sector	Log Employment		Log Earnings per Worker		Log Establishments	
	6 months	12 months	6 months	12 months	6 months	12 months
<i>Aggregate</i>						
Treatment effect	0.0008	-0.0016	-0.0001	-0.0008	-0.0043	-0.0051
RMSPE	2.2926	2.6687	4.2418	3.1581	1.7626	2.9954
RMSPE p-value	0.2711	0.2711	0.3253	0.5000	0.4819	0.3795
<i>N</i>	166	166	166	166	166	166
<i>Construction</i>						
Treatment effect	-0.0018	0.0248	0.0014	0.0105	-0.0029	0.0028
RMSPE	1.0277	1.0146	7.1415	3.8702	0.7032	0.4765
RMSPE p-value	0.6577	0.8054	0.1409	0.3490	0.8389	0.9732
<i>N</i>	149	149	149	149	149	149

Notes: Synthetic control estimates of the impact of Hurricane Irma on Orlando (6 and 12 months after Irma hit both Orlando and Jacksonville) on (deseasonalized, natural logarithm of) employment, earnings per worker, and establishments, using Jacksonville as the counterfactual Orlando with respect to exposure to Irma. Jacksonville and Orlando both lay approximately the same distance from Irma's eye when the storm was at the same intensity. Estimated using data from the QCEW. Employment is observed on a monthly basis; all other variables are observed on a quarterly basis. Significance is calculated using RMSPE *p*-values. \* Significance at the 10% level; \*\* significance at the 5% level; \*\*\* significance at the 1% level.

**Table A13***Estimated Average Treatment Effects, Top-3 and Top-5 Most Treated CZs*

Sector	Top-3 Most Treated CZs			Top-5 Most Treated CZs		
	Log Employment	Log Earnings per Worker	Log Establishments	Log Employment	Log Earnings per Worker	Log Establishments
<i>Aggregate</i>	12 month TE	12 month TE	12 month TE	12 month TE	12 month TE	12 month TE
Treatment effect	0.0056**	0.0010	0.0016	0.0058**	0.0014	0.0020
RMSPE <i>p</i> -val	0.0150	0.6823	0.5285	0.0390	0.9041	0.4825
Moving block <i>p</i> -val	0.0000	0.0000	0.1111	0.0000	0.1667	0.1111
<i>N</i>	165	165	165	165	165	165
<i>Construction</i>	12 month TE	12 month TE	12 month TE	12 month TE	12 month TE	12 month TE
Treatment effect	0.0193**	0.0215**	0.0045	0.0221**	0.0219**	0.0053
RMSPE <i>p</i> -val	0.0390	0.0140	0.3816	0.0120	0.0270	0.4246
Moving block <i>p</i> -val	0.0536	0.0000	0.0000	0.0179	0.0000	0.0000
<i>N</i>	149	149	149	149	149	149
<i>Retail</i>	12 month TE	12 month TE	12 month TE	12 month TE	12 month TE	12 month TE
Treatment effect	0.0165**	0.0040	0.0084	0.0145**	0.0039	0.0085
RMSPE <i>p</i> -val	0.0370	0.4366	0.3437	0.0340	0.7183	0.4046
Moving block <i>p</i> -val	0.0179	0.0000	0.2778	0.0179	0.0000	0.3333
<i>N</i>	170	170	170	170	170	170
<i>Hospitality</i>	12 month TE	12 month TE	12 month TE	12 month TE	12 month TE	12 month TE
Treatment effect	0.0373**	0.0116	-0.0003	0.0358***	0.0111	0.0021
RMSPE <i>p</i> -val	0.0210	0.4535	0.9860	0.0060	0.4466	0.9920
Moving block <i>p</i> -val	0.0179	0.0000	0.9444	0.0000	0.0000	0.9444
<i>N</i>	148	148	148	148	148	148

Notes: Average of synthetic control estimates of the impact of the immigration inflow on the residualized (after accounting for seasonal component and intercept) logarithms of the indicated outcomes, 12 months after Hurricane Maria hit Puerto Rico, in, respectively, the three and five CZs which received the most per capita FEMA applications (Orlando, FL, 0.00178 applications/capita; Lakeland-WinterHaven, FL, 0.0098 applications/capita; Springfield, MA, 0.00088 applications/capita; Daytona Beach, FL, 0.00039 applications/capita; and Tampa-St. Petersburg-Clearwater, FL, 0.00038 applications/capita), using data from the QWI. Columns 1-4 show estimates for non-Hispanic workers. Columns 5-8 show estimates for less-educated workers. The donor pool is restricted to include only those commuting zones which are observed for four quarters after the Hurricane, allowing 12-month estimates of the treatment effects. *p*-values calculated using Andrews (2003) end-of-sample instability test and the moving block test statistic proposed in Chernozhukov, Wuthrich, and Zhu (2017).

**Table A14***Difference-in-differences Estimated TE on Orlando log Housing Prices*

	Control Units: MSAs with positive weights	Control Units: Weighted Sum of MSAs from (1)
Orlando x POST	0.0180 (0.0351)	-0.00114 (0.00240)
Observations	513	114

Notes: Analysis using (natural logarithm of) MSA-level Zillow Home Value Index data between January 2014 and September 2018 (for consistency with other estimates) at a monthly frequency. All positively-weighted construction-sector employment donor units with weights applied are used as controls in column 1; we control for unit and month fixed effects. The single unit constructed using from the MSA using the construction employment synthetic control weights is the control in column 2; we control for month fixed effects. Robust standard errors in parentheses. \* Significance at the 10% level; \*\* significance at the 5% level; \*\*\* significance at the 1% level.

**Table A15**  
*Estimated Treatment Effects, Workers with Some College or More Education*

Sector	Log Employment		Log Earnings per Worker	
	6 month TE	12 month TE	6 month TE	12 month TE
<i>Aggregate</i>				
Treatment effect	-0.0016	0.0125	-0.0009	0.0030
RMSPE	1.2369	3.2480	2.2791	1.6230
RMSPE p-value	0.5643	0.4143	0.3071	0.6286
<i>N</i>	140	140	140	140
<i>Construction</i>				
Treatment effect	0.0035	0.0015	0.0021	-0.0051
RMSPE	1.1473	1.7327	2.2359	2.8788
RMSPE p-value	0.5116	0.6667	0.3023	0.2481
<i>N</i>	129	129	129	129
<i>Retail</i>				
Treatment effect	-0.0001	0.0105	0.0009	0.0123*
RMSPE	0.7646	1.8636	3.6395	5.6269
RMSPE p-value	0.6115	0.5683	0.1511	0.0935
<i>N</i>	139	139	139	139
<i>Hospitality</i>				
Treatment effect	-0.0014	-0.0046	-0.0030**	0.0129**
RMSPE	2.8278	2.2356	5.9932	8.1817
RMSPE p-value	0.2782	0.5338	0.0451	0.0301
<i>N</i>	133	133	133	133

Notes: Synthetic control estimates of the impact of the immigration inflow on the residualized (after accounting for seasonal component and intercept) logarithms of the indicated outcomes in Orlando (6 and 12 months after Hurricane Maria hit Puerto Rico), using data from the QWI. Columns 1-4 show estimates for workers with some college or more education. The donor pool is restricted to include only those commuting zones which are observed for four quarters after the Hurricane, allowing 12-month estimates of the treatment effects.

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