

Estimating the Migration of Puerto Ricans to Florida
Using Flight Passenger Data

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Abstract

Florida has been a primary destination for migrants from Puerto Rico for many years. Hurricane Maria, which made landfall in Puerto Rico on September 20, 2017, caused extensive damage on the island. In its aftermath, thousands of Puerto Ricans have moved to the U.S. mainland, many of them to Florida. Estimating the size of this inflow to Florida is no easy task, given that no direct measures of migration are available. Various indicators such as flight passenger arrivals, individuals served at multi-agency resource centers, school enrollments, FEMA applications, U.S. postal service address changes, and mobile phone data have been analyzed, often leading to quite different estimates. In this paper, the feasibility of using flight passenger data to estimate net migration between Puerto Rico and Florida is explored. The study compares historical flight passenger data to migration estimates from the American Community Survey (ACS). This is followed by a more detailed analysis of the flight passenger flows between Puerto Rico and Florida since Hurricane Maria; flight passenger flows between Puerto Rico and airports in other states on the U.S. mainland are also briefly examined. The study finds that – with some caveats – the flight passenger data may indeed be useful for estimating the hurricane-induced migration from Puerto Rico to Florida. Based on the available evidence, it is estimated that about 30,000 to 50,000 Puerto Ricans moved to Florida in the aftermath of Hurricane Maria.

Introduction

Hurricane Maria made landfall in Puerto Rico on Wednesday, September 20, 2017, as a Category 4 hurricane, causing widespread destruction on the island. In its aftermath, thousands of Puerto Ricans moved to the U.S. mainland, many of them to Florida. The first assessment of the demographic impacts of the hurricane on Florida was made on December 5, 2017, at the Demographic Estimating Conference in Tallahassee, Florida. At the conference, a hurricane-induced migration estimate of about 53,000 was adopted.¹ This estimate was based on counts of Puerto Ricans that had visited multi-agency resource centers at Orlando and Miami international airports – as well as the Port of Miami – through the end of November 2017; flight arrivals and school enrollment data were also considered. Another prominent estimate, based on school enrollment data, by the Center for Puerto Rican Studies at Hunter College, CUNY, arrived at a similar number (about 56,000).² In February, Ying Wang and I published a BEBR website article on the growth of the Puerto Rican population in Florida and on the U.S. mainland.³ The article focused primarily on longer term population changes since 2000, but it also briefly addressed the hurricane-induced migration. In the article, we concluded that the earlier estimate of 53,000 was “a reasonable estimate, given the available information at the time, but the eventual number could turn out quite differently. To us, this estimate seems somewhat conservative; we note, however, that some of the higher estimates that have circulated in the news appear to be highly speculative given the available data.” This article, published just over one year after the hurricane made landfall in Puerto Rico, provides an update to that earlier assessment.

Table 1 shows the three different data sources that were used in the December 5, 2017, estimate for the hurricane-induced migration from Puerto Rico: individuals arrived from Puerto Rico at Miami and Orlando international airports and the Port of Miami; individuals served at multi-agency resource centers at the three ports; and Florida school district enrollment of displaced students from Puerto Rico and the U.S. Virgin Islands. The data were released by the Florida Governor's Office starting on October 13, 2017, with updates every couple of weeks through February 2, 2018.⁴ At the time of the conference in early December, data through the end of November were available. As the table shows, in the following months the number of individuals arriving at the airports continued to go up, but the number of individuals served at the multi-agency resource centers, as well as the number of K–12 students from the islands enrolled in Florida schools, increased only marginally, especially after early January.

Much of the press coverage in the months after the hurricane focused on flight passengers from Puerto Rico arriving at Florida airports, whose number had reached almost 300,000 by the end of year (see Table 1). Headlines such as “A great migration from Puerto Rico is set to transform Orlando”⁵ and “Puerto Rico’s mass migration is reshaping Florida”⁶ were common. Flight passenger arrivals in Florida were used to extrapolate the potential demographic impact on the state: “Planes arriving from Puerto Rico remain full and some estimate as many as half a million people will eventually make their way to Florida.”⁷ A recent study on excess mortality from Hurricane Maria also used flight passenger data, complemented by monthly net domestic migration estimates provided by the Puerto Rico Institute of Statistics and a survey of airline travelers provided by the Puerto Rico Planning Board; it estimated a population reduction on the island of about 280,000 over the period mid-September 2017 to

mid-February 2018.⁸ Data sources such as FEMA applications, U.S. Postal Service address changes, and mobile phone data have been proposed as alternative – and potentially better – indicators with which to measure the hurricane-induced migration of Puerto Ricans to Florida and other states on the U.S. mainland.^{9 10} Stories of Puerto Ricans returning to the island also appeared, which showed that return migration needs to be considered in the estimates.¹¹

Given the prominence of the flight passenger data in discussions of post-Hurricane Maria migration from Puerto Rico to Florida, how valuable are these data for measuring actual migration flows? Flight passenger arrivals, by themselves, are not a good measure for gauging migration; only inflows are counted, and no distinction between migrants and other travelers can be made. The number of net flight passengers – calculated in this case as flight passengers from Puerto Rico to Florida minus flight passengers from Florida to Puerto Rico – on the other hand, may be indicative of migration. Puerto Rico represents a good case study for testing the feasibility of this approach, given its island location and the absence of regularly scheduled ferry service to and from the U.S. mainland. Although Puerto Rico is a major destination for cruise ships, most people moving between the island and Florida likely use commercial flights as their mode of transportation. The remainder of this article examines in more detail how the flight passenger data can be used to estimate migration flows between Puerto Rico and Florida. The analysis starts with an examination of historical flight passenger flows, which will be compared to historical migration data. This is followed by a more detailed look at the patterns since Hurricane Maria.

Historical Flight Passenger Data

The Bureau of Transportation Statistics at the U.S. Department of Transportation releases – on a monthly basis – flight passenger statistics reported by U.S. air carriers operating between airports located within the boundaries of the United States and its territories.¹² Puerto Rican airports with direct flights to Florida currently include Aguadilla (BQN), located in the northwestern tip of the island; Ponce (PSE), located in the southern part of the island; and San Juan (SJU), Puerto Rico’s capital and most populous municipality, located on the northeastern coast. San Juan accounts for almost 90% of all flight passengers between Puerto Rico and Florida. Florida airports with direct flights to Puerto Rico currently include Ft. Lauderdale (FLL), Ft. Myers (RSW), Miami (MIA), Orlando (MCO), Orlando Sanford (SFB), and Tampa (TPA); Orlando, Ft. Lauderdale, and Miami account for most of the traffic from and to Puerto Rico, followed at some distance by Tampa.

Figure 1 displays the annual number of flight passengers between Puerto Rico and Florida for the period 2005–2016. The number of flight passengers increased over time, from about 2.5 million per year in 2005/06 (the total volume in both directions) to almost 3.2 million per year by 2015/16, with elevated numbers in 2007 and 2008. In each year, more flight passengers flew from Puerto Rico to Florida than vice versa, though the overall number of flight passengers was quite balanced in both directions. Between 2005 and 2016, Florida’s net gain of about 320,000 flight passengers amounted to less than 1% of the overall volume of flight passengers between Puerto Rico and Florida (about 33.5 million). In addition to increasing overall flight passenger volumes, there was also an upward trend in the net gain of flight

passengers for Florida over the period, which ranged from about 7,000 in 2006 to 53,000 in 2015, though it dropped to 37,000 in 2016.

Figure 2 shows the monthly average number of flight passengers between airports in Puerto Rico and Florida for the same period 2005–2016. There is a distinct seasonal pattern, with the highest volumes during the summer months, and in January and December. In most months, on average, more passengers fly from Puerto Rico to Florida than from Florida to the island, especially in May and August; conversely, in January, June, and December more passengers fly from Florida to Puerto Rico. These seasonal patterns have been quite stable over time.

The flight passenger data thus indicate that more people have flown from Puerto Rico to Florida than vice versa since 2005, amounting to a net gain for Florida of about 320,000 by 2016. While only a fraction of all flight passengers in each direction can be assumed to be migrants – most people travel for vacation, business, to visit friends and family, etc. – the net balance of flight passengers may indeed reflect net migration, given the absence of other transportation options between Puerto Rico and Florida. To test this proposition, net flight passenger counts between Puerto Rico and Florida will be compared to net migration estimates between the island and the Sunshine State over the period 2005–2016.

Comparing Flight Passenger Data to Migration Estimates

The most comprehensive source for migration data in the United States is the American Community Survey (ACS) from the U.S. Census Bureau. Since 2005, the ACS has provided annual migration estimates, including migration flows between Puerto Rico and each state.¹³ The ACS

is a survey conducted throughout the year. In the case of the migration data, it covers migration over a one-year interval. That is, if a person's previous residence one year ago was different from the one at the time of the survey, then that person is considered a migrant. Since the ACS is administered throughout the year, however, the date of the actual migration event could have occurred at any time over a two year span. To illustrate, for someone filling out the survey on January 1, 2017, the date of the move could have occurred between January 1, 2016, and December 31, 2016, while for someone filling out the survey on December 31, 2017, the date of the move could have occurred between January 1, 2017, and December 31, 2017. Both survey responses would be included in the 2017 ACS, even though the actual date of the move could have happened at any time between January 1, 2016, and December 31, 2017. In addition, it is possible that moves at a later date are covered in an earlier ACS and vice versa. For example, someone who moved on September 15, 2016, and filled out the survey on December 15, 2016, would be included in the 2016 ACS, while someone who moved on March 15, 2016, and filled out the survey on January 15, 2017, would be included in the 2017 ACS; the former move occurred six months after the latter move, yet it would be included in an earlier ACS. Finally, there is also the relatively small sample size of the ACS to consider, which can result in fairly wide margins of error of the migration estimates.

These considerations complicate the comparison of the ACS migration data to the flight passenger data. The former include only migrants, for whom we know the exact origin and destination, but information on when a move occurred is imprecise, and the estimates are subject to sampling variability. The latter, in contrast, include a full count for each month, but only some of the flight passengers are migrants, and the data don't provide any information to

distinguish migrants from other travelers. Furthermore, we only know that X number of passengers were on a plane from airport Y to airport Z, not what the actual origins and destinations of the passengers were; i.e. connecting passengers cannot be distinguished from those whose journey started in Puerto Rico and ended in Florida (and vice versa). To illustrate, all flight passengers from Puerto Rico to Florida are included in the calculation, even those who connected to another flight with a destination beyond Florida (and who therefore should not be included). Similarly, all flight passengers from Puerto Rico to airports on the U.S. mainland outside of Florida are excluded, even those who connected from there to another flight to Florida (and who therefore should be included). The same applies for flights to Puerto Rico, where it is unknown whether the journey started in Florida, or whether a connecting flight that originated in another state was involved. To some extent, these may cancel out, but the limitations of the flight passenger data should be kept in mind when interpreting the results.

Figure 3 compares the two data sources for the period 2005–2016. Given that each 1-year ACS includes migration events that could have occurred over a two year span, as described above, the ACS migration data are best considered midyear-to-midyear rather than by calendar year. Accordingly, the flight passenger data were aggregated for July–June periods rather than by calendar year. For example, the two bars labeled “05–06” in Figure 3 include flight passengers over the period July 2005 through June 2006, which are compared to the migration data from the 2006 1-year ACS. The figure compares the net gains in flight passengers for Florida, which were calculated as all flight passengers from Puerto Rico to Florida minus all flight passengers from Florida to Puerto Rico, to estimates of Florida’s net migration with Puerto Rico from the ACS.

Figure 3 shows that the generally upward trend in net flight passengers over time can also be seen in the ACS migration data. In all years but 2005–06, there were more net flight passengers than estimated net migrants. The two measures were quite close in 2006–07 and 2010–11, while in 2009–10 the net gain in flight passengers far exceeded the ACS net migration estimate. Over the entire period, the net flight passenger counts exceeded the net migration estimates by about a factor of 2. This 2:1 ratio also applies for many individual years, especially since 2011, but given the difficulties in attributing the precise timing of migration in the ACS data, it is preferable to compare the two data sources over a longer period rather than for individual years.

Why do the flight passenger data show net gains for Florida about twice as large as the ACS migration data? Is it because the flight passenger data include persons in the net count who were not migrants? Most certainly, although how much this contributed to the higher numbers is impossible to determine. The fact that passengers on connecting flights to and from other states on the U.S. mainland cannot be distinguished from those traveling only between Puerto Rico and Florida, likely played a role as well. Yet one should also consider to what extent the net migration estimates from the ACS accurately reflect the “true” level of net migration between Puerto Rico and Florida.

To examine this issue, the migration estimates from the ACS are analyzed within the framework of the demographic equation, which determines the change in a population over a period of time. The demographic equation includes the following components of change: births, deaths, and net migration (in-migration minus out-migration). A population increases in size through births and in-migration, and decreases in size through deaths and out-migration. The

balance between births and deaths is called natural increase, which can be positive (when births exceed deaths) or negative (when deaths exceed births); negative natural increase is sometimes called natural decrease.

Figure 4 shows the components of change for the growth of the Puerto Rican population in Florida between 2005 and 2016. Over this period, according to the ACS 1-year estimates, the Puerto Rican population in Florida increased by about 420,000 from just under 650,000 in 2005 to about 1.07 million in 2016. Most of the growth came from the positive net migration balance with Puerto Rico (about 150,000), followed by natural increase (about 90,000), and from Puerto Ricans moving from other states to Florida (a net gain of about 80,000). Together, these three components add up to about 320,000. This number is about 100,000 short of the overall population change (shown as “Residual” in Figure 4).

What accounts for the difference between the sum of the components and overall population change? First, it is important to note that the data come from two different sources: the population and migration estimates come from the ACS, and the vital statistics come from the Florida Department of Health.¹⁴ Second, the ACS data are period estimates rather than point estimates, which makes a calculation of the components of change less straightforward. The ACS estimates contrast in this regard with the estimates from the U.S. Census Bureau’s Population Estimates Program (PEP). The latter include components of change that add up to overall population change; these components also include a residual, but its purpose is for the state and county population estimates to add up to the national totals, and it is usually quite small.¹⁵ Migration estimates from the ACS can be quite different from those from the PEP. To give an example, the Vintage 2017 PEP estimates show a domestic net migration estimate of

about 217,000 for Florida for July 1, 2015 to July 1, 2016; a comparable estimate calculated from the 2016 1-year ACS Public Use Microdata Sample (PUMS) files is about 177,000, or 40,000 lower. The PEP estimates are available by race and ethnicity for states and counties, but they do not include a breakout specifically for the Puerto Rican population. The present analysis therefore had to rely on ACS data.

These issues may have contributed to the relatively large residual shown in Figure 4. On top of that, the ACS estimates also contain a margin of error. Being based on data collected from a sample population, rather than the full population, the ACS estimates involve some degree of uncertainty. The margin of error measures the possible variation of the estimate around the population value at a given level of confidence (90%, in the case of the ACS).¹⁶ To illustrate, the 2016 ACS estimate of Florida's Puerto Rican population of 1,067,747 has a margin of error of $\pm 29,017$; i.e. the estimate could be as high as 1,096,764 or as low as 1,038,730. When one considers the margins of error of both the 2005 and 2016 ACS estimates, then the growth of the Puerto Rican population in Florida over that period could have been as high as 471,000 or as low as 374,000, a difference of almost 100,000. To complicate matters further, the margins of error of the ACS migration estimates tend to be wider than the ones for the overall estimate of the Puerto Rican population in Florida. The vital statistics data, being counts rather than estimates, don't include a margin of error, but they can contain some uncertainty as well, in particular with respect to attributions of race and ethnicity (e.g. births are recorded by the race and ethnicity of the mother only, and incorrect or incomplete transcriptions of race and ethnicity can occur in both the birth and death statistics).

The limitations and uncertainties associated with both data sets, unfortunately, make a direct comparison impossible. Although it appears that the net flight passenger counts may overstate net migration between Puerto Rico and Florida, the difference is probably not as large as the comparisons in Figures 3 and 4 suggest, especially once the margins of error of the ACS data are taken into account. When translating net flight passenger counts into net migrants, one could apply adjustment factors to the former, which would vary depending on how much of the residual of the components of change analysis gets allocated to Florida's ACS net migration estimates with Puerto Rico.¹⁷ Slight reductions to the net flight passenger counts may be warranted, but such adjustments are ultimately quite subjective. For simplicity, a 1:1 relationship between the two data sources will be assumed for the remainder of the analysis.

Estimating the Hurricane-induced Migration from Puerto Rico to Florida

Having compared the two data sources for past years, the focus now turns to the flight passenger data for 2017–18. Figure 5 displays monthly data from January 2017 through June 2018, the most recent month for which data are currently available. The first eight months of 2017 show a similar seasonal pattern to past years, with traffic volume lowest in February and highest in June/July; January and June show net losses for Florida, while April and May show the largest net gains. The overall volume of traffic was greatly reduced during September, which is not surprising given that Hurricanes Irma and Maria curtailed flight traffic for several days of the month. Yet despite the reduced overall traffic volumes, September showed the largest net gain in flight passengers for Florida since August 2015. In fact, there have been only

three months since 2005 when net gains for Florida exceeded the September 2017 count (data not shown).

The net gains for Florida accentuated over the following three months. The volume of flight passengers from Puerto Rico to Florida recovered much sooner than traffic towards the island, leading to large net gains for Florida, especially in October, with smaller – though still sizeable – net gains in November and December. The net gains for December are particularly notable, since in past years that month consistently recorded net outflows from Florida to Puerto Rico. Added together, over the four months September to December of 2017, there were about 94,000 more flight passengers travelling from Puerto Rico to Florida than flying to the island. January then showed a major trend reversal, with about 37,000 more passengers flying from Florida to Puerto Rico than vice versa. The following five months were characterized by an about evenly balanced number of flight passengers in both directions; there were small losses for Florida in February, April, and June, and small gains in March and May. Over the six month period January through June of 2018, about 46,000 more flight passengers travelled from Florida to Puerto Rico than in the other direction. If one subtracts that number from Florida's net gains over the period September through December of 2017, one gets a total figure of about 48,000 net flight passengers for the nine month period September 2017 to June 2018.

This number is quite close to the estimate made in early December 2017 at the Demographic Estimating Conference in Tallahassee (about 53,000). But does it reflect what one should consider hurricane-induced migration? For many years, more people have moved from Puerto Rico to Florida than vice versa, a pattern that could also be seen in the flight passenger

data (see Figure 3). One can thus argue that not all the net gains since September 2017 shown in Figure 5 should be attributed to the impacts of Hurricane Maria. Put differently, given Florida's long-term positive net migration balance with Puerto Rico, one can assume that a certain number of migrants would have come to Florida over that period even in the absence of push factors related to the hurricane. While the flight passenger data, of course, cannot be parsed for reasons of travel, one way to address this issue would be to compare the monthly net flight passenger numbers in 2017/18 to the average number of monthly net flight passengers from past years. From September 2017 onwards, the difference between the two figures could then be interpreted as hurricane-induced migration.

In Figure 6, the average monthly number of net flight passengers over the period 2005–2016 (as shown in Figure 2) is subtracted from the net monthly numbers for 2017–2018 (as shown in Figure 5). Figure 6 shows that over the first eight months of 2017, the overall volume of flight passengers between Puerto Rico and Florida was quite a bit larger than in past years; the net gains or losses for Florida fluctuated from month to month, but were not that different from those of past years. The five months from September 2017 through January 2018, in contrast, differ greatly from the historical patterns, both in terms of overall traffic volumes, and with respect to the resulting net gains or losses for Florida. From February 2018 onwards, traffic volumes in both directions stabilized again at a higher level than in past years. While the net losses for January and June are slightly lower when compared to past years – these two months typically exhibited higher traffic volumes from Florida to Puerto Rico than vice versa – all six months of 2018 show negative net balances for Florida. Aggregated over the entire period September 2017 to June 2018, the net gain for Florida is now reduced to about 31,000. That is,

the estimate of hurricane-induced migration, based on flight passenger counts between Puerto Rico and Florida, is about 17,000 lower than the estimate of overall net migration over the period September 2017 through June 2018.

Using the period 2005–2016 as a baseline to compare the post-hurricane Maria flight passenger counts against is of course only one possible option. As Figure 3 showed, Florida’s net gains in both flight passengers and migrants have trended upward over the years. Consequently, using more recent data – for example, for the period 2013–2016 – may be preferable to using an average calculated over the entire 2005–2016 period. Furthermore, it can be argued that the point estimates shown above suggest a level of precision that is not really warranted, given the uncertainties involved with the data; in that case, providing a range of estimates would be preferable. How could such a range be developed?

Table 2 shows annual flight passenger volumes between airports in Puerto Rico and Florida and the resulting net gains in flight passengers for Florida for 2005–2016 from September of each year through June of the following year. Also shown are net gains in flight passengers for Florida averaged over 3-year, 5-year, and 7-year periods. The “hurricane-induced migration estimates” at the bottom of the table then subtract the lowest past value from the September 2017 to June 2018 net figure to derive a maximum estimate, and subtract the highest past value to derive a minimum estimate; also shown is an estimate where the average of all past years is subtracted.

The estimates of hurricane-induced migration shown in Table 2 range from about 17,000 to 46,000 using individual years of past net flight passenger counts; the multi-year averages range from about 18,000 to 42,000 for the 3-year averages, from about 20,000 to

38,000 for the 5-year averages, and from about 24,000 to 36,000 for the 7-year averages. The range is widest when using individual years of past net flight passenger counts, which varied from under 10,000 during the recession to about 30,000 in 2012–16. The multi-year averages smooth out the extreme values, leading to a narrower range of hurricane-induced migration estimates. Taken together, these data suggest that about 20,000 to 40,000 Puerto Ricans moved to Florida permanently in the aftermath of Hurricane Maria.

Florida versus Other States on the U.S. Mainland

Before concluding, the paper examines whether the patterns described so far – strong net outflows from Puerto Rico during September through December 2017, followed by a strong net return flow in January 2018, and smaller net return flows thereafter – were specific to Florida, or whether other states on the U.S. mainland experienced similar flight passenger flows from and to Puerto Rico. By enlarging the analysis to airports on the U.S. mainland outside of Florida, one can get a better sense of the overall magnitude of the hurricane-induced migration from Puerto Rico. This may also alleviate, at least in part, the problem of connecting flight passengers. That is, if airports in other states on the U.S. mainland experienced similar flight passenger movements from and to Puerto Rico as did the Florida airports, then it would be more likely that any misattributed origins and/or destinations of flight passengers would cancel out (though connections to and from other countries would still complicate the picture).

Table 3 displays flight passenger counts for the 14 airports on the U.S. mainland with overall volumes from and to Puerto Rico of 100,000 or more over the period September 2017 to June 2018. These include four airports in Florida, and ten airports in other states. Of the five

airports with the highest volumes of flight passengers from and to Puerto Rico, three are in Florida (Orlando, Ft. Lauderdale, and Miami); the others are New York (JFK) and Atlanta. Together, the four Florida airports accounted for almost half of the total volume in flight passengers from and to Puerto Rico of these 14 airports. For each of the 14 airports, the table shows net flight passenger counts with the three airports in Puerto Rico that have direct flights to the U.S. mainland: Aguadilla, Ponce, and San Juan. Aguadilla currently has flights to and from Ft. Lauderdale, Orlando, New York, and Newark; Ponce has flights to and from Orlando and New York only; and San Juan has flights to and from all 14 airports listed in Table 3 (plus several others). The net flight passenger counts are presented for three different time periods: September to December 2017, January 2018, and February to June 2018.

The patterns shown in Table 3 for airports in other states are remarkably similar to the ones in Florida. All 14 airports on the U.S. mainland recorded strong net flight passenger inflows from Puerto Rico in September to December 2017, which were followed by sizeable net outflows in January 2018. In the aggregate, the net outflows in January 2018 were somewhat smaller for the 10 airports outside of Florida, but the overall pattern was very similar. From February to June 2018, the trends diverged somewhat, with three of the four Florida airports continuing to record net outflows, while Ft. Lauderdale reverted to small net gains. Of the 10 airports outside Florida, 6 had net gains and 4 had net losses, but compared to the gains and losses recorded between September 2017 and January 2018, the gains and losses from February 2018 onwards have been quite small. Thus, all things considered, airports in other states on the U.S. mainland experienced very similar flight passenger movements to the Florida airports.

Conclusion

The available data indicate that the migration of Puerto Ricans to Florida in the aftermath of Hurricane Maria, although quite substantial, did not reach the levels that circulated in the news in the months after the hurricane made landfall on the island. While proposed numbers in the hundreds of thousands never seemed credible, the BEBR assessment of the overall demographic impact on Florida fluctuated over time as new flight passenger counts and other data became available. By February, when our earlier article on the Puerto Rican population in Florida was published, the data suggested that the initial estimate of 53,000 might have been too low. This assessment gained currency once the flight passenger data through the end of 2017 had become available (there is usually a two to four month lag in the publication of the flight passenger data). The December data, in particular, led to an upward revision of the estimate, because in past years December was typically characterized by relatively strong net outflows from Florida to the island. Although a return movement to Puerto Rico was always considered likely, the net inflow during December suggested that the push factors driving Puerto Ricans to Florida were stronger than anticipated, and the estimate was raised to about 50,000 to 75,000. This assessment changed with the release of the January flight passenger data, which indicated a strong trend reversal; the estimate was lowered to about 40,000 to 60,000 accordingly. In the following five months the flight passenger data indicated further small net returns to the island, which eventually brought the estimate down to about 30,000 to 50,000. The analysis presented in this paper suggests an additional downward revision to about 20,000 to 40,000 might be in order.

While the flight passenger data support this lower estimate, it could be too low. Apart from the uncertainty associated with translating flight passengers into migrants, there are other factors that suggest slightly higher numbers. For one, it is likely that not all migrants from Puerto Rico who arrived in Florida in the aftermath of Hurricane Maria came on commercial flights. The data shown in Table 1 also include arrivals at the Port of Miami, though not broken out separately. Other modes of transportation, or other routes, could also have been used, though the overall numbers involved were probably small. More consequential might be arrivals from other states. As shown in Figure 4, the migration of Puerto Ricans from other states to Florida, while smaller than the migration from the island itself, contributed substantially to the overall growth of the Puerto Rican population in Florida. It is therefore reasonable to assume that some Puerto Ricans, who initially had moved to other states on the U.S. mainland, will make a secondary move to Florida (or have already done so). Estimating the volume of these secondary moves is near impossible, and one can question whether such moves should even be considered as hurricane-related, especially when the secondary move occurs at a much later date. Nonetheless, both factors would raise the estimate, and there might be others as well. Thus, in the absence of further evidence, keeping the estimated range of 30,000 to 50,000 seems sensible. Future releases of additional data may prompt further revisions to the estimate, but given that the flight passenger data have now shown five months of largely balanced movements between Puerto Rico and Florida, it appears that the migration directly attributable to the impacts of Hurricane Maria has largely ended. Evidence from airports in other states on the U.S. mainland supports this assessment.

Estimating the migration of Puerto Ricans to Florida in the aftermath of last year's hurricanes is no easy endeavor. The existing estimates have been based on indirect indicators – such as flight passengers – and involved a number of assumptions in their calculation. Will the ACS provide definite answers? The 2017 ACS 1-year estimates have been released on September 13, 2018. They show an increase in the Puerto Rican population in Florida of about 60,000 compared to the year before, which resulted in Florida becoming the state with the largest Puerto Rican population on the U.S. mainland, surpassing New York. While this represents a sizeable increase, there have been several years since 2005 when the Puerto Rican population increased by a larger number than in 2016–2017. Other variables that might indicate inflows from Puerto Rico, such as increases in household size or occupancy rates in counties with existing Puerto Rican populations, have so far been inconclusive. Household size increased in Orange County from 2016 to 2017, but it was unchanged in Osceola County; occupancy rates decreased in both counties (data not shown). The state-to-state migration data from the 2017 ACS have not yet been released, but whether the hurricane-induced migration from Puerto Rico will stand out in these estimates is not clear either. Because of the timing of the data collection, almost three quarters of survey responses for the 2017 ACS had already been collected by the time Hurricane Maria made landfall in Puerto Rico. This means that the hurricane-induced migration, to the extent that it is picked up in the ACS migration estimates, will be distributed between the 2017 and 2018 ACS data releases, the latter of which won't become available until late 2019.

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- ¹ Demographic Estimating Conference, Executive Summary. December 5, 2017. <http://edr.state.fl.us/Content/conferences/population/archives/171205demographic.pdf>
- ² “New Estimates: 135,000+ Post-Maria Puerto Ricans Relocated to Stateside.” Center for Puerto Rican Studies, Hunter College, CUNY. March 2018. <https://centropr.hunter.cuny.edu/research/data-center/data-sheets/new-estimates-135000-post-maria-puerto-ricans-relocated-stateside>
- ³ “Growth of the Puerto Rican Population in Florida and on the U.S. Mainland.” Stefan Rayer and Ying Wang, Bureau of Economic and Business Research, University of Florida. February 9, 2018. <https://www.bebr.ufl.edu/population/website-article/growth-puerto-rican-population-florida-and-us-mainland>
- ⁴ “Gov. Scott Issues Updates on State Action to Assist Puerto Rico.” <https://www.flgov.com/?s=puerto+rico>
- ⁵ “A Great Migration From Puerto Rico Is Set to Transform Orlando.” Lizette Alvarez, New York Times. November 17, 2017. <https://www.nytimes.com/2017/11/17/us/puerto-ricans-orlando.html>
- ⁶ “Puerto Rico’s Mass Migration Is Reshaping Florida.” Jonathan Levin and Jeanna Smialek, Bloomberg. December 13, 2017. <https://www.bloomberg.com/news/articles/2017-12-13/beyond-disney-world-a-new-florida-takes-shape-in-wake-of-maria>
- ⁷ “Puerto Ricans could transform Florida politics, and parties are taking notice.” Carmen Sesin, NBC News. November 27, 2017. <https://www.nbcnews.com/news/latino/puerto-ricans-could-transform-florida-politics-parties-are-taking-notice-n822051>
- ⁸ “Project Report: Ascertainment of the Estimated Excess Mortality from Hurricane Maria in Puerto Rico.” Milken Institute School of Public Health, George Washington University. 2018. <https://publichealth.gwu.edu/sites/default/files/downloads/projects/PRstudy/Acertainment%20of%20the%20Estimated%20Excess%20Mortality%20from%20Hurricane%20Maria%20in%20Puerto%20Rico.pdf>
- ⁹ “‘Exodus’ from Puerto Rico: A visual guide.” John D. Sutter and Sergio Hernandez, CNN. February 21, 2018. <https://www.cnn.com/2018/02/21/us/puerto-rico-migration-data-invs/index.html>
- ¹⁰ “Mapping Puerto Rico’s Hurricane Migration With Mobile Phone Data.” Martín Echenique and Luis Melgar, Citylab. May 11, 2018. <https://www.citylab.com/environment/2018/05/watch-puerto-ricos-hurricane-migration-via-mobile-phone-data/559889/>
- ¹¹ “A Bittersweet Journey Back to Puerto Rico after Maria.” Luis Ferré-Sadurní, New York Times. March 30, 2018. <https://www.nytimes.com/2018/03/30/nyregion/return-to-puerto-rico-hurricane-maria.html>
- ¹² Bureau of Transportation Statistics, U.S. Department of Transportation: Data Bank 28DM - T-100 Domestic Market Data - U.S. Air Carriers Traffic and Capacity Data. <https://www.bts.dot.gov/browse-statistical-products-and-data/bts-publications/data-bank-28dm-t-100-domestic-market-data-us>
- ¹³ U.S. Census Bureau, American Community Survey, State-to-State Migration Flows. <https://www.census.gov/data/tables/time-series/demo/geographic-mobility/state-to-state-migration.html>
- ¹⁴ Florida Department of Health. FLHealthCHARTS – Community Health Assessment Resource Tool Set. <http://www.flhealthcharts.com/charts/default.aspx>
- ¹⁵ “Methodology for the United States Population Estimates: Vintage 2017.” U.S. Census Bureau. <https://www2.census.gov/programs-surveys/popest/technical-documentation/methodology/2010-2017/2017-natstcopr-meth.pdf>
- ¹⁶ “Using American Community Survey (ACS) Estimates and Margins of Error.” Sirius Fuller, Decennial Statistical Studies Division, U.S. Census Bureau. April 18, 2018. <https://www.census.gov/programs-surveys/acs/guidance/training-presentations/acs-moe.html>
- ¹⁷ “Hurricane-Induced Migration: Estimating Puerto Rican Arrivals in Florida Using Air Passenger Data.” Stefan Rayer. Federal-State Cooperative for Population Estimates, 2018 Spring Meeting, April 23, 2018. Denver, CO.

Table 1. Arrivals from Puerto Rico in Florida

Date	Total ¹	Assistance ²	K–12 Students ³
October 13	27,000		
October 18	58,000	10,000	2,000
October 25	73,000	15,000	3,500
October 31	90,000	19,000	4,900
November 9	143,000	26,000	6,300
November 17	168,000	28,000	7,200
November 29	199,000	30,000	8,500
January 3	297,000	35,000	11,200
January 11	318,000	38,000	11,200
January 25	344,000	36,000	11,900
February 2	367,000	37,000	12,300

Notes:

¹ Individuals arrived from Puerto Rico at Miami International Airport, Orlando International Airport, and the Port of Miami since October 3, 2017.

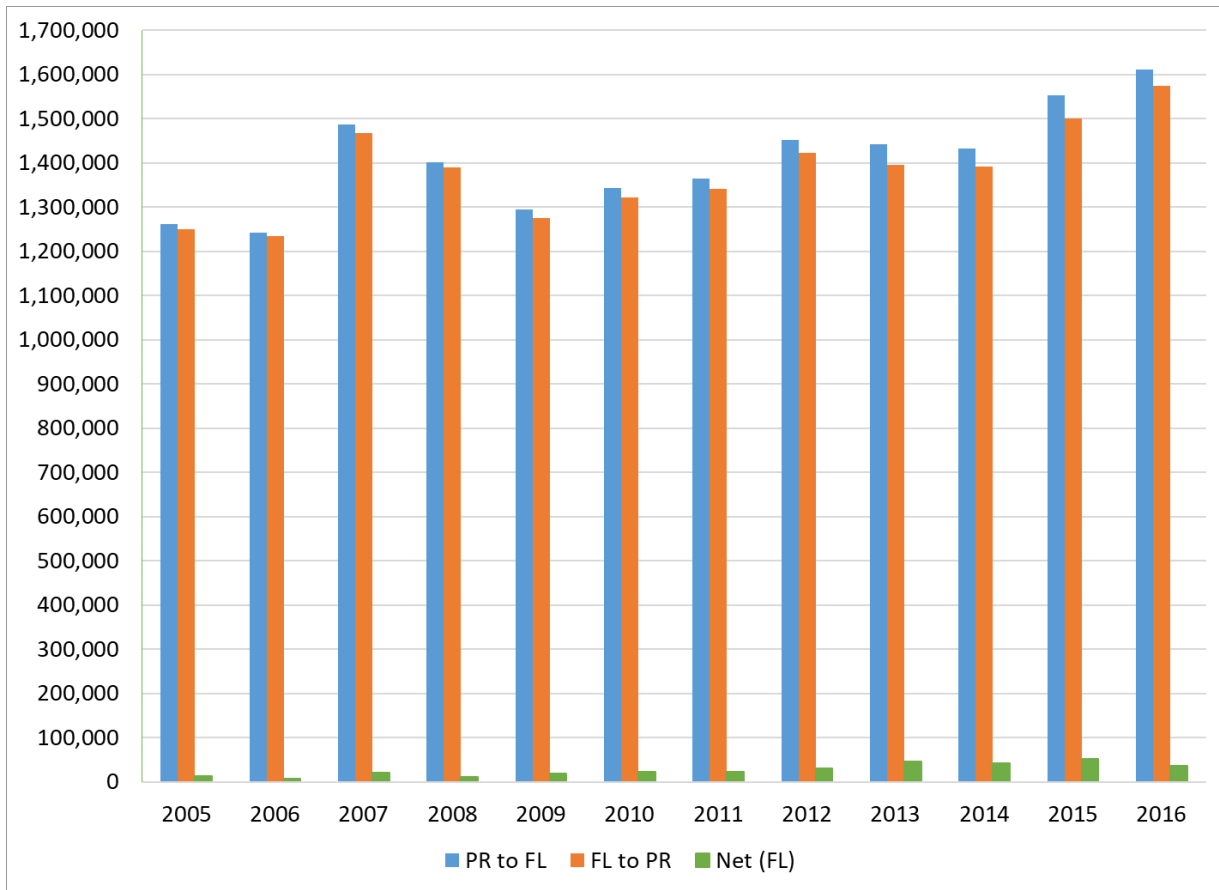
² Individuals served at Multi-Agency Resource Centers at the three ports.

³ Florida school district enrollment of displaced students from Puerto Rico and the U.S. Virgin Islands.

Source:

flgov.com (“Gov. Scott Issues Updates on State Action to Assist Puerto Rico”).

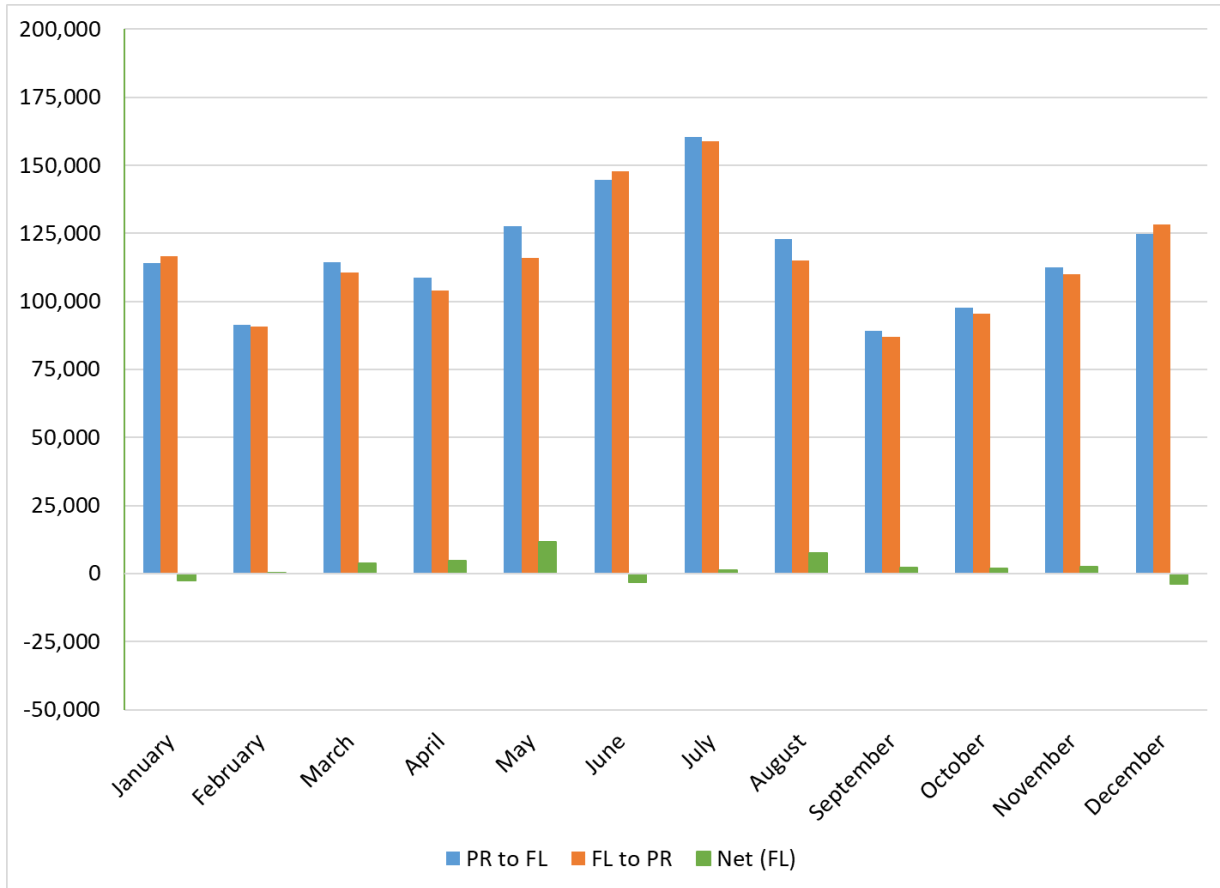
Figure 1. Flight Passengers between Puerto Rico and Florida: 2005–2016



Source:

Bureau of Transportation Statistics, U.S. Department of Transportation: Data Bank 28DM - T-100 Domestic Market Data - U.S. Air Carriers Traffic and Capacity Data.

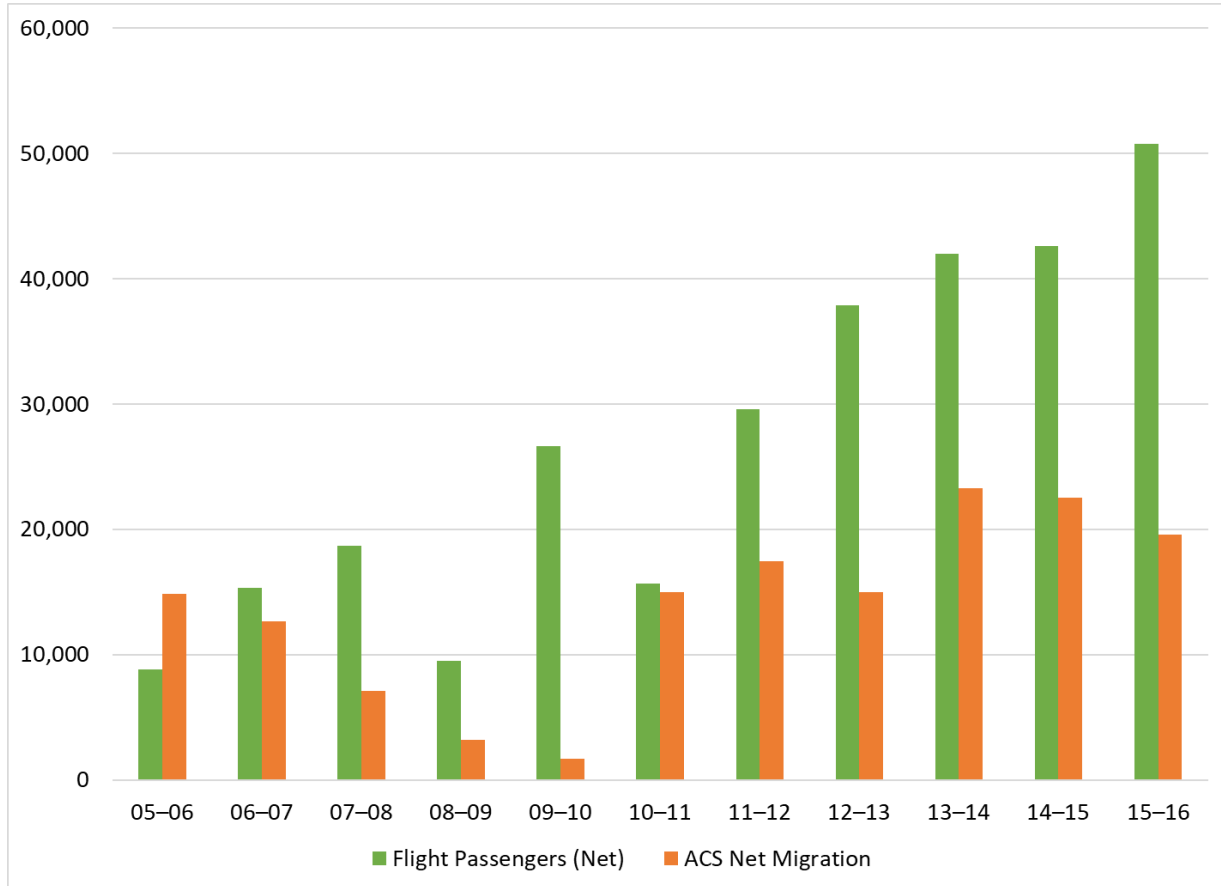
Figure 2. Flight Passengers between Puerto Rico and Florida: Monthly Average, 2005–2016



Source:

Bureau of Transportation Statistics, U.S. Department of Transportation: Data Bank 28DM - T-100 Domestic Market Data - U.S. Air Carriers Traffic and Capacity Data.

**Figure 3. Estimated Annual Net Migration between Puerto Rico and Florida:
Flight Passengers vs. ACS Migration Data**

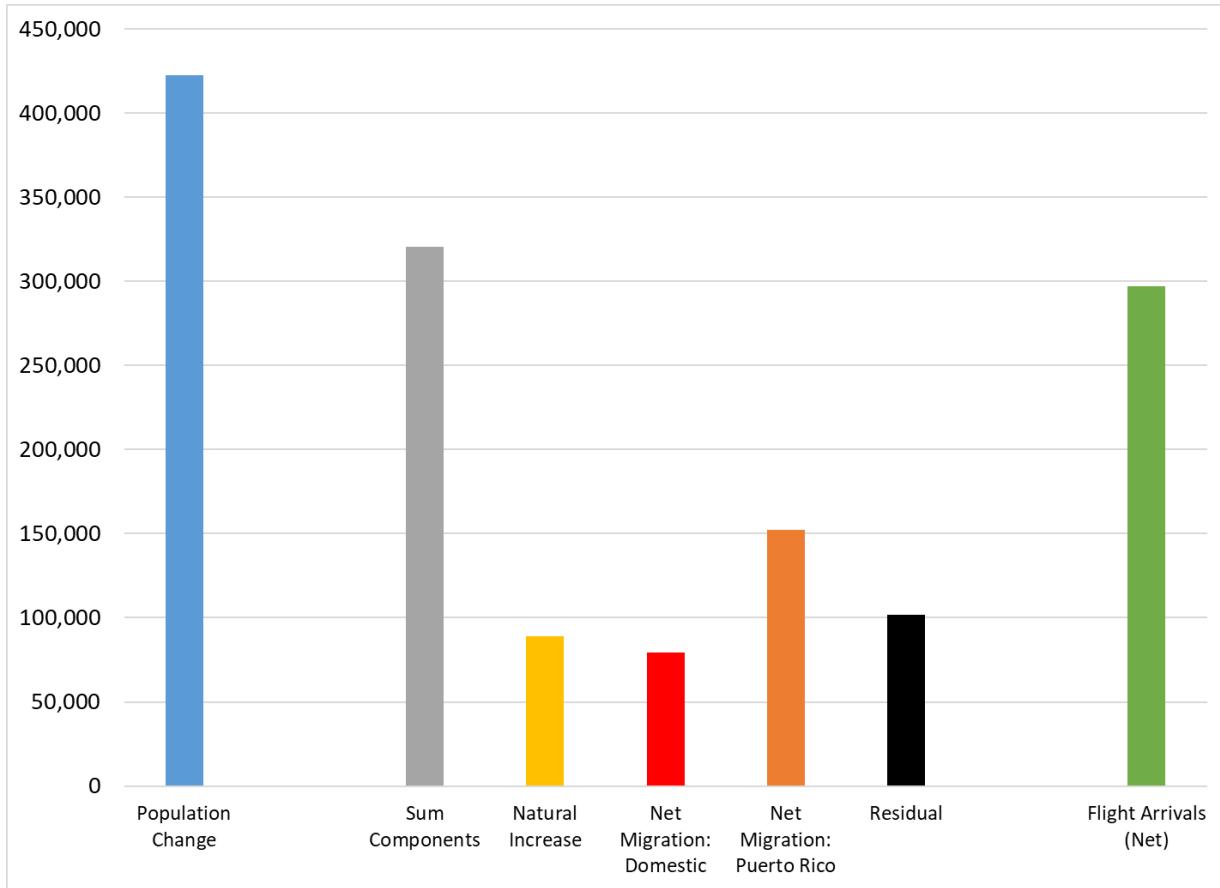


Sources:

¹ Bureau of Transportation Statistics, U.S. Department of Transportation: Data Bank 28DM - T-100 Domestic Market Data - U.S. Air Carriers Traffic and Capacity Data.

² U.S. Census Bureau, 2006–2016 ACS 1-Year Estimates.

Figure 4. Puerto Rican Population Change and Components of Change, Florida: 2005–2016



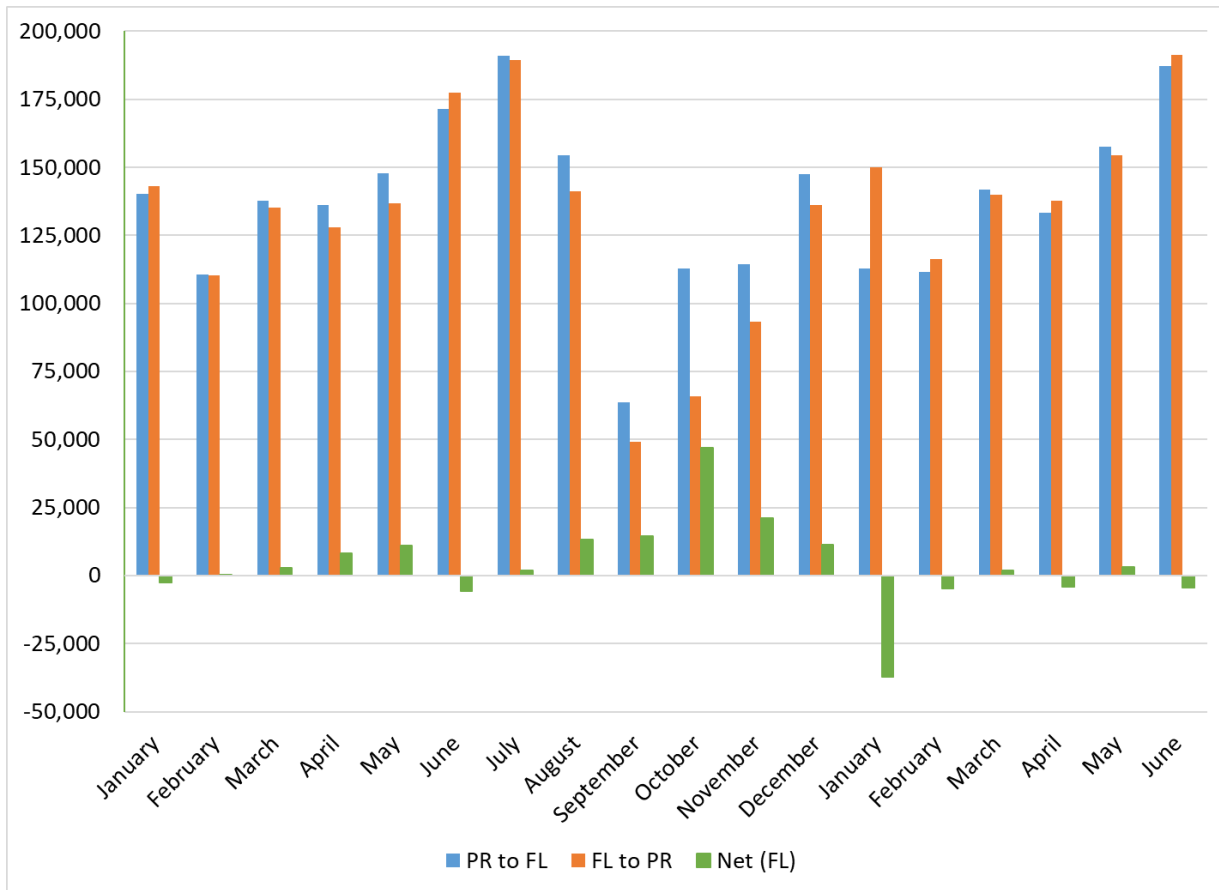
Sources:

¹ U.S. Census Bureau, 2005–2016 ACS 1-Year Estimates.

² Florida Department of Health, FLHealthCHARTS.

³ Bureau of Transportation Statistics, U.S. Department of Transportation: Data Bank 28DM - T-100 Domestic Market Data - U.S. Air Carriers Traffic and Capacity Data.

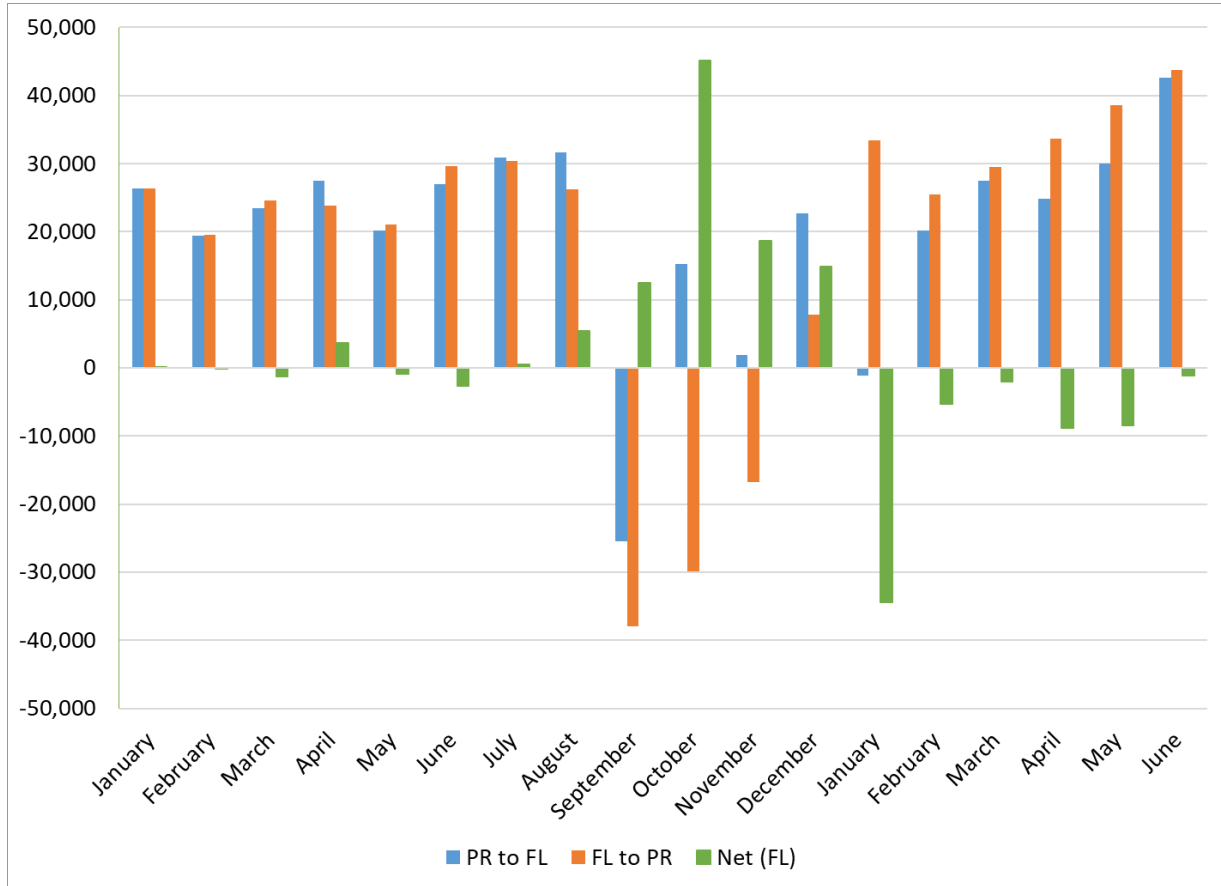
Figure 5. Flight Passengers between Puerto Rico and Florida: 2017–2018



Source:

Bureau of Transportation Statistics, U.S. Department of Transportation: Data Bank 28DM - T-100 Domestic Market Data - U.S. Air Carriers Traffic and Capacity Data.

**Figure 6. Flight Passengers between Puerto Rico and Florida:
2017–2018 vs. 2005–2016 Average**



Source:

Bureau of Transportation Statistics, U.S. Department of Transportation: Data Bank 28DM - T-100 Domestic Market Data - U.S. Air Carriers Traffic and Capacity Data.

Table 2. Comparison of Flight Passengers since Hurricane Maria to Similar Periods in Prior Years

Years	Months	PR to FL	FL to PR	Net (FL)	Multi-Year Averages, Net (FL)			
					3-Year	5-Year	7-Year	
05-06	Sep-Jun	993,256	982,113	11,143				
06-07	Sep-Jun	1,090,619	1,081,976	8,643				
07-08	Sep-Jun	1,206,133	1,198,742	7,391	9,059			
08-09	Sep-Jun	979,186	976,864	2,322	6,119			
09-10	Sep-Jun	1,077,634	1,057,698	19,936	9,883	9,887		
10-11	Sep-Jun	1,074,327	1,063,072	11,255	11,171	9,909		
11-12	Sep-Jun	1,149,663	1,126,339	23,324	18,172	12,846	12,002	
12-13	Sep-Jun	1,163,035	1,133,790	29,245	21,275	17,216	14,588	
13-14	Sep-Jun	1,141,458	1,110,439	31,019	27,863	22,956	17,785	
14-15	Sep-Jun	1,196,619	1,168,451	28,168	29,477	24,602	20,753	
15-16	Sep-Jun	1,283,911	1,253,031	30,880	30,022	28,527	24,832	
16-17	Sep-Jun	1,346,816	1,330,815	16,001	25,016	27,063	24,270	
17-18	Sep-Jun	1,282,275	1,233,907	48,368				
05-17 Ave	Sep-Jun	1,141,888	1,123,611	18,277				
Hurricane-induced Migration Estimates								
					Multi-Year Net Averages			
					1-Year	3-Year	5-Year	7-Year
Minimum					17,349	18,346	19,841	23,536
05-17 Ave					30,091	30,091	30,091	30,091
Maximum					46,046	42,249	38,481	36,366

Source:

Bureau of Transportation Statistics, U.S. Department of Transportation: Data Bank 28DM - T-100 Domestic Market Data - U.S. Air Carriers Traffic and Capacity Data.

Table 3. Total and Net Flight Passengers between Airports in Puerto Rico and in the United States, September 2017 to June 2018

Airport	Total Flight Passengers	Net Flight Passengers								
		September to December 2017			January 2018			February to June 2018		
		Aguadilla	Ponce	San Juan	Aguadilla	Ponce	San Juan	Aguadilla	Ponce	San Juan
Orlando (MCO)	1,072,057	1,931	1,791	29,597	-1,258	-809	-11,209	-470	-866	-4,668
New York (JFK)	760,830	2,074	1,332	30,933	-884	-1,047	-4,758	-716	-826	1,416
Fort Lauderdale (FLL)	726,059	3,665		30,557	-672		-10,582	385		1,832
Miami (MIA)	509,249			18,492			-10,189			-2,020
Atlanta (ATL)	354,751			8,771			-2,265			93
Newark (EWR)	337,433	897		10,051	-41		-2,995	522		-775
Philadelphia (PHL)	299,887			13,183			-5,915			895
Charlotte (CLT)	193,068			2,996			-2,177			709
Tampa (TPA)	181,883			5,697			-1,719			-2,701
Chicago (ORD)	167,325			7,566			-1,407			1,450
Baltimore (BWI)	164,464			6,602			-2,436			-2,460
Boston (BOS)	151,814			4,093			-1,224			-335
Dallas (DFW)	137,652			2,636			-615			1,121
Houston (IAH)	105,620			3,002			-850			-506
Florida Airports	2,489,248	5,596	1,791	84,343	-1,930	-809	-33,699	-85	-866	-7,557
Other Airports	2,672,844	2,971	1,332	89,833	-925	-1,047	-24,642	-194	-826	1,608
All Airports	5,162,092	8,567	3,123	174,176	-2,855	-1,856	-58,341	-279	-1,692	-5,949

Source:

Bureau of Transportation Statistics, U.S. Department of Transportation: Data Bank 28DM - T-100 Domestic Market Data - U.S. Air Carriers Traffic and Capacity Data.

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